

**CONSTRUCTION SPECIFICATIONS**

For:

The City of Shreveport Louisiana

IFB# 18-025

**RIVERVIEW THEATER AND HALL  
IMPROVEMENTS**

PREPARED BY:

KEVIN BRYAN ARCHITECT, LLC  
712 Texas Street  
Shreveport, LA 71101

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## **SECTION 01000 – SUMMARY OF WORK**

### **PART 1 - GENERAL**

#### **SUMMARY**

Section includes:

- Project information.
- Work covered by Contract Documents.
- Phased construction.
- Work under separate contracts.
- Access to site.
- Coordination with occupants.
- Work restrictions.
- Specification and drawing conventions.

Related Section:

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

#### **PROJECT INFORMATION**

Project Identification: Riverview Theater and Hall Improvements.

Project Location: Shreveport, Louisiana 71101.

Owner: The City of Shreveport, 505 Travis Street Ste. 600, Shreveport, Louisiana 71101.

Owner's Representative: Russell Delancy, 101 Crockett St., Ste. A, Shreveport, Louisiana 71101, (318) 673-5130.

Architect: Kevin Bryan Architect, 712 Texas Street, Shreveport, Louisiana 71101, (318) 673-9980.

#### **WORK COVERED BY CONTRACT DOCUMENTS**

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

New partial renovation to an existing theater and convention hall in order to bring the existing buildings up to current ADA standards. Project includes 5,500 S.F. of complete demolition and renovation of all restroom facilities. A new Elevator will be installed creating accessibility to three existing floor levels as well as an angled lift allowing accessibility to the existing orchestra pit. Ramps will allow accessibility inside the existing theater lobby and backstage areas. New fixed audience seating will be provided in a way that will allow accessibility to numerous areas inside the existing theater. All existing handrails will be either reconfigured or removed and replaced. In the process of upgrading the above mentioned areas new finishes including paint and some carpet will be provided as well.

Type of Contract.

Project will be constructed under a single prime contract.

## **PHASED CONSTRUCTION**

The Work shall be conducted in one phase.

## **WORK UNDER SEPARATE CONTRACTS**

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

Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

## **ACCESS TO SITE**

General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

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

Limits: Confine construction operations to primary construction area as bound by site plan drawing.

Limits: Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet beyond building perimeter; 10 feet beyond surface walkways, patios, surface parking, and utilities less than 12 inches in diameter; 15 feet beyond primary roadway curbs and main utility branch trenches; and 25 feet beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area.

Schedule deliveries to minimize use of driveways and entrances by construction operations.

Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

## **WORK RESTRICTIONS**

Work Restrictions, General: Comply with restrictions on construction operations.

Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

Notify Architect, Owner not less than two days in advance of proposed utility interruptions. Obtain Architect's written permission before proceeding with utility interruptions.

## **SPECIFICATION AND DRAWING CONVENTIONS**

Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

Specification requirements are to be performed by Contractor unless specifically stated otherwise.

Division 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of all Sections in the Specifications.

Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

### **PART 2 - PRODUCTS (Not Used)**

### **PART 3 - EXECUTION (Not Used)**

END OF SECTION 01000



## **SECTION 01027 - APPLICATIONS FOR PAYMENT**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

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

#### **SCHEDULE OF VALUES**

Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.

Coordinate line items in the Schedule of Values with other required administrative schedules and forms, including:

- Contractor's construction schedule.
- Application for Payment form.
- List of subcontractors.
- List of principal suppliers and fabricators.
- Schedule of submittals.

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.

Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.

Identification: Include the following Project identification on the Schedule of Values:

- Project name and location.
- Name of the Architect.
- Project number.
- Contractor's name and address.
- Date of submittal.

Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:

- Generic name.
- Related Specification Section.
- Name of subcontractor.
- Dollar value.

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.

Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.

For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

**Schedule Updating:** Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

## **APPLICATIONS FOR PAYMENT**

Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.

The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

**Payment Application Times:** Each progress payment date is as indicated in the Agreement. The period of construction Work covered by each Application or Payment is the period indicated in the Agreement.

**Payment Application Times:** The date for each progress payment is as indicated in the Agreement. The period of construction Work covered by each Application for Payment or payment is as indicated in the Agreement.

**Payment Application Forms:** Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment.

**Application Preparation:** Complete every entry on the form and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.

Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.

Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

**Transmittal:** Submit 5 *executed copies* of each Application for Payment to the Architect by means ensuring receipt within 24 hours, including supplier invoices, when required.

Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.

**Initial Application for Payment:** Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:

- List of subcontractors.
- List of principal suppliers and fabricators.
- Schedule of Values.
- Contractor's Construction Schedule (preliminary if not final).
- Submittal Schedule.
- Initial progress report.

Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:

- Completion of Project closeout requirements.
- Consent of Surety.
- Completion of items specified for completion after Acceptance.
- Assurance that unsettled claims will be settled.
- Assurance that Work not complete and accepted will be completed without undue delay.
- Transmittal of required Project construction records to Owner.
- Removal of temporary facilities and services.
- Removal of surplus materials, rubbish and similar elements.

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

**PART 3 - EXECUTION** (Not Applicable)

END OF SECTION 01027





## **SECTION 01035 - MODIFICATION PROCEDURES**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

Related Sections: The following sections contain requirements that relate to this section:

Division 1 Section "Application for Payment" for administrative procedures governing applications for payment.

Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

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

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.

Unless otherwise indicated in the proposal request, within 20 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.

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.

Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

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.

Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.

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.

Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

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.

## **CONSTRUCTION CHANGE DIRECTIVE**

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.

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.

Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

## **CHANGE ORDER PROCEDURES**

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 Document forms.

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

### **PART 3 - EXECUTION** (Not Applicable)

END OF SECTION 01035

## **SECTION 01040 - PROJECT COORDINATION**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section specifies administrative and supervisory requirements necessary for Project Coordination including, but not necessarily limited to:

- Coordination.
- Administrative and supervisory personnel.
- General installation provisions.
- Cleaning and protection.

Progress meetings, coordination meetings and pre-installation conferences are included in Section "Project Meetings."

Requirements for the Contractor's Construction Schedule are included in Section "Submittals."

#### **COORDINATION**

Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.

Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.

Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.

Make adequate provisions to accommodate items scheduled for later installation.

Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

- Preparation of schedules.
- Installation and removal of temporary facilities.
- Delivery and processing of submittals.
- Progress meetings.
- Project Close-out activities.

## **SUBMITTALS**

Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.

Show the interrelationship of components shown on separate Shop Drawings.

Indicate required installation sequence.

Comply with requirements contained in Section "Submittals."

Refer to Division-15 Section "General Provisions for Mechanical Work" for specific coordination Drawing requirements for mechanical and electrical installations.

Staff Names: Within 15 days after the Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.

Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

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

## **PART 3 - EXECUTION**

### **GENERAL INSTALLATION PROVISIONS**

Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

Recheck measurements and dimensions, before starting each installation.

Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

Mounting Heights: Where mounting heights are not indicated, install individual components at

standard mounting heights recognized within the industry for the particular application indicated. Comply with ADA Requirements where applicable. Refer questionable mounting height decisions to the Architect for final decision.

## **CLEANING AND PROTECTION**

During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Final Acceptance.

Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

Limiting Exposures: The General Contractor is responsible for all security. The General Contractor shall supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

- Excessive static or dynamic loading.
- Excessively high or low temperatures.
- Excessively high or low humidity.
- Water or ice.
- Solvents.
- Light.
- Rodent and insect infestation.
- Electrical current.
- Contact between incompatible materials.
- Misalignment.
- Excessive weathering.
- Unprotected storage.
- Improper shipping or handling.
- Theft.
- Vandalism.

END OF SECTION 01040



## **SECTION 01200 - PROJECT MEETINGS**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section specifies administrative and procedural requirements for project meetings including but not limited to:

- Pre-Construction Conference.
- Coordination Meetings.
- Progress Meetings.

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

Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than 10 days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

Attendees: The Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

Agenda: Discuss items of significance that could affect progress including such topics as:

- Tentative construction schedule.
- Critical Work sequencing.
- Designation of responsible personnel.
- Procedures for processing field decisions and Change Orders.
- Procedures for processing Applications for Payment.
- Distribution of Contract Documents.
- Submittal of Shop Drawings, Product Data and Samples.
- Use of the premises.
- Office, Work and storage areas.
- Equipment deliveries and priorities.
- Housekeeping.
- Working hours.

Minutes: The Architect will be responsible for preparing and distribute meeting minutes for the Pre-Construction Conference.

Submittals: The following items shall be submitted at this meeting:

- Schedule of Values.
- List of Subcontractors and material suppliers.
- Project Construction Schedule.



## **COORDINATION MEETINGS**

Conduct Project Coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.

Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

Minutes: The Architect will be responsible for preparing and distribute meeting minutes for the Coordination Meetings.

## **PROGRESS MEETINGS**

Conduct progress meetings at the Project site at regularly scheduled intervals. Notify the Owner and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request. Meetings shall occur once a month during the last week of the month.

Attendees: In addition to representatives of the Owner and Architect, each subcontractor, 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.

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.

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.

Review the present and future needs of each entity present, including such items as:

- Time.
- Sequences.
- Deliveries.
- Off-site fabrication problems.
- Access.
- Hours of Work.
- Housekeeping.
- Quality and work standards.
- Change Orders.
- Documentation of information for payment requests.

Minutes: The Architect will be responsible for preparing and distribute meeting minutes for the Progress Meetings.

END OF SECTION 01200

## **SECTION 01330 - SUBMITTAL PROCEDURES**

### **PART 1 - GENERAL**

#### **SUMMARY**

Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

Related Sections:

Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.

Division 1 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

Division 1 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.

Division 1 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

#### **DEFINITIONS**

Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.

#### **ACTION SUBMITTALS**

Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

#### **SUBMITTAL ADMINISTRATIVE REQUIREMENTS**

Architect's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.

Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.

Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that requires sequential activity.

Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

**Processing Time:** Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

**Initial Review:** Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

**Intermediate Review:** If intermediate submittal is necessary, process it in same manner as initial submittal.

**Resubmittal Review:** Allow 15 days for review of each resubmittal.

**Identification and Information:** Place a permanent label or title block on each paper copy submittal item for identification.

Indicate name of firm or entity that prepared each submittal on label or title block.

Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.

Include the following information for processing and recording action taken:

Project name.

Date.

Name of Architect.

Name of Construction Manager.

Name of Contractor.

Name of subcontractor.

Name of supplier.

Name of manufacturer.

Submittal number or other unique identifier, including revision identifier.

Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

Number and title of appropriate Specification Section.

Drawing number and detail references, as appropriate.

Location(s) where product is to be installed, as appropriate.

Other necessary identification.

**Identification and Information:** Identify and incorporate information in each electronic submittal file as follows:

Assemble complete submittal package into a single indexed file with links enabling navigation to each item.

Name file with submittal number or other unique identifier, including revision identifier.

File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-06100.01.A).

Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.

Include the following information on an inserted cover sheet:

Project name.

Date.

Name and address of Architect.

Name of Construction Manager.

Name of Contractor.

Name of firm or entity that prepared submittal.

Name of subcontractor.

Name of supplier.

Name of manufacturer.

Number and title of appropriate Specification Section.

Drawing number and detail references, as appropriate.

Location(s) where product is to be installed, as appropriate.

Related physical samples submitted directly.

Other necessary identification.

Options: Identify options requiring selection by the Architect.

Deviations: Identify deviations from the Contract Documents on submittals.

Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.

Transmittal Form: Use Contractor's standard transmittal form.

On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

Note date and content of previous submittal.

Note date and content of revision in label or title block and clearly indicate extent of revision.

Resubmit submittals until they are marked with approval notation from Architect's action stamp.

Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

## **PART 2 - PRODUCTS**

### **2.1 SUBMITTAL PROCEDURES**

General Submittal Procedure Requirements:

Action Submittals: Submit six paper copies of each submittal, unless otherwise indicated. Architect will return five copies.

Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 1 Section "Closeout Procedures."

Test and Inspection Reports Submittals: Comply with requirements specified in Division 1 Section "Quality Requirements."

Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

Mark each copy of each submittal to show which products and options are applicable.

Include the following information, as applicable:

- Manufacturer's catalog cuts.

- Manufacturer's product specifications.

- Standard color charts.

- Statement of compliance with specified referenced standards.

- Testing by recognized testing agency.

- Application of testing agency labels and seals.

- Notation of coordination requirements.

- Availability and delivery time information.

For equipment, include the following in addition to the above, as applicable:

- Wiring diagrams showing factory-installed wiring.

- Printed performance curves.

- Operational range diagrams.

- Clearances required to other construction, if not indicated on accompanying Shop Drawings.

Submit Product Data before or concurrent with Samples.

Submit Product Data in the following format:

Six paper copies of Product Data, unless otherwise indicated. Architect will return five copies.

Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

Identification of products.

Schedules.

Compliance with specified standards.

Notation of coordination requirements.

Notation of dimensions established by field measurement.

Relationship and attachment to adjoining construction clearly indicated.

Seal and signature of professional engineer if specified.

Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.

Submit Shop Drawings in the following format:

Six opaque copies of each submittal. Architect will retain two copies; remainder will be returned.

Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

Identification: Attach label on unexposed side of Samples that includes the following:

Generic description of Sample.

Product name and name of manufacturer.

Sample source.

Number and title of applicable Specification Section.

Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

Number of Samples: Submit two sets of Samples. Architect will retain all samples.

If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

Submit product schedule in the following format:

- a. Six paper copies of product schedule or list, unless otherwise indicated. Architect will return five copies.

Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."

Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."

Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design.

Submit subcontract list in the following format:

Number of Copies: Six paper copies of subcontractor list, unless otherwise indicated. Architect will return five copies.

**LEED Submittals:** Comply with requirements specified in Division 1 Section "LEED Requirements."

Submit LEED submittals in the following format:

Six paper copies of LEED submittals, unless otherwise indicated.

Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

**Installer Certificates:** Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

**Manufacturer Certificates:** Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

**Product Certificates:** Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

**Material Certificates:** Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

**Material Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

**Product Test Reports:** Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

**Research Reports:** Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

**Schedule of Tests and Inspections:** Comply with requirements specified in Division 1 Section "Quality Requirements."

**Preconstruction Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

**Compatibility Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

**Field Test Reports:** Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

**Maintenance Data:** Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."

**Design Data:** Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## **DELEGATED-DESIGN SERVICES**

**Performance and Design Criteria:** Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.



If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally-signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

## **PART 3 - EXECUTION**

### **CONTRACTOR'S REVIEW**

Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 1 Section "Closeout Procedures."

Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### **ARCHITECT'S ACTION**

General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

Incomplete submittals are not acceptable, will be considered non-responsive, and will be returned without review.

Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01330

## **SECTION 01400 - QUALITY CONTROL SERVICES**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section specifies administrative and procedural requirements for quality control services.

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 enforcement activities performed by the Architect.

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.

Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.

Inspections, test and relates actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

#### **RESPONSIBILITIES**

Contractor Responsibilities: The Owner shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities.

The Owner will engage and pay for the services of an independent agency to perform inspections and tests specified as the Owner's responsibility.

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.

Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.

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:

Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.

Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.

**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.

The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

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.

The agency shall not perform any duties of the Contractor.

**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.

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

## **SUBMITTALS**

The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate.

Submit additional copies of each written report directly to the User Agency, Owner, and General Contractor.

**Report Data:** Written reports of each inspection, test or similar service shall include, but not be limited to:

- Date of issue.
- Project title and number.
- Name, address and telephone number of testing agency.
- Dates and locations of samples and tests or inspections.
- Names of individuals making the inspection or test.
- Designation of the Work and test method.
- Identification of product and Specification Section.
- Complete inspection or test data.
- Test results and an interpretations of test results.
- Comments or professional opinion as to whether inspected or tested Work complies with Contract Documents requirements.
- Name and signature of laboratory inspector.
- Recommendations on retesting.

## **QUALITY ASSURANCE**

Qualifications 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.

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**

### **REPAIR AND PROTECTION**

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."

Protect construction exposed by or for quality control service activities, and protect repaired construction.

Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01400



## **SECTION 01420 - REFERENCES**

### **PART 1 - GENERAL**

#### **DEFINITIONS**

General: Basic Contract definitions are included in the Conditions of the Contract.

"Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

"Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

"Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

"Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

"Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

"Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

"Provide": Furnish and install, complete and ready for the intended use.

"Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

#### **INDUSTRY STANDARDS**

Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

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

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

## ABBREVIATIONS AND ACRONYMS

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

Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

A.	
AA	Aluminum Association, Inc. (The)
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ABAA	Air Barrier Association of America
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies, Inc. (The)
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AGC	Associated General Contractors of America (The)
AHAM	Association of Home Appliance Manufacturers
AHRI	Air-Conditioning, Heating, and Refrigeration Institute
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction
ISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALSC	American Lumber Standard Committee, Incorporated
AMCA	Air Movement and Control Association International, Inc.

ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts, Inc.
APA	Architectural Precast Association
APA	APA - The Engineered Wood Association
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute (Now AHRI)
ARMA	Asphalt Roofing Manufacturers Association
ASCE	American Society of Civil Engineers
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International (American Society of Mechanical Engineers International)
ASSE	American Society of Safety Engineers
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (American Society for Testing and Materials International)
ATIS	Alliance for Telecommunications Industry Solutions
AWCI	Association of the Wall and Ceiling Industry
AWCMA	American Window Covering Manufacturers Association (Now WCMA)
AWI	Architectural Woodwork Institute
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association)
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
BICSI	BICSI, Inc.
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International)



BISSC	Baking Industry Sanitation Standards Committee
BWF	Badminton World Federation (Formerly: IBF - International Badminton Federation)
CCC	Carpet Cushion Council
CDA	Copper Development Association
CEA	Canadian Electricity Association
CEA	Consumer Electronics Association
CFFA	Chemical Fabrics & Film Association, Inc.
CGA	Compressed Gas Association
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CRRC	Cool Roof Rating Council
CPA	Composite Panel Association
CPPA	Corrugated Polyethylene Pipe Association
CRI	Carpet and Rug Institute (The)
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSA	CSA International (Formerly: IAS - International Approval Services)
CSI	Cast Stone Institute
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)
DHI	Door and Hardware Institute
ECA	Electronic Components Association
EIA	Electronic Industries Alliance

EIMA	EIFS Industry Members Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.
ESD	ESD Association (Electrostatic Discharge Association)
ETL SEMCO	Intertek ETL SEMCO
FIBA	Federation Internationale de Basketball (The International Basketball Federation)
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation)
FM Approvals	FM Approvals LLC
FM Global	FM Global (Formerly: FMG - FM Global)
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.
FSA	Fluid Sealing Association
FSC	Forest Stewardship Council
GA	Gypsum Association
GANA	Glass Association of North America
GRI	(Part of GSI)
GS	Green Seal
GSI	Geosynthetic Institute
HI	Hydraulic Institute
HI	Hydronics Institute
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.
IAS	International Approval Services (Now CSA International)
IBF	International Badminton Federation (Now BWF)
ICEA	Insulated Cable Engineers Association, Inc.

ICRI	International Concrete Repair Institute, Inc.
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IES	Illuminating Engineering Society
IESNA	Illuminating Engineering Society of North America (Now IES)
IEST	Institute of Environmental Sciences and Technology
IGCC	Insulating Glass Certification Council
IGMA	Insulating Glass Manufacturers Alliance
ILI	Indiana Limestone Institute of America, Inc.
ISO	International Organization for Standardization Available from ANSI
ISSFA	International Solid Surface Fabricators Association
ITS	Intertek Testing Service NA (Now ETL SEMCO)
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturers Association
MFMA	Maple Flooring Manufacturers Association, Inc.
MFMA	Metal Framing Manufacturers Association, Inc.
MH	Material Handling (Now MHIA)
MHIA	Material Handling Industry of America
MIA	Marble Institute of America
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International (National Association of Corrosion Engineers International)

NADCA	National Air Duct Cleaners Association
NAGWS	National Association for Girls and Women in Sport
NAIMA	North American Insulation Manufacturers Association
NBGQA	National Building Granite Quarries Association, Inc.
NCAA	National Collegiate Athletic Association (The)
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute
NCTA	National Cable & Telecommunications Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFHS	National Federation of State High School Associations
NFPA	NFPA (National Fire Protection Association)
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association)
NOMMA	National Ornamental & Miscellaneous Metals Association
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	NSF International (National Sanitation Foundation International)
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
NTRMA	National Tile Roofing Manufacturers Association

	(Now TRI)
NWFA	National Wood Flooring Association
NWWDA	National Wood Window and Door Association (Now WDMA)
PCI	Precast/Prestressed Concrete Institute
PDCA	Painting & Decorating Contractors of America
PDI	Plumbing & Drainage Institute
PGI	PVC Geomembrane Institute
PLANET	Professional Landcare Network
PTI	Post-Tensioning Institute
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service
SAE	SAE International
SCTE	Society of Cable Telecommunications Engineers
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SGCC	Safety Glazing Certification Council
SIA	Security Industry Association
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMPTE	Society of Motion Picture and Television Engineers
SPFA	Spray Polyurethane Foam Alliance
SPIB	Southern Pine Inspection Bureau
SPRI	Single Ply Roofing Industry

SSINA	Specialty Steel Industry of North America
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
SWRI	Sealant, Waterproofing, & Restoration Institute
TCNA	Tile Council of North America, Inc.
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
TMS	The Masonry Society
TPI	Truss Plate Institute, Inc.
TPI	Turfgrass Producers International
TRI	Tile Roofing Institute
UL	Underwriters Laboratories Inc.
UNI	Uni-Bell PVC Pipe Association
USAV	USA Volleyball
USGBC	U.S. Green Building Council
USITT	United States Institute for Theatre Technology, Inc.
WASTEC	Waste Equipment Technology Association
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association
WCSC	Window Covering Safety Council
WDMA	Window & Door Manufacturers Association
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California)
WIC	Woodwork Institute of California (Now WI)
WMMPA	Wood Moulding & Millwork Producers Association
WSRCA	Western States Roofing Contractors Association
WWPA	Western Wood Products Association

Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

DIN	Deutsches Institut f?r Normung e.V.
IAPMO	International Association of Plumbing and Mechanical Officials
ICC	International Code Council
ICC-ES	ICC Evaluation Service, Inc.
UBC	Uniform Building Code (See ICC)

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

CE	Army Corps of Engineers
CPSC	Consumer Product Safety Commission
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FDA	Food and Drug Administration
GSA	General Services Administration
HUD	Department of Housing and Urban Development
LBL	Lawrence Berkeley National Laboratory
NCHRP	National Cooperative Highway Research Program (See TRB)
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety & Health Administration
PBS	Public Buildings Service (See GSA)
PHS	Office of Public Health and Science
RUS	Rural Utilities Service (See USDA)

SD	State Department
TRB	Transportation Research Board
USDA	Department of Agriculture
USPS	Postal Service

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

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board
CFR	Code of Federal Regulations Available from Government Printing Office
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point
DSCC	Defense Supply Center Columbus (See FS)
FED-STD	Federal Standard (See FS)
FS	Federal Specification Available from Department of Defense Single Stock Point  Available from Defense Standardization Program  Available from General Services Administration  Available from National Institute of Building Sciences
FTMS	Federal Test Method Standard (See FS)
MIL	(See MILSPEC)
MIL-STD	(See MILSPEC)
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point
UFAS	Uniform Federal Accessibility Standards Available from Access Board

State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.



CBHF State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation

CCR California Code of Regulations

CDHS California Department of Health Services  
(See CDPH)

CDPH California Department of Public Health, Indoor Air Quality Section

CPUC California Public Utilities Commission

TFS Texas Forest Service  
Forest Resource Development

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION (Not Used)**

END OF SECTION 01420

## **SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS**

### **PART 1 - GENERAL**

#### **SUMMARY**

Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

Related Section:

Division 1 Section "Summary" for limitations on work restrictions and utility interruptions.

#### **USE CHARGES**

General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

#### **INFORMATIONAL SUBMITTALS**

Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

#### **QUALITY ASSURANCE**

Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

#### **PROJECT CONDITIONS**

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

### **PART 2 - PRODUCTS**

#### **TEMPORARY FACILITIES**

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

Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate project meetings specified in other Division 1 Sections. Keep office clean and orderly.

Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

## **EQUIPMENT**

Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction and clean HVAC system as required in Division 1 Section "Closeout Procedures."

Project Identification: Provide one (1) Project identification sign in general location as indicated on Drawings and/or as indicated by Architect. Maintain sign throughout the construction period in a manner, which will properly inform both the public and persons seeking entrance to the project. Do not allow the installation of other unauthorized signs, which are made visible to persons outside the project site.

Project Identification Sign, Size and Material: Provide sign of exterior type, Grade B-C plywood sanded both sides, 4 feet by 8 feet by 3/4 inches thick. Erect sign on 4 inch by 4 inch posts securely anchored and braced at location directed by Architect.

The Architect will provide the artwork to the Contractor after the award of the contract. It will include a rendering of the building, name of the project, Architect's and Contractor's name and other information deemed necessary by the Owner and/or Architect. Install the vinyl (4' x 8') print of the sign artwork over the plywood sign backing described above.

## **PART 3 - EXECUTION**

### **INSTALLATION, GENERAL**

Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

Locate facilities to limit site disturbance as specified in Division 1 Section "Summary."

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

## TEMPORARY UTILITY INSTALLATION

General: Install temporary service or connect to existing service.

Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

Install electric power service underground, unless otherwise indicated.

Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

Provide additional telephone lines for the following:

Provide a dedicated telephone line for each facsimile machine in each field office.

At each telephone, post a list of important telephone numbers.

- Police and fire departments.
- Ambulance service.
- Contractor's home office.
- Architect's office.
- Engineers' offices.
- Owner's office.

Principal subcontractors' field and home offices.

Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

## **SUPPORT FACILITIES INSTALLATION**

General: Comply with the following:

Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.

Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

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

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

Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.

Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 2 Section "Earthwork."

Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.

Traffic Controls: Comply with requirements of authorities having jurisdiction.

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

Parking: Provide temporary parking areas for construction personnel.

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

Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.

Remove snow and ice as required to minimize accumulations.

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

Identification Signs: Provide Project identification signs as indicated on Drawings.

Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

Provide temporary, directional signs for construction personnel and visitors.

Maintain and touchup signs so they are legible at all times.

Waste Disposal Facilities: Comply with requirements specified in Division 1 Section "Construction Waste Management."

Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.

Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

Temporary Elevator Use: Use of elevators is not permitted.

Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

## **SECURITY AND PROTECTION FACILITIES INSTALLATION**

Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Division 2 Section "Site Clearing."

Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

Tree and Plant Protection: Comply with requirements specified in Division 2 Section "Tree Protection and Trimming."

Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

**Security Enclosure and Lockup:** Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

**Barricades, Warning Signs, and Lights:** Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

**Temporary Enclosures:** Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

**Temporary Fire Protection:** Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

Prohibit smoking in construction areas.

Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

## **MOISTURE AND MOLD CONTROL**

**Contractor's Moisture Protection Plan:** Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

**Exposed Construction Phase:** Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.

**Partially Enclosed Construction Phase:** After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.

Keep interior spaces reasonably clean and protected from water damage.

Discard or replace water-damaged and wet material.

Discard, replace or clean stored or installed material that begins to grow mold.

Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

**Controlled Construction Phase of Construction:** After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

Control moisture and humidity inside building by maintaining effective dry-in conditions.

Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

## **OPERATION, TERMINATION, AND REMOVAL**

Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

Maintenance: Maintain facilities in good operating condition until removal.

Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

END OF SECTION 01500





## **SECTION 01570 - TEMPORARY CONSTRUCTION SIGNING**

### **PART 1 - GENERAL**

- 1.1 SCOPE. Contractor shall furnish, install, and maintain all temporary construction signing as noted on the drawings and specified herein.

### **PART 2 - MATERIALS**

- 2.1 MATERIALS. Contractor shall furnish all barricades with lights, barrels, striping, and construction signs in accordance with the Manual of Uniform Traffic Control Devices (M.U.T.C.D.) and Louisiana Department of Transportation and Development Regulations.

### **PART 3 - EXECUTION**

- 3.1 INSTALLATION. Contractor shall install all temporary construction signing and striping as specified. All signs, barricades, barrels, lights, etc. shall be constantly maintained by the Contractor and moved and adjusted as required at each phase of construction and as required to provide construction safety.

END OF SECTION 01570



## **SECTION 01600 - MATERIALS AND EQUIPMENT**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **DEFINITIONS**

Definitions used in this Article are not intended to change the meaning of other terms used in Contract Documents, such as "specialties," "systems," "structures," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.

"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.

"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.

"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.

"Equipment" is a product with operations parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

#### **SUBMITTALS**

Product List Schedule: Prepare a schedule showing products specified in a tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.

Coordinate the project list schedule with the Contractor's Construction Schedule.

Form: Prepare the product listing schedule with information on each item tabulated under the following column headings:

Related Specification Section number.  
Generic name used in Contract Documents.  
Proprietary name, model number and similar designations.  
Manufacturer's name and address.

Completed Schedule: Within 30 days after date of commencement of the Work, submit 3 copies of the completed product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.

Architect's Action: The Architect will respond in writing to the Contractor within 2 weeks of receipt of the completed product list schedule. No response within this time period constitutes no objection to listed manufacturers or products, but does not constitute a waiver of the requirement that products comply with Contract Documents. The Architect's response will include the following:

A list of unacceptable product selections, containing a brief explanation of reasons for this action.

## **QUALITY ASSURANCE**

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

When specified products are available only from sources that do not or cannot produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect for a determination of the most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources that produce products that possess these qualities, to the fullest extent possible.

Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

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

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.

Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.

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.

Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.

## **PART 2 - PRODUCTS**

### **PRODUCT SELECTION**

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

Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

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:

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.

**Descriptive Specification Requirements:** When 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.

**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.

Manufacturer's recommendations may be contained in published product literature, or by the manufacture's certification of performance.

**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**

#### **INSTALLATION OF PRODUCTS**

Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated.

END OF SECTION 01600



## **SECTION 01631 - PRODUCT SUBSTITUTIONS**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section specifies administrative and procedural requirements for handling requests for substitutions made prior to the bid opening.

#### **DEFINITION**

Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor prior to bid opening are considered requests for "substitutions."

Revisions to Contract Documents requested by the Owner or Architect prior to bid opening.

Specified options of products and construction methods included in Contract Documents.

All Substitutions shall comply with the requirements set forth in the Instruction to Bidders.

#### **SUBMITTALS**

Substitution Request Submittal: Use CSI Form 13.1.A. The requests for substitution will be considered if received at least 7 working days prior to date for receipt of bids. Requests received after 7 working days prior approval will be rejected at the discretion of the Architect.

Submit 3 copies of each request for substitution for consideration.

Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

Product Data, including Drawings and descriptions of products, fabrication and installation procedures.

Samples, where applicable or requested.

A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.

Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate



Contractors, that will become necessary to accommodate the proposed substitution.

Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated.

The burden of proof on the merit of the proposed substitute is upon the proposer. The Architect's decision or approval or disapproval of the proposed substitution will be final.

Architect's Action: If the Architect approves any proposed substitution, such approval will be set forth in an addendum. Bidder shall not rely upon approvals made in any other manner.

## **PART 2 - PRODUCTS**

### **SUBSTITUTIONS**

Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.

Extensive revisions to Contract Documents are not required.

Proposed changes are in keeping with the general intent of Contract Documents.

The request is timely, fully documented and properly submitted.

The request is directly related to an "approved equal" clause or similar language in the Contract Documents.

The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

## **PART 3 - EXECUTION (Not Applicable)**

END OF SECTION 01631

## **SECTION 01700 - PROJECT CLOSEOUT**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

- Inspection procedures.
- Project record document submittal.
- Operating and maintenance manual submittal.
- Submittal of warranties.
- Final cleaning.

#### **SUBSTANTIAL COMPLETION**

**Preliminary Procedures:** Before requesting inspection for certification of "Recommendation of Acceptance," complete the following. List exceptions in the request.

In the Application for Payment that coincides with, or first follows, the date of Acceptance 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.

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.

Advise Owner of pending insurance change-over requirements.

Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

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.

Submit record drawings, maintenance manuals, and similar final record information.

Deliver tools, spare parts, extra stock, and similar items.

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.

Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finished.

**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 Acceptance following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

The Architect will repeat inspection when requested and assured that the Work has been substantially completed.

Results of the completed inspection will form the basis of requirements for final acceptance.

## **FINAL ACCEPTANCE**

**Preliminary Procedures:** Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

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.

Submit an updated final statement, accounting for final additional changes to the Contract Sum.

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.

Submit consent of surety to final payment.

Submit a final liquidated damages settlement statement.

**Reinspection Procedure:** The Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.

The Architect will perform one (1) inspection for Acceptance, upon request from the Contractor.

If the Architect is unable to issue the Certificate of Acceptance because the work is not considered to be substantially complete, then the Contractor shall pay all subsequent inspection costs, including compensation for the Architect's services and expenses.

Only one (1) certificate of Acceptance will be issued, for the entire project.

Results of the completed inspection will form the basis of requirements for final acceptance.

Upon completion of reinspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

If necessary, re-inspection will be repeated.

## **RECORD DOCUMENT SUBMITTALS**

Record Drawings: Reference Section 01781; Project Record Drawings for additional information.

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

## **PART 3 - EXECUTION**

### **CLOSEOUT PROCEDURES**

Operation and Maintenance Manuals: Reference Section 01782; Operation and Maintenance Data for additional information.

### **FINAL CLEANING**

General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities."

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.

Complete the following cleaning operations before requesting inspection for Certification of Acceptance.

Remove labels that are not permanent labels.

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.

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.

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.

END OF SECTION 01700



## **SECTION 01701 - EXECUTION REQUIREMENTS**

### **PART 1 - GENERAL**

#### **SUMMARY**

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

- Construction layout.
- Field engineering and surveying.
- Installation of the Work.
- Cutting and patching.
- Coordination of Owner-installed products.
- Progress cleaning.
- Starting and adjusting.
- Protection of installed construction.
- Correction of the Work.

#### **Related Sections:**

- Division 1 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.
- Division 7 Section "Through-Penetration Firestop Systems" for patching penetrations in fire-rated construction.

#### **INFORMATIONAL SUBMITTALS**

**Certificates:** Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

**Landfill Receipts:** Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

**Certified Surveys:** Submit two copies signed by land surveyor.

**Final Property Survey:** Submit 5 copies showing the Work performed and record survey data.

#### **QUALITY ASSURANCE**

**Land Surveyor Qualifications:** A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

## **PART 2 - PRODUCTS**

### **MATERIALS**

General: Comply with requirements specified in other Sections.

For projects requiring compliance with sustainable design and construction practices and procedures, utilize products for patching that comply with requirements of Division 1 Section "LEED Requirements."

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.

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**

### **EXAMINATION**

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.

Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### **PREPARATION**

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

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.

Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

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 1 Section "Project Management and Coordination."

## **CONSTRUCTION LAYOUT**

**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 promptly.

**General:** Engage a land surveyor to lay out the Work using accepted surveying practices.

Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.

Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

Inform installers of lines and levels to which they must comply.

Check the location, level and plumb, of every major element as the Work progresses.

Notify Architect when deviations from required lines and levels exceed allowable tolerances.

Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

**Site Improvements:** Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

**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.

**Record Log:** Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

## **FIELD ENGINEERING**

**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.

**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.

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

**Certified Survey:** On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.



Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

## **INSTALLATION**

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

Make vertical work plumb and make horizontal work level.

Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

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

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

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.

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

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.

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.

Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.

Allow for building movement, including thermal expansion and contraction.

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.

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.

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

## **PROGRESS CLEANING**

General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.

Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

Site: Maintain Project site free of waste materials and debris.

Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

Remove liquid spills promptly.

Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

## **STARTING AND ADJUSTING**

Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

Manufacturer's Field Service: Comply with qualification requirements in Division 1 Section "Quality Requirements."

## **PROTECTION OF INSTALLED CONSTRUCTION**

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

Comply with manufacturer's written instructions for temperature and relative humidity.

## **CORRECTION OF THE WORK**

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

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

Restore permanent facilities used during construction to their specified condition.

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

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

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

END OF SECTION 01701

## **SECTION 01732 - SELECTIVE DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

##### **A. Section Includes:**

1. Demolition and removal of selected site elements.

#### **1.2 DEFINITIONS**

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

#### **1.3 PREINSTALLATION MEETINGS**

- A. Predemolition Conference: Conduct conference at per Owner direction.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For refrigerant recovery technician.
- B. Predemolition Photographs or Video: Submit before Work begins.
- C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

#### **1.6 QUALITY ASSURANCE**

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

## 1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
  - 1. Before selective demolition, Owner will remove the following items:
    - a. Ceiling fans and light kits.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: Hazardous materials may be encountered in the Work.
  - 1. Provide lead testing to all suspected materials that will be disturbed by work.
  - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Contracting officer. Hazardous materials will be removed by Owner under a separate contract.
- E. Hazardous Materials: Hazardous materials are present in buildings and structures 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.
  - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
  - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
- F. Storage or sale of removed items or materials on-site is not permitted.
- G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

## 1.8 WARRANTY

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

## 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. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
  - 1. Comply with requirements specified in Division 1 Section "Photographic Documentation."

### 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 1 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. Building 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.

- g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in Division 1 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.
- 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.

### 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. 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.
  - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  - 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 5. Dispose of demolished items and materials promptly.
- B. Removed and Salvaged Items:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to Owner.
  - 4. Transport items to Owner's storage area designated by Owner.
  - 5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. 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 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.

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 1 Section "Construction Waste Management."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### 3.6 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 01732





## **SECTION 01740 - WARRANTIES AND BONDS**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section specifies administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

General closeout requirements are included in Section "Project Closeout."

Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Division-2 through -16.

Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

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.

#### **DEFINITIONS**

Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

#### **WARRANTY REQUIREMENTS**

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 placed to provide access for correction of warranted Work.

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.

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 benefitted from use of the Work through a portion of its anticipated useful service life.

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 limited on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

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.

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.

## **SUBMITTALS**

Submit written warranties to the Architect prior to the date certified for Acceptance. If the Architect's Certificate of Acceptance designates a commencement date for warranties other than the date of Acceptance for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.

Forms of Submittal: At Acceptance compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the Installer.

Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.

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**

### **SCHEDULE OF WARRANTIES**

**Schedule:** Provide warranties and bonds on products and installations as specified in Sections 2 through 16.

END OF SECTION 01740

## **SECTION 01781 - PROJECT RECORD DOCUMENTS**

### **PART 1 - GENERAL**

#### **SUMMARY**

Section includes administrative and procedural requirements for project record documents, including the following:

- Record Drawings.
- Record Specifications.
- Record Product Data.

Related Sections:

Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

Divisions 2 through 16 Sections for specific requirements for project record documents of the Work in those Sections.

#### **CLOSEOUT SUBMITTALS**

Record Drawings: Comply with the following:

Final Submittal: Submit one paper copy set and PDF electronic files of marked-up record prints, and one set(s) of corrected record digital data files, and three set(s) of corrected record digital data file plots. Plot each drawing file, whether or not changes and additional information were recorded.

Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.

### **PART 2 - PRODUCTS**

#### **RECORD DRAWINGS**

Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.

Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

Record data as soon as possible after obtaining it.

Record and check the markup before enclosing concealed installations.

Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.

Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

**Record Digital Data Files:** Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

Format: Same digital data software program, version, and operating system as the original Contract Drawings.

Format: DWG, operating in Microsoft Windows operating system.

Format: Annotated PDF electronic file.

Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.

Refer instances of uncertainty to Architect for resolution.

Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

**Format:** Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

**Record Prints:** Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

Format: Annotated PDF electronic file.

**Record Digital Data Files:** Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

**Identification:** As follows:

Project name.

Date.

Designation "PROJECT RECORD DRAWINGS."

Name of Architect.

Name of Contractor.

## **RECORD SPECIFICATIONS**

**Preparation:** Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

Note related Change Orders, record Product Data and record Drawings where applicable.

Format: Submit record Specifications as annotated PDF electronic file.

## **RECORD PRODUCT DATA**

Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

Note related Change Orders, record Specifications and record Drawings where applicable.

Format: Submit record Product Data as annotated PDF electronic file.

## **MISCELLANEOUS RECORD SUBMITTALS**

Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

Format: Submit miscellaneous record submittals as PDF electronic file.

## **PART 3 - EXECUTION**

### **RECORDING AND MAINTENANCE**

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

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

END OF SECTION 01781



## **SECTION 01782 - OPERATION AND MAINTENANCE DATA**

### **PART 1 - GENERAL**

#### **SUMMARY**

Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

- Operation and maintenance documentation directory.
- Emergency manuals.
- Operation manuals for systems, subsystems, and equipment.
- Product maintenance manuals.

Related Sections:

Divisions 2 through 16 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

#### **CLOSEOUT SUBMITTALS**

Format: Submit operations and maintenance manuals in the following format:

PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Architect.

Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.

Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training.

### **PART 2 - PRODUCTS**

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

Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

- Title page.
- Table of contents.
- Manual contents.

Title Page: Include the following information:

- Subject matter included in manual.



Name and address of Project.

Name and address of Owner.

Date of submittal.

Name and contact information for Contractor.

Name and contact information for Construction Manager.

Name and contact information for Architect.

Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.

Cross-reference to related systems in other operation and maintenance manuals.

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

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

Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel upon opening file.

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

Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name and subject matter of contents and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.

Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## **EMERGENCY MANUALS**

Content: Organize manual into a separate section for each of the following:

- Type of emergency.
- Emergency instructions.
- Emergency procedures.

Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

- Fire.
- Flood.
- Gas leak.
- Water leak.
- Power failure.
- Water outage.
- System, subsystem, or equipment failure.
- Chemical release or spill.

Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

Emergency Procedures: Include the following, as applicable:

- Instructions on stopping.
- Shutdown instructions for each type of emergency.
- Operating instructions for conditions outside normal operating limits.
- Required sequences for electric or electronic systems.
- Special operating instructions and procedures.

## **OPERATION MANUALS**

Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

- System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
- Performance and design criteria if Contractor is delegated design responsibility.
- Operating standards.
- Operating procedures.
- Operating logs.

Wiring diagrams.  
Control diagrams.  
Piped system diagrams.  
Precautions against improper use.  
License requirements including inspection and renewal dates.

Descriptions: Include the following:

Product name and model number. Use designations for products indicated on Contract Documents.  
Manufacturer's name.  
Equipment identification with serial number of each component.  
Equipment function.  
Operating characteristics.  
Limiting conditions.  
Performance curves.  
Engineering data and tests.  
Complete nomenclature and number of replacement parts.

Operating Procedures: Include the following, as applicable:

Startup procedures.  
Equipment or system break-in procedures.  
Routine and normal operating instructions.  
Regulation and control procedures.  
Instructions on stopping.  
Normal shutdown instructions.  
Seasonal and weekend operating instructions.  
Required sequences for electric or electronic systems.  
Special operating instructions and procedures.

Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## **PRODUCT MAINTENANCE MANUALS**

Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

Product Information: Include the following, as applicable:

- Product name and model number.
- Manufacturer's name.
- Color, pattern, and texture.
- Material and chemical composition.
- Reordering information for specially manufactured products.

Maintenance Procedures: Include manufacturer's written recommendations and the following:

- Inspection procedures.
- Types of cleaning agents to be used and methods of cleaning.
- List of cleaning agents and methods of cleaning detrimental to product.
- Schedule for routine cleaning and maintenance.
- Repair instructions.

Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

## **SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS**

Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

- Standard maintenance instructions and bulletins.
- Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
- Identification and nomenclature of parts and components.
- List of items recommended to be stocked as spare parts.

Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

- Test and inspection instructions.
- Troubleshooting guide.
- Precautions against improper maintenance.

Disassembly; component removal, repair, and replacement; and reassembly instructions.

Aligning, adjusting, and checking instructions.

Demonstration and training video recording, if available.

**Maintenance and Service Schedules:** Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

**Spare Parts List and Source Information:** Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

**Maintenance Service Contracts:** Include copies of maintenance agreements with name and telephone number of service agent.

**Warranties and Bonds:** Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

### **PART 3 - EXECUTION**

#### **MANUAL PREPARATION**

**Emergency Manual:** Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

**Product Maintenance Manual:** Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

**Operation and Maintenance Manuals:** Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

**Manufacturers' Data:** Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

**Drawings:** Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

Do not use original project record documents as part of operation and maintenance manuals.

Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01782

## **SECTION 01820 - DEMONSTRATION AND TRAINING**

### **PART 1 - GENERAL**

#### **SUMMARY**

Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

- Demonstration of operation of systems, subsystems, and equipment.

- Training in operation and maintenance of systems, subsystems, and equipment.

- Demonstration and training video recordings.

#### **INFORMATIONAL SUBMITTALS**

Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

Indicate proposed training modules utilizing manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

#### **CLOSEOUT SUBMITTALS**

Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

At completion of training, submit complete training manual(s) for Owner's use.

#### **QUALITY ASSURANCE**

Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training.

#### **COORDINATION**

Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

## **PART 2 - PRODUCTS**

### **INSTRUCTION PROGRAM**

Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

Basis of System Design, Operational Requirements, and Criteria: Include the following:

- System, subsystem, and equipment descriptions.
- Performance and design criteria if Contractor is delegated design responsibility.
- Operating standards.
- Regulatory requirements.
- Equipment function.
- Operating characteristics.
- Limiting conditions.
- Performance curves.

Documentation: Review the following items in detail:

- Emergency manuals.
- Operations manuals.
- Maintenance manuals.
- Project record documents.
- Identification systems.
- Warranties and bonds.
- Maintenance service agreements and similar continuing commitments.

Emergencies: Include the following, as applicable:

- Instructions on meaning of warnings, trouble indications, and error messages.
- Instructions on stopping.
- Shutdown instructions for each type of emergency.
- Operating instructions for conditions outside of normal operating limits.
- Sequences for electric or electronic systems.
- Special operating instructions and procedures.

Operations: Include the following, as applicable:

- Startup procedures.
- Equipment or system break-in procedures.
- Routine and normal operating instructions.
- Regulation and control procedures.
- Control sequences.
- Safety procedures.
- Instructions on stopping.
- Normal shutdown instructions.
- Operating procedures for emergencies.
- Operating procedures for system, subsystem, or equipment failure.
- Seasonal and weekend operating instructions.
- Required sequences for electric or electronic systems.

Special operating instructions and procedures.

Adjustments: Include the following:

- Alignments.
- Checking adjustments.
- Noise and vibration adjustments.
- Economy and efficiency adjustments.

Troubleshooting: Include the following:

- Diagnostic instructions.
- Test and inspection procedures.

Maintenance: Include the following:

- Inspection procedures.
- Types of cleaning agents to be used and methods of cleaning.
- List of cleaning agents and methods of cleaning detrimental to product.
- Procedures for routine cleaning
- Procedures for preventive maintenance.
- Procedures for routine maintenance.
- Instruction on use of special tools.

Repairs: Include the following:

- Diagnosis instructions.
- Repair instructions.
- Disassembly; component removal, repair, and replacement; and reassembly instructions.
- Instructions for identifying parts and components.
- Review of spare parts needed for operation and maintenance.

## **PART 3 - EXECUTION**

### **PREPARATION**

Assemble educational materials necessary for instruction, including documentation and training module.  
Assemble training modules into a training manual organized in coordination with requirements in Division 1 Section "Operations and Maintenance Data."

### **INSTRUCTION**

Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

Owner will furnish Contractor with names and positions of participants.

Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

Schedule training with Owner, through Architect, with at least seven days advance notice.

END OF SECTION 01820





## **SECTION 02110 - DEMOLITION, CLEARING AND GRUBBING**

1. GENERAL. Demolition, clearing and grubbing shall consist of removing all natural and artificial objectionable materials from the construction areas. Pavement and related utility items, and such other areas as may be specified on the Drawings shall be removed. This work shall be performed in advance of new construction and in accordance with the requirements herein specified.

1.1 Clearing. The natural ground surface shall be cleared of all vegetative growth, such as trees, logs, upturned stumps, roots, brush, grass, weeds, and all other objectionable materials, within the limits of construction.

1.2 Grubbing. All trees, stumps, roots 1-1/2 inches in diameter or larger, buried logs, and all other objectionable material shall be removed.

2. PRESERVATION OF PROPERTY. Existing improvements, adjacent property utilities and other facilities, and trees and plants that are not to be removed shall be protected from injury or damage.

3. REMOVAL AND DISPOSAL OF MATERIALS. All combustible and other waste materials shall be removed from the site and disposed of by and at the expense of the Contractor. The site shall be left with a neat and finished appearance. No burning shall be allowed.

4. PAVEMENT. Concrete curbs and pavement and base material shall be saw cut and neatly removed where noted on the drawings.

END OF SECTION 02110



## **SECTION 03210 - CONCRETE WALKS**

1. SCOPE. The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, materials, and performing all work in connection with the construction of concrete pavement. All work shall be in strict accordance with this section of the specifications, the applicable drawings, and subject to the terms and conditions of the contract.

### **2. MATERIALS.**

2.1 Concrete. Materials and concrete work for concrete pavement shall conform to the requirements of the SECTION 033000 – CAST-IN-PLACE CONCRETE, except as otherwise specified herein or shown on the drawings. All pavement concrete shall have a 4000 psi strength at 28 days. Concrete shall have 5%  $\nabla$ 1 percent entrained air.

#### **2.2 Joint filler:**

2.2.1 For expansion joints: Filler shall be preformed materials conforming to ASTM D 1751 or D 1752.

2.2.2 For contraction joints: Sawable type contraction joint inserts shall conform to ASTM D 2828.

2.3 Dowels shall be plain steel bars conforming to ASTM Specification A 675, grade 80, or A 499.

2.4 Reinforcement: All reinforcement shall be free from loose flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete. Removal of thin powdery rust and tight rust is not required. However, reinforcing steel which is rusted to the extent that it does not conform to the required dimensions or mechanical properties shall not be used.

2.5 Welded steel wire fabric shall conform to ASTM A 185.

2.6 Welded deformed steel wire fabric shall conform to ASTM A 497.

### **3. JOINTS:**

3.1 General: Joints shall conform to the details indicated and shall be perpendicular to the finished grade of the pavement. Transverse expansion and contraction joints shall be straight and continued from edge to edge of the pavement.

#### **3.2 Construction joints:**

3.2.1 Longitudinal construction joints: Longitudinal construction joints between paving lanes shall be located as indicated. Keys and tie bars shall be installed in the longitudinal construction joints as indicated. The dimensions of the keyway forms shall not vary more than plus or minus 1/8 inch from the dimensions indicated and shall not deviate more than plus or minus 1/4 inch from the mid-depth of the pavement. Longitudinal construction joints shall be edged and subsequently sawed to provide a groove at the top conforming to the details and dimensions indicated.

4. FINISH FOR PAVEMENT: The pavement shall be struck off to grade and immediately straight-edged with a 10-ft. straight-edge in both directions. Floating shall be started after the surface has been straight-edged and all the surface water has disappeared. The initial floating may be performed by use of power-driven equipment. The final surface texture of the pavement shall be provided by means of a burlap drag, or broom as approved.

4.1 Broom texturing: Surface texture shall be applied using an approved hand or mechanical stiff bristle broom of a type that will produce uniform corrugations.

5. CURING AND PROTECTION: The contractor shall protect the pavement against all damage prior to final acceptance of the work. Traffic shall be excluded from the pavement until the concrete is at least 14 days old, or attains a compressive strength of 3000 psi. Curing of concrete shall be as specified in SECTION CONCRETE, of these specifications.

6. PAVEMENT THICKNESS: The pavement shall be constructed in accordance with the thickness shown on the drawings. No variation in thickness of over 1/4-inch will be permitted. If a variation in thickness occurs and is sufficient to seriously impair the service expected from the pavement, the deficient area shall be removed and replaced with a slab of quality and thickness satisfactory to the Contracting Officer's Representative, in conformance with the paragraph, REMOVAL AND REPLACEMENT OF DEFECTIVE PAVEMENT AREAS.

7. REMOVAL AND REPLACEMENT OF DEFECTIVE PAVEMENT AREA: Defective pavement areas shall be removed and replaced as specified herein with pavements of the thickness and quality required by these specifications. The defective pavement shall be carefully removed in such manner that the adjacent pavement will not be damaged and the existing keys or dowels at the joints will be left intact. When a portion of an unfractured slab is to be replaced, a saw cut 2 inches deep shall be made transversely across the slab in the required location, and the concrete shall be removed to provide an essentially vertical face in the remaining portion of the slab. Prior to the placement of the fresh concrete, the face of the slab shall be cleaned of debris and loose concrete, and then thoroughly coated with epoxy/resin grout. The epoxy/resin coating shall be approximately 1/16 inch, and shall be applied by scrubbing a thin coat of grout into the surface with a stiff bristle brush followed by a second application. Placement of the fresh portland cement concrete shall be accomplished while the epoxy/resin is still tacky and in such manner that the grout coating will not be removed. Longitudinal and transverse joints of the replaced slab or portions thereof shall be constructed as indicated. No payment will be made for the defective pavements removed nor for the cost of removing the defective pavements.

8. PRECAST CONCRETE WHEEL STOPS. Shall be installed in accordance with the applicable drawings, and shall be the product of a manufacturer regularly engaged in producing precast items. Concrete used in the manufacture of the wheel stops shall have a 3000 psi compressive strength when tested at 28 days.

9. TESTING. Concrete pavement testing shall be as follows:

Concrete Paving - Set of 3 cylinders for each day=s concrete placement.

Test and report concrete breaks at 7 and 28 days.

END OF SECTION 03210

## **SECTION 03300 - CAST-IN-PLACE CONCRETE**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Footings.
  - 2. Foundation walls and Grade beams.
  - 3. Slabs-on-grade.
  - 4. Slabs-on-metal deck.
- B. Related Sections:
  - 1. Division 32 Section "Concrete Paving" for concrete pavement and walks.

#### **1.3 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - 1. Location of construction joints is subject to approval of the Architect.

- F. Samples: For waterstops and vapor retarder.
- G. Qualification Data: For Installer and manufacturer.
- H. Welding certificates.
- I. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Form materials and form-release agents.
  - 4. Waterstops.
  - 5. Curing compounds.
  - 6. Bonding agents.
  - 7. Vapor retarders.
  - 8. Semirigid joint filler.
  - 9. Repair materials.
- J. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
  - 1. Aggregates.
- K. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- L. Field quality-control reports.
- M. Minutes of preinstallation conference.

#### 1.5 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 LaDOTD requirements for production facilities and equipment.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301, "Specifications for Structural Concrete,"
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
  - a. Contractor's superintendent.
  - b. Independent testing agency responsible for concrete design mixtures.
  - c. Ready-mix concrete manufacturer.
  - d. Concrete subcontractor.
  - e. Special concrete finish subcontractor.
2. Review testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

## 1.6 DELIVERY, STORAGE, AND HANDLING

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

## PART 2 - PRODUCTS

### 2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.



1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
  3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.
- C. Deformed-Steel Wire: ASTM A 496/A 496M.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

## 2.3 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. 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.

## 2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type I, gray. Supplement with the following:
    - a. Fly Ash: ASTM C 618, Class F or C.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years'

satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches1 inch nominal.
  2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Lightweight Aggregate: ASTM C 330, ¾ inch nominal maximum aggregate size.
- E. Water: ASTM C 94/C 94M and potable.

## 2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
  7. Concrete Moisture Vapor Reduction Admixture (MVRA): Barrier one high performance concrete admixture.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Axim Italcementi Group, Inc.; CATEXOL CN-CI.
    - b. BASF Construction Chemicals - Building Systems; Rheocrete CNI.
    - c. Euclid Chemical Company (The), an RPM company; ARMATECT, EUCON BCN, EUCON CIA.
    - d. Grace Construction Products, W. R. Grace & Co.; DCI.
    - e. Sika Corporation; Sika CNI.
- D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Construction Chemicals - Building Systems; Rheocrete 222+.
    - b. Cortec Corporation; MCI- 2000.
    - c. Grace Construction Products, W. R. Grace & Co.; DCI-S.
    - d. Sika Corporation; FerroGard 901.

## 2.6 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
  - 1. Products: Subject to compliance with requirements, provide waterstop approved by waterproofing manufacturer as part of waterproofing system:
    - a. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP.
    - b. CETCO; Volclay Waterstop-RX.
    - c. Concrete Sealants Inc.; Conseal CS-231.
    - d. Greenstreak; Swellstop.
    - e. Henry Company, Sealants Division; Hydro-Flex.
    - f. JP Specialties, Inc.; Earth Shield Type 20.

## 2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
  - 1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
    - a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
    - b. Fortifiber Building Systems Group; Moistop Ultra 10.
    - c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
    - d. Insulation Solutions, Inc.; Viper VaporCheck 10.
    - e. Meadows, W. R., Inc.; Perminator 10 mil.
    - f. Raven Industries Inc.; Vapor Block 10.
    - g. Reef Industries, Inc.; Griffolyn 10 mil Green.
    - h. Stego Industries, LLC; Stego Wrap 10 mil Class A.
- B. Granular Fill: Washed concrete sand..

## 2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
    - b. BASF Construction Chemicals - Building Systems; Confilm.
    - c. ChemMasters; SprayFilm.
    - d. Conspec by Dayton Superior; Aquafilm.
    - e. Dayton Superior Corporation; Sure Film (J-74).
    - f. Edoco by Dayton Superior; BurkeFilm.
    - g. Euclid Chemical Company (The), an RPM company; Eucobar.
    - h. Kaufman Products, Inc.; Vapor-Aid.
    - i. Lambert Corporation; LAMBCO Skin.
    - j. L&M Construction Chemicals, Inc.; E-CON.

- k. Meadows, W. R., Inc.; EVAPRE.
  - l. Metalcrete Industries; Waterhold.
  - m. Nox-Crete Products Group; MONOFILM.
  - n. Sika Corporation; SikaFilm.
  - o. SpecChem, LLC; Spec Film.
  - p. Symons by Dayton Superior; Finishing Aid.
  - q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
  - r. Unitex; PRO-FILM.
  - s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
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.; AH Clear Cure WB.
  - b. BASF Construction Chemicals - Building Systems; Kure-N-Seal WB.
  - c. ChemMasters; Safe-Cure & Seal 20.
  - d. Conspec by Dayton Superior; Cure and Seal WB.
  - e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
  - f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
  - g. Edoco by Dayton Superior; Spartan Cote WB II.
  - h. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
  - i. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
  - j. Lambert Corporation; Glazecote Sealer-20.
  - k. L&M Construction Chemicals, Inc.; Dress & Seal WB.
  - l. Meadows, W. R., Inc.; Vocomp-20.
  - m. Metalcrete Industries; Metcure.
  - n. Nox-Crete Products Group; Cure & Seal 150E.
  - o. Symons by Dayton Superior; Cure & Seal 18 Percent E.
  - p. TK Products, Division of Sierra Corporation; TK-2519 WB.
  - q. Vexcon Chemicals, Inc.; Starseal 309.

## 2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. 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.
- F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

## 2.10 REPAIR MATERIALS

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

## 2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 20 percent.

2. Silica Fume: 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
  1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
  4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

## 2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Pile Caps, Grade Beams & Piers: Proportion normal-weight concrete mixture as follows:
  1. Minimum Compressive Strength: 3000 psi at 28 days.
  2. Maximum Water-Cementitious Materials Ratio: 0.50.
  3. Slump Limit: 4 inches, plus or minus 1 inch.
- B. Foundation Walls: Proportion normal-weight concrete mixture as follows:
  1. Minimum Compressive Strength: 3000 psi at 28 days.
  2. Maximum Water-Cementitious Materials Ratio: 0.50.
  3. Slump Limit: 5 - 8 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.
- C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
  1. Minimum Compressive Strength: 3000 psi at 28 days.
  2. Minimum Cementitious Materials Content: 520 lb/cu. yd..
  3. Slump Limit: 4 inches plus or minus 1 inch.
  4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- D. Slabs-on-Metal Deck: Proportion normal-weight concrete mixture as follows:
  1. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
  2. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25mm) prior to addition of water-reducing admixture.
  3. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
- E. Slabs-on-Metal Deck: Proportion structural lightweight concrete mixture as follows:
  1. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
  2. Calculated equilibrium weight: #5 110 lb/cu. ft. (1762 kg/cu. m.) plus or minus 3 lb/cu. ft. (48.1 kg/cu. m.) as determined by ASTM C567.
  3. Slump limit 4 inches (100mm) plus or minus 1 inch (25mm).

## 2.13 FABRICATING REINFORCEMENT

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

## 2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M[ and ASTM C 1116/C 1116M], and furnish batch ticket information.
  - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 FORMWORK

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

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

### 3.2 EMBEDDED ITEMS

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

### 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that do not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
  - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### 3.4 VAPOR RETARDERS

- A. 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.
- C. Granular Course: Place vapor retarder on granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
  - 1. Place and compact a 1/2-inch-thick layer of fine-graded granular material over granular fill.

### 3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- 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 for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, at locations indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
  2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
  3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

### 3.7 WATERSTOPS

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

### 3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. 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.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
  - 1. Maintain concrete temperature below 96 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.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### 3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
  - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
  3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
  1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings, to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
  1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. 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 exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 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 3/16 inch.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
  1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
  1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

### 3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

### 3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
  - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### 3.13 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 joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### 3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 2. After concrete has cured at least 14 days, correct high areas by grinding.
  - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  - 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. 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.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
  2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
  6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  7. Compression Test Specimens: ASTM C 31/C 31M.



- a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
  - 8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
  - 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
  - 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
  - 11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
  - 12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
  - 13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
  - 14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  - 15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

**END OF SECTION 03300**

## **SECTION 04200 - UNIT MASONRY**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section includes the following:

- Face Brick.
- Concrete unit masonry.
- Masonry reinforcement.
- Mortar and Grout.
- Masonry Cell Insulation.
- Embedded Flashing.

#### **SUBMITTALS**

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data for each different masonry unit, accessory, and other manufactured product indicated.

Samples for verification of the following:

Full-size units for each different exposed masonry unit required showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.

Include size-variation data for Type FBX and Type FBS brick, verifying that actual range of sizes for brick falls within ASTM C 216 dimension tolerances.

Contractor to provide a full size 48" x 48" on site mock-up of the proposed masonry veneer with specified mortar color and joint type.

#### **QUALITY ASSURANCE**

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

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

Field-Constructed Mock-Ups: Prior to installation of unit masonry, erect sample wall panels to further verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of Work:

Locate mock-ups on site in locations indicated or, if not indicated, as directed by Architect.

Build mock-ups for the following types of masonry in sizes of approximately 4 feet long by 4 feet high by full thickness.

Notify Architect one week in advance of the dates and times when mock-ups will be erected.

Protect mock-ups from the elements with weather-resistant membrane.

Retain and maintain mock-ups during construction in undisturbed condition as standard for judging completed unit masonry construction.

When directed, demolish and remove mock-ups from Project site.

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

Deliver masonry materials to project in undamaged condition.

Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

Store cementitious materials off the ground, under cover, and in dry location.

Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

## **PROJECT CONDITIONS**

Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

Stain prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed. Remove immediately any grout, mortar, and soil that come in contact with such masonry.

Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

Protect sills, ledges, and projections from mortar droppings.

Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings.

Cold-Weather Construction: Comply with referenced unit masonry standard for cold-weather construction and the following:

Do not lay masonry units that are wet or frozen.

Remove masonry damaged by freezing conditions.

Hot-Weather Construction: Comply with referenced unit masonry standard.

## **PART 2 - PRODUCTS**

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

Concrete Masonry Units:

Burns & Russell Co. (The).  
Louisiana Industries.  
Trenwyth Industries, Inc.

Brick:

Acme Brick Co. – color by architect.

Portland Cement, Mortar Cement, Masonry Cement, and Lime:

Essroc Materials, Inc.  
Glen-Gery Corporation.  
Lafarge Corporation.  
Lehigh Portland Cement Co.  
Riverton Corporation (The).

Mortar Pigments:

Davis Colors.  
Lafarge Corporation.  
Solomon Grind-Chem Services, Inc.

Joint Reinforcement, Ties, and Anchors:

AA Wire Products Co.  
Dur-O-Wal, Inc.  
Hohmann & Barnard, Inc.  
Masonry Reinforcing Corp. of America.  
National Wire Products Industries.  
Southern Construction Products.

## **MATERIALS, GENERAL**

Comply with referenced unit masonry standard and other requirements specified in this Section applicable to each material indicated.

## **CONCRETE MASONRY UNITS**

General: Comply with requirements indicated below applicable to each form of concrete masonry unit required.

Provide special shapes for smooth faced concrete masonry units, where indicated on the Drawings and as follows:

For lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

Bullnose units for outside corners and windows sills, unless otherwise indicated.

Size: Provide concrete masonry units complying with requirements indicated below for size that are manufactured to specified face dimensions within tolerances specified in the applicable referenced ASTM specification for concrete masonry units.

Concrete Masonry Units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated on drawings.

Provide Type II, non-moisture-controlled units.

Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

Hollow Load-Bearing Concrete Masonry Units: ASTM C 90, Grade N and as follows:

Types of Concrete Masonry Units:

Interior: Smooth faced concrete masonry unit.

Sizes: 4", 6" or 8" wide x 8" high x 16" long. Reference Drawings for location of the different sizes.

Unit Compressive Strength: Provide units with minimum average net area compressive strength indicated below:

1900 psi.

Not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.

Weight Classification: Lightweight.

Fire Rated: Provide Type D-2, two (2) hour fire rated concrete masonry units where indicated on the Drawings and/or required by the code.

## **BRICK**

General: Provide shapes indicated and as follows for each form of brick required.

Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps

and for similar applications that would otherwise expose unfinished brick surfaces.

Provide special shapes or solid brick for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

Provide special shapes or solid brick for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

Provide special shapes or solid brick for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

Face Brick: ASTM C 216 and as follows:

Grade and Unit Compressive Strength: Provide units with grade and minimum average net-area compressive strength indicated below:

Grade: SW; 8000 psi (55.2 MPa).

Initial Rate of Absorption: Between 5 and 20 g/30 sq. in. (g/194 sq. cm) per minute when tested per ASTM C 67.

Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).

Type: FBS.

Appearance: Equal to any brand from Cherokee Brick Company ([picabrick.com](http://picabrick.com)) or equal.

Size: Bricks manufactured to the following actual dimensions within tolerances specified in ASTM C 216:

Modular: 3-1/2 to 3-5/8 inches thick by 2-1/4 inches high by 7-1/2 to 7-5/8 inches long.

Texture: Typical of early 1900's period brick.

Color: French Quarter Tumble

## **MORTAR AND GROUT MATERIALS**

Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide ivory buff by acme brick or equal mortar color.

Hydrated Lime: ASTM C 207, Type S.

Aggregate for Mortar: ASTM C 144, except for joints less than 1/4 inch use aggregate graded with 100 percent passing the No. 16 sieve.

Aggregate for Grout: ASTM C 404.

Water: Clean and potable.

## **REINFORCING STEEL**

General: Provide reinforcing steel complying with requirements of referenced unit masonry standard

and this article.

Steel Reinforcing Bars: Material and grade as follows:

Billet steel complying with ASTM A 615.

Grade 60.

Deformed Reinforcing Wire: ASTM A 496.

Plain Welded Wire Fabric: ASTM A 185.

## **JOINT REINFORCEMENT**

General: Provide joint reinforcement complying with requirements of referenced unit masonry standard and this article, formed from the following:

Galvanized carbon steel wire, coating class as required by referenced unit masonry standard for application indicated.

Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements indicated below:

Wire Diameter for Side Rods: 0.1875 inch.

Wire Diameter for Cross Rods: 0.1483 inch (9 gage).

For single-wythe masonry provide type as follows with single pair of side rods:

Truss design with continuous diagonal cross rods spaced not more than 16 inches o.c.

For multiwythe masonry provide type as follows:

Truss design with diagonal cross rods spaced not more than 16 inches o.c. and number of side rods as follows:

Number of Side Rods for Multiwythe Concrete Masonry: One side rod for each face shell of hollow masonry units more than 4 inches in nominal width plus one side rod for each wythe of masonry 4 inches or less in nominal width.

Use units with adjustable 2-piece rectangular ties where horizontal joints of facing wythe do not align with those of backup by more than and where indicated.

## **TIES AND ANCHORS, GENERAL**

General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of referenced unit masonry standard and of this article.

Galvanized Carbon Steel Wire: ASTM A 82, coating class as required by referenced unit masonry standard for application indicated.

Wire Diameter: 0.1875 inch.

Galvanized Steel Sheet: As follows:

ASTM A 526 (commercial quality), Coating Designation G60, steel sheet zinc-coated by hot-dip

process on continuous lines prior to fabrication, for sheet metal ties and anchors completely embedded in mortar.

ASTM A 366 (commercial quality), cold-rolled carbon steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153, Class B2 (for unit lengths over 15 inches) and Class B3 (for unit lengths under 15 inches), for sheet metal ties and anchors exposed to the weather and not completely embedded in mortar and grout.

Galvanized Steel Sheet Thickness: For steel sheet hot-dip galvanized by continuous process prior to fabrication:

0.0785 inch (14 gage).

## **BENT WIRE TIES**

Individual units prefabricated from bent wire to comply with requirements indicated below:

Tie Shape for Hollow Masonry Units Laid with Cells Vertical: Rectangular with closed ends and not less than 4 inches wide.

## **MISCELLANEOUS ANCHORS**

Anchor Bolts: Steel bolts complying with A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

Headed bolts.

Nonheaded bolts, straight.

Nonheaded bolts, bent in manner indicated.

## **EMBEDDED FLASHING MATERIALS**

Sheet Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 7 Section "Flashing and Sheet Metal".

Asphalt-Coated Copper Flashing: Manufacturer's standard product consisting of sheet copper of weight per sq. ft. indicated below coated with flexible asphalt.

Weight: 5 oz.

Application: Use where flashing is fully concealed in masonry.

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

Asphalt-Coated copper Flashing:

"Cop-A-Cote," Afco Products Inc.

"Type ACC-Asphalt Bituminous Coated," Phoenix Building Products.

"Coated Copper Flashing," Sandell Manufacturing Co., Inc.

"Copperseal," York Manufacturing, Inc.



## **MISCELLANEOUS MASONRY ACCESSORIES**

Preformed Control Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

Styrene-Butadiene Rubber Compound: ASTM D 2000, Designation 2AA-805.

Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

Weep Holes: Provide the following:

Wicking Material: Material as indicated below, in length required to produce a 2 inch exposure on exterior and 18 inches in the cavity.

Fibrous glass rope.

## **INSULATION**

Loose granular vermiculite insulation equal to ASTM C516, Type II (surface treated for water repellency and limited moisture absorption) or Type VI (surface treated for water repellency to limit dust generation).

## **MASONRY CLEANERS**

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

For masonry not subject to metallic oxidation stains, use formulation consisting of a liquid blend of surface-acting acids and special inhibitors.

For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.

Products: Subject to compliance with requirements, provide the following:

"Sure Klean No. 600 Detergent," ProSoCo, Inc.  
"Sure Klean No. 101 Lime Solvent," ProSoCo, Inc.  
"Sure Klean Vana Trol," ProSoCo, Inc.

## **MORTAR AND GROUT MIXES**

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

Do not use calcium chloride in mortar or grout.

Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification for job-mixed mortar and ASTM C 1142 for ready-mixed mortar, of types indicated below:

Limit cementitious materials in mortar to portland cement-lime.

For reinforced masonry and where indicated, use type indicated below:

Type S.

For exterior, above-grade load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions, and for other applications where another type is not indicated, use type indicated below:

Type N.

### **PART 3 - EXECUTION**

#### **INSTALLATION, GENERAL**

Comply with referenced unit masonry standard and other requirements indicated applicable to each type of installation included in Project.

Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

Build chases and recesses as shown or required to accommodate items specified in this and other Sections of the Specifications. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.

Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.

Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.

#### **LAYING MASONRY WALLS**

Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

Bond Pattern for Exposed Masonry: Lay exposed masonry in a running bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, provide a flush cut masonry joint and brush out joints while mortar is still wet prior to laying fresh masonry.

Built-In Work: As construction progresses, build-in items specified under this and other Sections of the

Specifications. Fill in solidly with masonry around built-in items.

Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

At exterior frames insert extruded polystyrene board insulation around perimeter of frame in thickness indicated but not less than 3/4 inch to act as a thermal break between frame and masonry.

Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

Fill core in hollow concrete masonry units with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

## **MORTAR BEDDING AND JOINTING**

Lay hollow concrete masonry units as follows:

With full mortar coverage on horizontal and vertical face shells.

Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.

For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not furrow bed joints or slush head joints.

Provide rough flush masonry joints.

## **STRUCTURAL BONDING OF MULTI-WYTHE MASONRY**

Use structural bonding system indicated on Drawings.

Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

Provide continuity with horizontal joint reinforcement at corners using prefabricated "L" units, in addition to masonry bonding.

Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:

Provide continuity with horizontal joint reinforcement using prefabricated "T" units.

Nonbearing Interior Partitions: Partitions shall extend above the ceiling heights as indicated on the drawings.

## **HORIZONTAL JOINT REINFORCEMENT**

General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in

mortar for their entire length with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcing a minimum of 6 inches.

Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

## **MOVEMENT (CONTROL AND EXPANSION) JOINTS**

General: Install control and expansion joints in unit masonry where indicated. Build in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-place restraint of wall or partition movement.

## **LINTELS**

Provide masonry lintels where shown and wherever openings of more than 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.

For hollow concrete masonry unit walls, use specially formed bond beam units with reinforcement bars placed as indicated and filled with coarse grout.

Install steel lintels where indicated.

Provide steel lintels where shown and where openings of more than 12 inches (305 mm) for brick size units and 24 inches (610 mm) for block size units are shown without structural steel or other supporting lintels.

Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

## **MASONRY CELL INSULATION**

Pour granular insulation into the cavities of all the concrete masonry units, located at the exterior walls and around Toilet Rooms, and completely fill a void spaces. Maintain inspection ports to show presence of insulation at the extremities of each pour area. Close ports after complete coverage has been confirmed.

## **FLASHING/WEEP HOLES**

General: Install weep holes in masonry at base of wall, other obstructions to the downward flow of water in the wall, and where indicated.

Prepare Masonry surfaces so that they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive/sealant/tape as recommended by flashing manufacturer before covering with mortar.

At masonry-veneer walls, extend flashing from exterior face of veneer, through the veneer, up face of sheathing at least 8 inches (200 mm), and behind air-infiltration barrier/building paper.

At lintels and shelf angles, extend flashing a minimum of 4 inches (100 mm) into masonry at each

end. At heads and sills, extend flashing 4 inches (100 mm) at ends and turn up not less than 2 inches (50 mm) to form a pan.

Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above footing and at  $\pm 8$  inches above finish grade.

Form weep holes with product specified in Part 2 of this Section.

Form weep holes by keeping head joints free and clear of mortar.

Space weep holes 32 inches o.c.

## **INSTALLATION OF REINFORCED UNIT MASONRY**

General: Install reinforced unit masonry to comply with requirements of referenced unit masonry standard.

Temporary Formwork: Construct formwork and shores to support reinforced masonry elements during construction.

Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

## **REPAIRING, POINTING, AND CLEANING**

Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.

Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

Wet wall surfaces with water prior to application of cleaners; scrub brick surfaces with brush to remove excess mortar and film from face of brick, remove cleaners promptly by rinsing thoroughly with clear water. Clean brick surfaces as the work progresses. Do not wait until the

end of the work to clean brick. Do not use power washers on the brick.

Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

END OF SECTION 04200



## **SECTION 05120 - STRUCTURAL STEEL**

### **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. Structural steel.
  - 2. Grout.
- B. Related Sections include the following:
  - 1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
  - 2. Division 5 Section "Steel Deck" for field installation of shear connectors.
  - 3. Division 5 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.

#### **1.3 DEFINITIONS**

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.
  - 1. Fabricator shall use a specialty engineer to design the special connections noted using the service level loads shown.
  - 2. Select and complete connections using schematic details indicated using AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4.
  - 3. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.
- B. Construction: Type 2, simple framing unless noted as a moment connection.



## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
  - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
  - 5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Qualification Data: For Installer, fabricator, and professional engineer.
- E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
  - 1. Structural steel including chemical and physical properties.
  - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  - 3. Direct-tension indicators.
  - 4. Tension-control, high-strength bolt-nut-washer assemblies.
  - 5. Shear stud connectors.
  - 6. Shop primers.
  - 7. Nonshrink grout.
  - 8. Certification of recycled content.
- F. Source quality-control test reports.

## 1.6 QUALITY ASSURANCE

- A. Shop-Painting Applicators: Qualified according to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel."
- C. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
  - 2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
  - 3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
  - 4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
  - 5. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
  - 6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
  - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

## 1.8 COORDINATION

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

# PART 2 - PRODUCTS

## 2.1 STRUCTURAL-STEEL MATERIALS

- A. Structural steel materials shall contain a minimum of 50% recycled content.
- B. W-Shapes: ASTM A 992/A 992M.
- C. Channels, Angles, M , S-Shapes: ASTM A 36/A 36M.
- D. Plate and Bar: ASTM A 36/A 36M.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
  - 1. Weight Class: as indicated.
  - 2. Finish: Black.
- G. Welding Electrodes: Comply with AWS requirements.

## 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
  - 1. Finish: Plain.
  - 2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.
    - a. Finish: Plain.
- B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

- C. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
  - 1. Nuts: ASTM A 563 heavy hex carbon steel.
  - 2. Washers: ASTM F 436 hardened carbon steel.
  - 3. Finish: Plain.
- D. Threaded Rods: ASTM A 36/A 36M.
  - 1. Nuts: ASTM A 563 heavy hex carbon steel.
  - 2. Washers: ASTM F 436 hardened carbon steel.
  - 3. Finish: Plain.
- E. Clevises and Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.
- F. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.
- G. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

## 2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

## 2.4 GROUT

- A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
  - 1. Camber structural-steel members where indicated.
  - 2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
  - 3. Mark and match-mark materials for field assembly.
  - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened, unless indicated
  - 2. Join Type: Slip Critical for bolts in tension, bolts in bracing members, and bolts in moment connections.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
  - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
  - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
  - 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
    - a. Grind butt welds flush.
    - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

## 2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2. Surfaces to be field welded.
  - 3. Surfaces to be high-strength bolted with slip-critical connections.
  - 4. Surfaces to receive sprayed fire-resistive materials.
  - 5. Galvanized surfaces.

- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

## 2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.
  - 1. Fill vent holes and grind smooth after galvanizing.

## 2.9 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
  - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
  - 1. Liquid Penetrant Inspection: ASTM E 165.
  - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  - 3. Ultrasonic Inspection: ASTM E 164.
  - 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

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

### **3.2 PREPARATION**

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

### **3.3 ERECTION**

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
- B. Base[ and Bearing] Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
  1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
  2. Weld plate washers to top of base plate.
  3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
  4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be

in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
  2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.
  2. Join Type: Slip Critical for bolts in tension, bolts in bracing members, and bolts in moment connections.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
  2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
  3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
  4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances.[ Prevent weld show-through on exposed steel surfaces.]
    - a. Grind butt welds flush.
    - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
  - 1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
  - 1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
  - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

### 3.6 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
  - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
  - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 05120





## SECTION 05500 - METAL FABRICATIONS

### 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. Steel framing and supports for ceiling-hung toilet compartments.
  - 2. Steel framing and supports for operable partitions.
  - 3. Steel framing and supports for overhead doors.
  - 4. Steel framing and supports for countertops.
  - 5. Steel framing and supports for mechanical and electrical equipment.
  - 6. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 7. Elevator hoist beams.
  - 8. Support angles for elevator door sills.
  - 9. Shelf angles.
  - 10. Loose bearing and leveling plates.
  - 11. Steel weld plates and angles for casting into concrete not specified in other Sections.
  - 12. Metal ladders.
  - 13. Ladder safety cages.
  - 14. Metal bollards.
  - 15. Pipe guards.
  - 16. Bicycle racks.
  - 17. Metal floor plate and supports.
  - 18. Abrasive metal nosings, treads, and thresholds.
  - 19. Metal downspout boots.
- B. Products furnished, but not installed, under this Section include the following:
  - 1. Loose steel lintels.
  - 2. Steel pipe sleeves, indicated to be cast into concrete or built into unit masonry.
- C. Related Sections include the following:
  - 1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
  - 2. Division 5 Section "Structural Steel."
  - 3. Division 5 Section "Metal Stairs."
  - 4. Division 5 Section "Pipe and Tube Railings."
  - 5. Division 14 Section "Hydraulic Elevators" for elevator pit ladders and support angles for elevator door sills.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. 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.

### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Metal nosings and treads.
  - 2. Paint products.
  - 3. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
  - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
  - 2. Provide templates for anchors and bolts specified for installation under other Sections.
  - 3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Verification: For each type and finish of extruded nosing and tread.
- D. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- E. Welding certificates.
- F. Qualification Data: For professional engineer.
- G. LEED Submittals:
  - Product Data for Credit MR 4.1: Indicating percentages by weight of postconsumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

### 1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."

## 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
  - 2. Provide allowance for trimming and fitting at site.

## 1.7 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. 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.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

# 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 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

## 2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- C. Steel Tubing: ASTM A 500, cold-formed steel tubing.

- D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

## 2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36.
  - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.3.
- G. Plain Washers: Round, ASME B18.22.1.
- H. Lock Washers: Helical, spring type, ASME B18.21.1.
- I. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- J. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

## 2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for reglazing welds in steel, complying with SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

## 2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
  1. Fabricate units from slotted channel framing where indicated.
  2. Furnish inserts if units are installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

## 2.8 LOOSE STEEL LINTELS

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

## 2.9 SHELF ANGLES

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

- C. Prime shelf angles located in exterior walls with zinc-rich primer.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

#### 2.10 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates after fabrication.
- C. Prime plates with zinc-rich primer.

#### 2.11 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

#### 2.12 MISCELLANEOUS STEEL TRIM

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

#### 2.13 METAL LADDERS

- A. General:
  - 1. Comply with ANSI A14.3, unless otherwise indicated.
  - 2. For elevator pit ladders, comply with ASME A17.1.
  - 3. Space siderails 18 inches apart, unless otherwise indicated.
  - 4. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.
- B. Steel Ladders:
  - 1. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
  - 2. Rungs: 3/4-inch- diameter steel bars.
  - 3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.



4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
5. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung by a proprietary process.
6. Available Products:
  - a. IKG Industries, a Harsco company; Mebac.
  - b. W. S. Molnar Company; SlipNOT.
7. Prime exterior ladders and interior ladders, where indicated, including brackets and fasteners, with zinc-rich primer.

C. Aluminum Ladders:

1. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
2. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
3. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.

## 2.14 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe.
  1. Cap bollards with 1/4-inch- thick steel plate.
  2. Where bollards are indicated to receive push-button controls for door operators, provide necessary cutouts for push-button controls and hole for wire.
- B. Fabricate bollards with 3/8-inch- thick steel baseplates for bolting to concrete slab. Drill baseplates at all 4 corners for 3/4-inch anchor bolts.
  1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
- D. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4 inch steel machine bolt.

## 2.15 PIPE GUARDS

- A. Fabricate pipe guards from 3/8-inch- thick by 12-inch- wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.
- B. Galvanize pipe guards after fabrication.

## 2.16 BICYCLE RACKS

- A. Fabricate from Schedule 40 steel pipe, fully welded together, to lengths indicated.
- B. Fabricate with NPS 3 top rails and end posts, NPS 1-1/2 bottom rails and intermediate posts not more than 72 inches o.c., and NPS 3/4 vertical separators at approximately 8 inches o.c.
- C. Make top rails 36 inches above pavement/floor and bottom rails 4 inches above pavement/floor.
- D. Fabricate end posts and intermediate posts with 1/4-inch- thick steel baseplates for bolting to concrete slab. Drill end post baseplates at all 4 corners and intermediate-post baseplates at 2 opposite sides for 1/2-inch anchor bolts.
- E. Galvanize bicycle racks after fabrication.

## 2.17 ABRASIVE METAL NOSINGS, TREADS, AND THRESHOLDS

- A. Cast-Metal Units: Cast gray iron, Class 20, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
  - 1. Available Manufacturers:
    - a. American Safety Tread Co., Inc.
    - b. Balco Inc.
    - c. Barry Pattern & Foundry Co., Inc.
    - d. Granite State Casting Co.
    - e. Safe-T-Metal Co.
    - f. Wooster Products Inc.
  - 2. Nosings: Cross-hatched units, 4 inches wide with 1-inch lip, for casting into concrete steps.
  - 3. Nosings: Cross-hatched units, 1-1/2 by 1-1/2 inches, for casting into concrete curbs.
  - 4. Treads: Cross-hatched units, full depth of tread with 3/4-by-3/4-inch nosing, for application over bent plate treads or existing stairs.
  - 5. Thresholds: Plain-stepped- (stop-) type units, 5 inches wide by 1/2 inch high, with 1/2-inch step.
- B. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
  - 1. Available Manufacturers:
    - a. ACL Industries, Inc.
    - b. American Safety Tread Co., Inc.
    - c. Amstep Products.
    - d. Armstrong Products, Inc.
    - e. Balco Inc.
    - f. Granite State Casting Co.
    - g. Wooster Products Inc.
  - 2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.

3. Provide solid-abrasive-type units without ribs.
  4. Nosings: Square-back units, 4 inches wide, for casting into concrete steps.
  5. Nosings: Beveled-back units, 4 inches wide with 1-3/8-inch lip, for surface mounting on existing stairs.
  6. Nosings: Two-piece units, 3 inches wide, with subchannel for casting into concrete steps.
  7. Treads: Square-back units, full depth of tread with 1-3/8-inch lip, for application over existing stairs.
- C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- D. Drill for mechanical anchors and countersink. Locate not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
1. Provide 2 rows of holes for units more than 5 inches wide, with 2 holes aligned at ends and intermediate holes staggered.
- E. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete.
- F. Apply clear lacquer to concealed bottoms, sides, and edges of extruded units set into concrete.

## 2.18 METAL DOWNSPOUT BOOTS

- A. Provide downspout boots made from cast gray iron in heights indicated with inlets of size and shape to suit downspouts.
1. Outlet: At 35 degrees from horizontal, to discharge onto splash block or pavement.

## 2.19 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

## 2.20 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
1. ASTM A 123/A 123M, for galvanizing steel and iron products.
  2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## 2.21 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

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

### 3.3 INSTALLING PREFABRICATED BUILDING COLUMNS

- A. Install prefabricated building columns to comply with AISC's "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary" and with requirements applicable to listing and labeling for fire-resistance rating indicated.

### 3.4 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
  - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
  - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.5 INSTALLING METAL BOLLARDS

- A. Anchor bollards to existing construction with expansion anchors.. Provide four 3/4-inch bolts at each bollard, unless otherwise indicated.
  - 1. Embed anchor bolts at least 4 inches in concrete.

- B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete, in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- D. Anchor internal sleeves for removable bollards in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of sleeve. Fill annular space around internal sleeves solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward internal sleeve.
- E. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.
- F. Place removable bollards over internal sleeves and secure with 3/4-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner will furnish padlocks.
- G. Fill bollards solidly with concrete, mounding top surface to shed water.
  - 1. Do not fill removable bollards with concrete.

### 3.6 INSTALLING PIPE GUARDS

- A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

### 3.7 INSTALLING BICYCLE RACKS

- A. Anchor bicycle racks to existing construction with expansion anchors. Provide four 1/2-inch bolts at each end post and 2 at each intermediate post.

### 3.8 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

- A. Center nosings on tread widths.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Division 7 Section "Joint Sealants" to provide a watertight installation.

### 3.9 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

## **SECTION 06100 - ROUGH CARPENTRY**

### **PART 1 - GENERAL**

#### **SUMMARY**

Section Includes:

Rooftop equipment bases and support curbs.

Wood blocking, cants, and nailers.

Plywood backing panels.

#### **ACTION SUBMITTALS**

Product Data: For each type of process and factory-fabricated product.

Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements

Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

### **PART 2 - PRODUCTS**

#### **WOOD PRODUCTS, GENERAL**

Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

Regional Sources: Plywood shall be manufactured a maximum of 500 miles from the mill and supplier to Shreveport.

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.

Factory mark each piece of lumber with grade stamp of grading agency.

For exposed lumber indicated to receive a stained or natural finish.

Provide dressed lumber, S4S, unless otherwise indicated.

Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal thickness or less unless otherwise indicated.



## **WOOD-PRESERVATIVE-TREATED LUMBER**

Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

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

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

Application: Treat all rough carpentry unless otherwise indicated.

Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

Wood sills, sleepers, blocking and similar concealed members in contact with masonry or concrete.

Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.

Wood floor plates that are installed over concrete slabs-on-grade.

## **MISCELLANEOUS LUMBER**

General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

Blocking.

Nailers.

Rooftop equipment bases and support curbs.

Cants.

For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.

For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

Mixed southern pine; No.2 grade; SPIB.

## **PLYWOOD BACKING PANELS**

Backing Panels behind limestone cladding: DOC PS 1, Exposure 1, C-D Plugged in thickness indicated or, if not indicated, not less than 5/8-inch nominal thickness.

Telephone Boards or other exposed plywood panels: DOC PS 1, Exterior, AC, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness

## **GYPSUM BOARD SHEATHING SUBSTRATE**

Gypsum Sheathing Product: Subject with compliance with requirements, provide gypsum sheathing substrate equal to:

Basis of Design: G-P Gypsum Corp.; Dens-Glass Gold Sheathing.

Thickness: 1/2 inch, where indicated on the Drawings

## **COMMERCIAL WEATHER BARRIER**

Commercial Weather Barrier Product: Subject with compliance with requirements, provide gypsum sheathing substrate equal to:

Basis of Design: DuPont: Tyvek.

## **FASTENERS**

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

Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

Power-Driven Fasteners: NES NER-272.

Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

## **EXECUTION**

### **INSTALLATION, GENERAL**

Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

NES NER-272 for power-driven fasteners.

Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

## **PROTECTION**

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.

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

## **COMMERCIAL WEATHER BARRIER**

Install the weather barrier over all plywood and Dens Glass substrates.

Starting at a corner of the building unroll DuPont Tyvek weather barrier keeping the roll plumb.

Extend approximately 12" past either the inside or outside corner of the wall.

Vertically overlap the next sheet of DuPont Tyvek by at least 6". Vertical grid lines are provided every 8" on DuPont Tyvek Commercial Wrap to assist in alignment with stud spacing. Proper shingling shall be maintained by installing DuPont Tyvek weather barriers from the bottom of the building up.

DuPont Tyvek should overlap through-wall flashing by a minimum of 6". For maximum air leakage reduction (when installing as an air barrier), seal wrap at the bottom of the wall with sealant, DuPont Tyvek Tape, or DuPont

Tape all horizontal and vertical seams with 3" DuPont™Tyvek® Tape.

END OF SECTION 06100

## **SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section includes the following:

- Laminate clad cabinets (plastic-covered casework).

- Laminate clad wall panels

#### **SUBMITTALS**

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components. .

Samples of the plastic laminate showing full range of colors, textures, and patterns available for each type of material indicated.

#### **QUALITY ASSURANCE**

Manufacturer Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation.

AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated. Particle board, masonite, or flake board are not acceptable on this project.

Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

Regional Sources: Plywood shall be manufactured a maximum of 500 miles from the mill and supplier to Shreveport.

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

Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage,

soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

## **PROJECT CONDITIONS**

**Environmental Conditions:** Obtain and comply with Woodwork Manufacturer's and Installer's coordinated advise for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

**Field Measurements:** Where woodwork is indicated to be other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

## **PART 2 - PRODUCTS**

### **HIGH PRESSURE DECORATIVE LAMINATE MANUFACTURERS**

**Manufacturer:** Subject to compliance with requirements, provide high pressure decorative laminates of one of the following:

Formica Corp.  
Nevamar Corp.  
Wilsonart

**Fabricators:** Subject to compliance with requirements, utilize a manufacturer of one of the following:

Tyler Millwork  
Contemporary in Texarkana  
Hanly Vermillion

## **MATERIALS**

**General:** Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:

High Pressure Laminate: NEMA LD 3.

Softwood Plywood: PS 1.

**Formaldehyde Emission Levels:** Comply with formaldehyde emission requirements of each voluntary standard referenced below:

Hardwood Plywood: HPMA FE.

## **FABRICATION, GENERAL**

**Wood Moisture Content:** Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.

Fabricate woodwork to dimensions, profiles, and details indicated on the Drawings.

Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

Factory-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. Smooth edges of cutouts and, where located in countertops and similar exposures.

### **LAMINATE CLAD CABINETS AND WALL PANELS (PLASTIC-COVERED CASEWORK)**

Quality Standard: Comply with AWI Section 400 and its Division 400B "Laminate Clad Cabinets."

Grade: Premium.

AWI Type of Cabinet Construction: Flush overlay.

Laminate Cladding: High pressure decorative laminate complying with the following requirements:

Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

Match color, pattern, and finish indicated by reference to laminate manufacturer's standard designations for these characteristics.

Provide selections made by Architect from laminate manufacturer's full range of standard colors and finishes in the following categories:

Solid colors, stones, patterns and woodgrains.

Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.

Horizontal Surfaces Other Than Tops: GP-50 (0.050-inch nominal thickness).

Vertical Surfaces: GP-28 (0.028-inch nominal thickness).

Vertical Surfaces: Metal laminate .055 inch with phenolic backing.

Edges: GP-28 (0.028-inch nominal thickness).

Semiexposed Surfaces: Provide surface materials indicated below:

High pressure laminate, CL-20.

Unexposed Surfaces: Provide surface materials indicated below:

Thermalfused laminate (melamine); NEMA LD-3-1991 for GP-28.

Provide dust panels of 1/4-inch plywood above compartments and drawers with locks, except where location directly under tops.

Core: Core material shall be plywood thickness as detailed on the Drawings. Wall panel manufacturer will fabricate laminate clad wall panels in a manner to prevent warping.

### **CABINET HARDWARE AND ACCESSORY MATERIALS**

General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

Cabinet Hardware Schedule: Refer to schedule at end of this section for cabinet hardware required for architectural cabinets.

Hardware Standard: Comply with ANSI/BHMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BHMA numbers or referenced to this standard.

Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA code number indicated.

Satin Stainless Steel, Stainless Steel Base: BHMA 630.

For concealed hardware provide manufacturer's standard finish that complies with product class requirements of ANSI/BHMA A156.9.

### **ARCHITECTURAL CABINET TOPS (COUNTERTOPS)**

Countertops will be either solid surface or stone. Cabinet manufacturer will be responsible for fabricating a cabinet substructure capable of adequately supporting indicated countertops.

### **FASTENERS AND ANCHORS**

Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

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 bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

## **PART 3 - EXECUTION**

### **PREPARATION**

Condition woodwork to average prevailing humidity conditions in installation areas before installing.

Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.

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

### **INSTALLATION**

Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.

Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.

Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish.

Cabinets: Install without distortion so that 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 the installation of hardware and accessory items as indicated.

Tops: Anchor securely to base units and other support systems as indicated.

Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.

### **ADJUSTMENT AND CLEANING**

Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

Clean, lubricate, and adjust hardware.

Clean woodwork on exposed and semiexposed surfaces. Touch up or replace factory-applied finishes to restore damaged or soiled areas, to the satisfaction of the Architect.

### **PROTECTION**

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that woodwork is being without damage or deterioration at time of Final Acceptance.

### **HARDWARE SCHEDULE**

Unless noted specifically in drawings provide the following as options for hardware:

Door & Drawer Pulls: Equal to Stanley #4477; brushed chrome; 4inches long.

Catches: Magnetic catches, BHMA A156.9, B03141.

Adjustable Standards and Brackets: Equal to KV-255 and KV-256 or vinyl (drill adapted).

Frameless Concealed Hinges: European Type BHMA A156.9, B01602, 170 degree of opening.

Drawer Slides: Equal to Blum, BS 430 E, Bottom Mount, Full Extension.

Locks: Equal to Corbin US26D 02066 for Drawers and 02067 for Doors (5 pin tumbler).

Grommets for Cable Passage through Countertops: 2" OD molded plastic grommets and matching plastic caps with slot for wire passage.

Color: To be selected by Architect from manufacturer's standard colors after receipt of bids.

END OF SECTION 06402





## **SECTION 07141 – CRYSTALLINE, CAPILLARY WATERPROOFING FOR CONCRETE**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Crystalline Water-Proofing System for negative side application.
- B. Related Section: Division 7 Section "Joint Sealants" for joint-sealant materials and installation.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Product test reports.

#### **1.3 QUALITY ASSURANCE**

- A. Installer Qualifications: A firm that is approved or licensed by waterproofing manufacturer for installation of waterproofing required for this Project.
- B. Pre-installation Conference: Conduct conference at Project site.
  - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and flashings, installation procedures, testing and inspection procedures, and protection and repairs.

#### **1.4 PROJECT CONDITIONS**

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer.

#### **1.5 WARRANTY**

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which waterproofing manufacturer and Installer agree to repair or replace waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
  - 1. Warranty Period: 20 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 CRYSTALLINE, CAPILLARY WATERPROOFING SYSTEM FOR CONCRETE**

- A. Basis of Design is Cadeco's Tegraproof: Comply with ANSI Standard 61 and with manufacturer's written physical requirements.
  - 1. Acceptable Manufacturers:
    - a. American Permaquik Inc.
    - b. Anti-Hydro International, Inc.
    - c. Carlisle Coatings & Waterproofing Inc.
    - d. Degussa Building Systems
    - e. Karnak Corporation
    - f. Meadows, W.R., Inc.; Sealtight Meadow-Pruf Seamless
    - g. Mer-Kote Products, Inc.; Mer-Thane 320.

## **PART 3 - EXECUTION**

### **3.1 SURFACE PREPARATION**

- A. Clean and prepare substrate according to manufacturer's written recommendations. Provide clean, dust-free, and dry substrate for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage or over- application affecting other construction.
- C. Water blast or acid etch new concrete per manufacturer recommendation.
- D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

### **3.2 WATERPROOFING APPLICATION**

- A. Apply waterproofing according to [ANSI/NSF 61 and manufacturer's written instructions].
  - 1. Apply slurry coat with brush. Apply second coat as and if needed. Wait the appropriate time between coats – ref. manufacturer's instructions.

### **3.3 CURING, PROTECTION, AND CLEANING**

- A. Cure waterproofing according to manufacturer's written recommendations, taking care to prevent contamination and damage during application stages and curing.
  - 1. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07141



## **SECTION 07210 - BUILDING INSULATION**

### **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 includes the following:
  - 1. Sound insulation in batt form.

#### **1.3 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of insulation product specified.

#### **1.4 QUALITY ASSURANCE**

- A. Fire Performance Characteristics: Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per the ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.
  - 1. Surface Burning Characteristic: ASTM E 84.
  - 2. Fire Resistance Ratings: ASTM E 119.
- B. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

#### **1.5 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 recommendations for handling, storage, and protection during installation.
- B. Protect insulation as follows:
  - 1. Protect against ignition at all times. Do not deliver insulating materials to project site ahead of installation time.
  - 2. Complete installation and concealment of materials as rapidly as possible in each area of construction.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide insulation products of one of the following:
  - 1. Manufacturers of Glass Fiber Insulation:
    - a. CertainTeed Corp.
    - b. Insulation Corporation of America.
    - c. Knauf Fiber Glass GmbH.
    - d. Manville: Building Insulation Div., Manville Sales Corp.
    - e. Owens/Corning Fiberglas Corp.

### **2.2 INSULATING MATERIALS**

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
- B. Performed Units: Sizes to fit applications indicated on the Drawings, selected from manufacturer's standard thicknesses, widths, and lengths. All insulation materials shall be fully encased.
- C. Location and Sizes:
  - 1. Interior stud walls: 3 1/2" thick; at all walls separating guest rooms and toilet rooms – Ref. plans.
  - 2. Un- Faced.
- D. Mineral Fiber Blanket/Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type III, Class A ;blankets with reflective vapor-retarder membrane facing with flame spread of 25 or less; vapor-retarder membrane of one face, and as follows:
  - 1. Mineral Fiber Type: Fibers manufactured from glass.
  - 2. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.

### **2.3 INSULATION FASTENERS**

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- B. Anchor Adhesives: Product with demonstrated capability to bond insulation anchors securely in place to substrates indicated without damaging insulation and substrate to which anchor is attached.
  - 1. AGM Industries, Inc. TACTOO Adhesive.

2. Eckel Industries of Canada Limited; Stic-Klip Type S Adhesive.
3. Gemco; Tuff Bond Hanger Adhesive.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates and conditions with Installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION**

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections that might puncture vapor retarders.

#### **3.3 INSTALLATION, GENERAL**

- A. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.
- B. Extend insulation full thickness as 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.
- C. Apply a single layer of insulation of required thickness, where indicated.

#### **3.4 INSTALLATION OF GENERAL BUILDING INSULATION**

- A. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support units.
- B. Set vapor retarder faced units with vapor retarder to warm side of construction, except as otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
- C. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Set reflective, foil-faced units accurately with not less than 0.75-inch air space in front of foil as indicated.

#### **3.5 PROTECTION**

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

**END OF SECTION 07210**





## **SECTION 07901 - JOINT SEALANTS**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

Extent of each form and type of joint sealer is indicated on drawings and schedules.

This Section includes joint sealers for the following locations:

Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:

- Control joints in unit masonry.
- Joints in aluminum sandwich panels.
- Joints in sheet metal.
- Joints between different materials.
- Perimeter joints between materials and frames of doors and windows.
- Other joints as indicated.

Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:

- Control joints on exposed interior surfaces of exterior walls.
- Perimeter joints of exterior openings where indicated.
- Tile control joints.
- Perimeter joints between interior wall surfaces and frames of interior doors and windows.
- Perimeter joints of toilet fixtures.

Sealants for glazing purposes are specified in Division-8 Section "Glass and Glazing."

Reference: Section 07841; Fire Stop Sealants.

#### **SYSTEM PERFORMANCES**

Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

#### **SUBMITTALS**

Product Data from manufacturers for each joint sealer product required, including instructions for joint preparation and joint sealer application.

Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project name, addresses, names of Architects and Owners, plus other information specified.

Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

Product test reports for each type of joint sealers indicated, evidencing compliance with requirements specified.

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

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 multi-component materials.

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.

## **PROJECT CONDITIONS**

Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:

When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturers.

When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 deg F (4.4 deg C).

When joint substrates are wet due to rain, frost, condensation, or other causes.

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.

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**

### **MATERIALS, GENERAL**

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.

Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by Architect from manufacturer's full range standard colors.

### **ELASTOMERIC JOINT SEALANTS**

Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements.

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

#### **One-Part Mildew-Resistant Silicone Sealant:**

"Dow Corning 786"; Dow Corning Corp.  
"SCS 1702 Sanitary"; General Electric Co.  
"863 #345 White"; Pecora Corp.  
"Proglaze White"; Tremco Corp.

"OmniPlus"; Sonneborn Building Products Div., Rexnord Chemical Products Inc.

#### **Single Component Nonsag Urethane Sealant**

Vulkem 116; Mameco International  
Vulkem 230; Mameco International  
Sikaflex 1a; Sika Corporation  
NP-1; Sonneborn Building Products Div., Chem Rex, Inc.

#### **Multi-Component Nonsag Sealant**

Chem Calk 2641,; Bostik, Inc.  
Vulkem 227; Mameco International  
Vulkem 922; Mameco International  
NP-2; Sonneborn Building Products Div., Chem Rex, Inc.

### **LATEX JOINT SEALANTS**

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.

Silicone Emulsion Sealant: Manufacturer's standard one part, nonsag, mildew-resistant, silicone-emulsion sealant complying with ASTM C 834 and ASTM C 920, 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 12-1/2 percent.

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

#### **Acrylic-Emulsion Sealant:**

"Chem-Calk 600"; Bostik Construction Products Div.  
"AC-20"; Pecora Corp.  
"Sonolac"; Sonneborn Building Products Div., Rexnord Chemical Products, Inc.

### **JOINT SEALANTS FOR PAVING**

One-Part Jet-Fuel-Resistant Cold-Applied Urethane Sealant: Manufacturer's standard, pourable, coal-tar modified urethane formulation complying with performance requirements of FS SS-S-200, Type H.

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

#### **One-Part Jet-Fuel-Resistant Cold-Applied Sealant:**

"Vulkem 200"; Mameco International, Inc.  
"Sonomeric CT 1"; Sonneborn Building Products Div., Rexnord Chemical Products Inc.

### **JOINT SEALANT BACKING**

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.

Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F (-15 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

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.

## **MISCELLANEOUS MATERIALS**

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.

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.

Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

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.

## **JOINT FILLERS FOR CONCRETE PAVING**

General: Provide joint fillers of thickness and widths indicated.

Bituminous Fiber Joint Filler: Preformed strips of composition below, complying with ASTM D 1751:

1/2" thick asphalt saturated fiberboard.

## **PART 3 - EXECUTION**

### **EXAMINATION**

Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements 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.

### **PREPARATION**

Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:

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 repellent; water; surface dirt; and frost.

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.

Remove laitance and form release agents from concrete.

Clean metal, glass, 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.

**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.

**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.

## **INSTALLATION OF JOINT SEALERS**

**General:** Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

**Elastomeric Sealant Installation Standard:** Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.

**Latex Sealant Installation Standard:** Comply with requirements of ASTM C 790 for use of latex sealants.

**Installation of Sealant Backings:** Install sealant backings to comply with the following requirements:

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.

Do not leave gaps between ends of joint fillers.

Do not stretch, twist, puncture, or tear joint fillers.

Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material.

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.

**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.

**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.

Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.

Provide recessed joint configuration per Figure 6C in ASTM C 962, of recess depth and at locations indicated.

**Installation of Preformed Foam Sealants:** Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools which produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

## **CLEANING**

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.

## **PROTECTION**

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.

END OF SECTION 07901

## **SECTION 08211 - FLUSH WOOD DOORS**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:

1. Solid-core doors with plastic laminate faces.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
1. Indicate dimensions and locations of mortises and holes for hardware.
  2. Indicate dimensions and locations of cutouts.
  3. Indicate requirements for veneer matching.
  4. Indicate fire ratings for fire doors.

- B. Samples for Verification:

1. Corner section of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish sample per requirements of Section 09931-Wood Stains and Transparent Finishes.

#### **1.3 QUALITY ASSURANCE**

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
    - A. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
    - B. Test Pressure: Test at atmospheric pressure.
    - C. Oversize, Fire-Rated Wood Doors: For door assemblies exceeding sizes of tested assemblies, provide oversize fire door label or certificate of inspection, from a testing and inspecting agency acceptable to authorities having jurisdiction, stating that doors comply with requirements of design, materials, and construction.
    - D. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

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

- A. Comply with requirements of referenced standard and manufacturer's written instructions.



- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

## 1.5 PROJECT CONDITIONS

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

## 1.6 WARRANTY

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

- 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
- 2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

- A. Solid-Core Interior Doors: Life of installation.

## PART 2 – PRODUCTS

### 2.1 MANUFACTURERS

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

- 1. Flush Wood Doors:
  - a. Eagle Plywood and Door Manufacturing, Inc.
  - b. GRAHAM Manufacturing Corp.
  - c. VT Industries Inc.
  - d. Chappel Door Company
  - e. Oshcosh Wood Doors
  - f. Southwood Wood Doors

### 2.2 DOOR CONSTRUCTION, GENERAL

- A. Adhesives: Do not use adhesives containing urea formaldehyde.
- B. Doors for Transparent Finish:
  - 1. Grade: Premium, with Grade AA faces.
  - 2. Species and Cut: Birch, rotary cut.
  - 3. Match between Veneer Leaves: Book match.
  - 4. Assembly of Veneer Leaves on Door Faces: Center balance match.
  - 5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

## 2.3 SOLID-CORE DOORS

- A. General: Flush wood doors faced with NEMA LD 3, Grade HGS (0.048 inch (1.21mm) thick high pressure plastic laminate:

1. Total Thickness: 1-3/4 inches (44mm).
2. Facing selection: High pressure plastic laminate selected from manufacturer's standard line of solids, patterns or wood grains.
3. Edge Banding: Matching facing laminate.

- B. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade LD-1.
  - a. Use particleboard made with binder containing no urea-formaldehyde resin.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
  - a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
  - b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
  - c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
3. Provide doors with either glued-block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.

- B. Interior Veneer-Faced Doors:

1. Core: Particleboard.
2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

- C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware as follows:
  - a. 5-inch (125-mm) top-rail blocking.
  - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
  - c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
  - d. 4-1/2-by-10-inch (114-by-250-mm) lock blocks 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile matching face veneer, and laminated backing at hinge stiles for improved screw-holding capability and split resistance.
4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals.

## 2.4 LIGHT FRAMES

- A. Metal Frames for Light Openings in Fire and Non-Rated Doors: Manufacturer's standard frame formed of 0.0478-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory primed and approved for use in doors of fire rating indicated and non-rated doors.

## 2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
  - 1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHIWDHS-
  - 1. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
  - 2. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  - 3. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

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

### 3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
  - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

E. Field-Finished Doors: Refer to the following for finishing requirements:

1. Division 9 Section "Painting."

### 3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08211



## SECTION 08710 - DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:
  - a. Swinging doors.
2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

B. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.

1. Pivots, thresholds, weather stripping, and lock cylinders to be installed under other Sections.
2. Permanent lock cores to be installed by Owner.

#### 1.2 SUBMITTALS

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

B. Shop Drawings: Details of electrified door hardware.

C. Samples: For each exposed product and for each color and texture specified.

D. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
  - b. Content: Include the following information:
    - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
    - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    - 4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.

### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI and LSFM as follows:
- C. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
- E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
  - 1. Air Leakage Rate: Maximum air leakage of 0.3 sq. ft at the tested pressure differential of 0.3-inch of water.
- F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- G. Means of Egress Doors: Latches do not require more than 15 lb to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ADA-ABA Accessibility Guidelines.
  - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lb.
  - 2. Comply with the following maximum opening-force requirements:
    - a. Interior, Non-Fire-Rated Hinged Doors: 5 lb. applied perpendicular to door.
    - b. Sliding or Folding Doors: 5 lb. applied parallel to door at latch.
    - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
  - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
  - 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- I. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- B. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

#### 1.5 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. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
    - a. Electromagnetic and Delayed-Egress Locks: 2 years from date of Substantial Completion.
    - b. Exit Devices: 5 years from date of Substantial Completion.
    - c. Manual Closers: 10 years from date of Substantial Completion.
    - d. Concealed Floor Closers: 5 years from date of Substantial Completion.

#### 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. Door Hardware: 2 extra Electronic entry card locks – Match existing.

### **PART 2 - PRODUCTS**

#### 2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
  - 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 Schedule" Article. Products are identified by using door hardware designations, as follows:
  - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
  - 2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.



## 2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
  - 2. Basis-of-Design Product: ZERO International  
Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Baldwin Hardware Corporation.
    - b. Hager Companies.
    - c. Lawrence Hardware Inc.
    - d. McKinney Products Company; an ASSA ABLOY Group company.
    - e. Stanley Commercial Hardware; Div. of The Stanley Works.

## 2.3 SELF-CLOSING HINGES AND PIVOTS

- A. Mortise-type Cam lift hinges: Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: ZERO #Z953 for up to 300 lbs.  
Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Baldwin Hardware Corporation.
    - b. Hager Companies.
    - c. Lawrence Hardware Inc.
    - d. McKinney Products Company; an ASSA ABLOY Group company.
    - e. Stanley Commercial Hardware; Div. of The Stanley Works.

## 2.4 MECHANICAL LOCKS AND LATCHES

- A. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
  - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  - 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
  - 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- B. Bored Locks: BHMA A156.2; Grade 1 Series 4000.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Sargent 11 Line LL Trim X26D  
Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Corbin Russwin Architectural Hardware; n ASSA ABLOY Group Company.
    - b. Medeco Security Locks, Inc.; an ASSA ABLOY Group company.
    - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    - d. Yale Security Inc.; an ASSA ABLOY Group company.

- e. Best-Lock
- C. Mortise Locks: BHMA A156.13; Operational Grade 1 stamped steel case with steel or brass parts; Series 1000.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Sargent 8200 LNL X26D  
Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
    - b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
    - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    - d. Yale Security Inc.; an ASSA ABLOY Group company.
    - e. Best-Lock

## 2.5 AUXILIARY LOCKS

- A. Bored Auxiliary Locks: BHMA A156.5: Grade 1; with strike that suits frame.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Sargent 470 Series  
Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Hager Companies.
    - b. Medeco Security Locks, Inc.; an ASSA ABLOY Group company.
    - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    - d. Yale Security Inc.; an ASSA ABLOY Group company.
    - e. Best-Lock
- B. Mortise Auxiliary Locks: BHMA A156.5; Grade 1 ; with strike that suits frame.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Sargent 4800 Series  
Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
    - b. Arrow USA; an ASSA ABLOY Group company.
    - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    - d. Yale Security Inc.; an ASSA ABLOY Group company.
    - e. Corbin-Russwin
    - f. Best-Lock
- C. Narrow Stile Auxiliary Locks: BHMA A156.5; Grade 1; with strike that suits frame.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

- a. Accurate Lock & Hardware Co.
  - b. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
- D. Push-Button Combination Locks: BHMA A156.5; cylindrical; Grade 1; lock opens by entering a one- to five-digit code by pushing correct buttons in correct sequence; automatically relocks when door is closed; with strike that suits frame.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: L1021  
Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Kaba Ilco Corp.; a Kaba Group company.

## 2.6 ELECTROMECHANICAL LOCKS (if required by door schedule)

- A. Electromechanical Locks: BHMA A156.25; Grade 1 motor or solenoid driven; bored, mortise latchbolt, mortise deadbolt, mortise deadlocking latchbolt; with strike that suits frame.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Match existing  
Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. DynaLock Corp.
    - b. Rutherford Controls Int'l. Corp.
    - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    - d. Security Door Controls.
    - e. Yale Security Inc.; an ASSA ABLOY Group company.
    - f. Best-Lock

## 2.7 SELF-CONTAINED ELECTRONIC LOCKS (if required by door schedule)

- A. Self-Contained Electronic Locks: BHMA A156.25, bored, mortise; with internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case, and strike that suits frame. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Match existing  
Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Kaba Ilco Corp.; a Kaba Group company.
    - b. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    - c. Yale Security Inc.; an ASSA ABLOY Group company.
    - d. Best-Lock

## 2.8 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Trimco 3917 Manual  
Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
    - b. Burns Manufacturing Incorporated.
    - c. Don-Jo Mfg., Inc.
    - d. Door Controls International, Inc.
    - e. Hiawatha, Inc.
    - f. Trimco.

## 2.9 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Trimco 3510 X 3525  
Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Rockwood
    - b. Door Controls International, Inc.
    - c. Trimco.

## 2.10 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: sergeant 80 X ETL Trim  
Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
    - b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
    - c. Door Controls International, Inc.
    - d. Dor-O-Matic; an Ingersoll-Rand company.
    - e. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    - f. Best-Lock
    - g. Yale Security Inc.; an ASSA ABLOY Group company.

## 2.11 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturer: Same manufacturer as for locking devices.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

- a. Best-Lock

- B. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

## 2.12 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. 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: Two.
- c. Grand Master Keys: Two.
- d. Two extra cut keys for each lock.

## 2.13 KEY CONTROL SYSTEM

- A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

- a. American Key Boxes and Cabinets.
- b. GE Security, Inc.
- c. HPC, Inc.
- d. Lund Equipment Co., Inc.
- e. MMF Industries.
- f. Tri Palm International.

3. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

## 2.14 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release
- B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: BHMA A156.22.

## 2.15 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Arrow USA; an ASSA ABLOY Group company.
    - b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
    - c. Norton Door Controls; an ASSA ABLOY Group company.
    - d. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
    - e. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    - f. Yale Security Inc.; an ASSA ABLOY Group company.

## 2.16 CONCEALED CLOSERS

- A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
    - a. Norton Door Controls; an ASSA ABLOY Group company.
    - b. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
    - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

## 2.17 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or

flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hager Companies.
  - b. National Guard Products.
  - c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
  - d. Reese Enterprises, Inc.
  - e. ZERO International.
2. Drop Down Door Threshold: basis of design is ZERO Mortised #369AA for STC50 or better.
3. Self Adhesive Weatherstripping: basis of design is ZERO #824N for STC50 or better.

## 2.18 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hager Companies.
  - b. National Guard Products.
  - c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
  - d. Reese Enterprises, Inc.
  - e. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
  - f. Zero International.
2. Rabbeted Thresholds: basis of design is ZERO #568A for STC50 or better.

## 2.19 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Baldwin Hardware Corporation.
  - b. Don-Jo Mfg., Inc.
  - c. Hager Companies.
  - d. Rockwood Manufacturing Company.
  - e. Trimco.

## 2.20 AUXILIARY ELECTRIFIED DOOR HARDWARE

- A. Auxiliary Electrified Door Hardware:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

- a. DynaLock Corp.
- b. GE Security, Inc.
- c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
- d. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
- e. Security Door Controls.
- f. Must be compatible with existing card locks.

## 2.21 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
  - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
  - 2. Fire-Rated Applications:
    - a. Wood or Machine Screws: For the following:
      - 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
      - 2) Strike plates to frames.
      - 3) Closers to doors and frames.
    - b. Steel Through Bolts: For the following unless door blocking is provided:
      - 1) Surface hinges to doors.
      - 2) Closers to doors and frames.
      - 3) Surface-mounted exit devices.
  - 3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
  - 4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
  - 5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

## 2.22 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule or 626/630.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. All exterior glazing must be AT/FP compliant.



## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
- C. Mounting Heights: Mount door hardware units at heights indicated on Drawings to comply with the following unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  - 2. Custom Steel Doors and Frames: HMMA 831.
  - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- D. 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 9 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.
- E. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- F. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
- G. Lock Cylinders: Install construction cores to secure building and areas during construction period.
  - 1. Replace construction cores with permanent cores as indicated in keying schedule.
  - 2. Furnish permanent cores to Owner for installation.
- H. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- I. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room]. Verify location with Architect.
  - 1. Configuration: Provide one power supply for each door opening least number of power supplies required to adequately serve doors with electrified door hardware.
- J. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

- K. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- L. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- M. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- N. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- O. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.2 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.

### 3.3 DOOR HARDWARE SCHEDULE

**END OF SECTION 08710**



## **SECTION 08830 - MIRRORS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes the following types of silvered flat glass mirrors:
  - 1. Annealed monolithic glass mirrors.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.
- C. Samples:
  - 1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
  - 2. Mirror Clips: Full size.
  - 3. Mirror Trim: 12 inches long.
- D. Preconstruction test reports.
- E. Maintenance data.
- F. Warranty: Sample of special warranty.

#### **1.3 QUALITY ASSURANCE**

- A. Glazing Publications: Comply with GANA's "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- B. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing and substrates on which mirrors are installed.

#### **1.4 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.

## **PART 2 - PRODUCTS**

### **2.1 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.
- B. Clear Glass: Mirror Glazing Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission.
  - 1. Nominal Thickness: 5.0 mm.
- C. Tempered Clear Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.
  - 1. Nominal Thickness: 5.0mm.

### **2.2 MISCELLANEOUS MATERIALS**

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Approved by mirror manufacturer.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors.
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

## **2.3 MIRROR HARDWARE**

- A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
  - 1. Finish: Clear bright anodized.
- B. Mirror Bottom Clips: As indicated.
- C. Mirror Top Clips: As indicated.
- D. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- E. Anchors and Inserts: Provide devices as required for mirror hardware installation.

## **2.4 FABRICATION**

- A. Cutouts: Fabricate cutouts before tempering for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- B. Mirror Edge Treatment: Flat high-polished. Seal edges of mirrors with edge sealer.
- C. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
  - 1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.
- B. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.
- C. 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.
- D. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

- E. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- F. Do not permit edges of mirrors to be exposed to standing water.
- G. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- H. 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 08830

## **SECTION 09250 - GYPSUM BOARD ASSEMBLIES**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

Extent of each type of gypsum drywall construction required is indicated on Drawings.

This Section includes the following types of gypsum board construction:

- Steel framing members to receive gypsum board.

- Gypsum board screw-attached to steel framing and furring members.

#### **DEFINITIONS**

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

#### **SUBMITTALS**

Product data from manufacturers for each type of product specified.

#### **QUALITY ASSURANCE**

Fire-Resistance Ratings: Where indicated, provide materials and construction which are identical to those of assemblies whose fire resistance rating has been determined per ASTM E 119 by a testing and inspecting organization acceptable to authorities having jurisdiction.

- Provide fire-resistance-rated assemblies identical to those indicated by reference to GA File No.'s in GA-600 "Fire Resistance Design Manual" or to design designations in U.L. "Fire Resistance Directory" or in listing of other testing and agencies acceptable to authorities having jurisdiction.

Single Source Responsibility: Obtain each type of gypsum board and related joint treatment materials from a single manufacturer.

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

Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.

Handle gypsum boards to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

#### **PROJECT CONDITIONS**

Environmental Conditions, General: Establish and maintain environmental conditions for application



and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.

Minimum Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously thereafter until drying is complete.

Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

## **PART 2 - PRODUCTS**

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

### **Steel Framing and Furring:**

Clark Steel Framing Systems.  
Dale Industries, Inc. - Dale/Incor.  
Dietrich Industries, Inc.  
MarinoWare; Division of Ware Ind.  
National Gypsum Company.  
Unimast, Inc.

### **Gypsum Boards and Related Products:**

CertainTeed  
Georgia-Pacific Corp.  
Gold Bond Building Products Div., National Gypsum Co.  
United States Gypsum Co.

## **STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS**

General: Provide components, which comply with ASTM C 754 for materials and sizes, unless otherwise indicated.

Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

Channels: Cold-rolled steel, 0.0598 inch minimum thickness of base (uncoated) metal and 7/16 inch wide flanges, protected with rust-inhibitive paint, and as follows:

Carrying Channels: 1-1/2 inch deep, 475 lbs per 1000 ft., unless otherwise indicated.

Furring Channels: 3/4 inch deep, 300 lbs per 1000 ft., unless otherwise indicated.

Steel Studs for Furring Channels: ASTM C 645, with flange edges bent back 90 deg and doubled over to form 3/16" minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:

Thickness: 0.0179 inch, unless otherwise indicated.

Depth: As indicated.

Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth of 7/8 inch.

Grid Suspension System: ASTM C 645, manufacturer's standard grid suspension system composed of main beams and cross furring members which interlock to form a modular supporting network.

## **STEEL FRAMING FOR WALLS AND PARTITIONS**

Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 deg and doubled over to form 3/16" minimum lip (return) and comply with the following requirements for minimum thickness of base (uncoated) metal and for depth:

Depth: 3 5/8", 20 gauge.

Depth: 6", 20 gauge.

Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:

Depth: 3/4 inch.

Depth: 7/8 inch.

Depth: 1 1/2 inch.

Thickness: 0.0179 inch, unless otherwise indicated.

Furring Brackets: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet complying with ASTM C 645, minimum thickness of base (uncoated) metal of 0.0329 inch, designed for screw attachment to steel studs and steel rigid furring channels used for furring.

Steel Channel Bridging: Cold-rolled steel, 0.0598-inch minimum thickness of base (uncoated) metal and 7/16-inch wide flanges, 1-1/2 inches deep.

## **GYPSUM BOARD**

General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end joints.

Thickness: Provide gypsum board in thicknesses indicated, or if not otherwise indicated, 5/8-inch thicknesses to comply with ASTM C 840 for application system and support spacing indicated.

Gypsum Wallboard: ASTM C 36, and as follows:

Type: Type X.

Edge: Tapered.

Thickness: 5/8 inch.

Products: Subject to compliance with requirements, provide one of the following products where Type X gypsum wallboard is indicated:

"ProRoc Type X Gypsum Board", CertainTeed.

"Gyprock Fireguard 'C' Gypsum Board"; Domtar Gypsum Co.

"Fire-Shield G"; Gold Bond Building Products Div., National Gypsum Co.

"SHEETROCK Brand FIRECODE 'C' Gypsum Panels"; United States Gypsum Co.

Water-Resistant Gypsum Backing Board: ASTM C 630, and as follows:

Type: Type X.

Thickness: 5/8 inch.

## TRIM ACCESSORIES

Cornerbead and Edge Trim for Interior Installation: Provide corner beads, edge trim and control joints, which comply with ASTM C 1047 and requirements, indicated below:

Materials: Formed metal, plastic or metal combined with paper, with metal complying with the following requirements:

Sheet steel zinc-coated by hot-dip process.

Edge trim shapes indicated below by reference to designations of Fig. 1 in ASTM C 1047:

"LC" Bead, unless otherwise indicated.

One-Piece Control Joint: Formed with vee-shaped slot per Fig. 1 in ASTM C 1047, with slot opening covered with removable strip.

Adjustable Furring Bracket: 20 gage galvanized metal adjustable furring clip with corrugated edges.

## GYPSUM BOARD JOINT TREATMENT MATERIALS

General: Provide materials complying with ASTM C 475, ASTM C 840, and recommendations of manufacturer of both gypsum board and joint treatment materials for the application indicated.

Joint Tape: Paper reinforcing tape, unless otherwise indicated.

Use pressure sensitive or staple-attached open weave glass fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.

Setting-Tape Joint Compounds: Factory-prepackaged, job-mixed chemical-hardening powder products formulated for uses indicated.

Where setting-type joint compounds are indicated for use as taping and topping compounds, use formulation for each which develops greatest bond strength and crack resistance and is compatible with other joint compounds applied over it.

For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.

For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer for this purpose.

Drying-Type Joint Compounds: Factory-prepackaged vinyl-based products complying with the following requirements for formulation and intended use.

Ready-Mix Formulation: Factory-premixed product.

All-purpose compound formulated for use as both taping and topping compound.

## MISCELLANEOUS MATERIALS

General: Provide auxiliary materials for gypsum drywall construction, which comply with referenced standards and the recommendations of the manufacturer of the gypsum board.

Gypsum Board Screws: ASTM C 1002.

Asphalt Felt: ASTM D 226, Type I (No. 15).

## **PART 3 - EXECUTION**

### **EXAMINATION**

Examine substrates to which drywall construction attaches or abuts, preset hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of drywall construction. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **PREPARATION**

Ceiling Anchorages: Coordinate installation of ceiling suspension system with installation of overhead structural systems to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling anchors in a manner that will develop their full strength and at spacing required to support ceiling.

### **INSTALLATION OF STEEL FRAMING, GENERAL**

Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer, or if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.

Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at locations indicated below to comply with details shown on Drawings:

Where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetrations of structural elements.

Where partition and wall framing abuts overhead structure.

Provide slip or cushioned type joints as detailed at attain lateral support and avoid axial loading.

Do not bridge building expansion and control joints with steel framing or furring members; independently frame both sides of joints with framing or furring members or as indicated.

### **INSTALLATION OF STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS**

Secure hangers to structural support by connecting directly to structure where possible, otherwise connect to cast-in concrete inserts or other anchorage devices or fasteners as indicated.

Do not attach hangers to metal roof deck.

Do not conceal or suspend steel framing from ducts, pipes or conduit.

Keep hangers and braces 2 inches clear of ducts, pipes and conduit.

Sway-brace suspended steel framing with hangers used for support.

Install suspended steel framing components in sizes and at spacings indicated but not less than that required by referenced steel framing installation standard.

Wire Hangers: 0.1320-inch diameter (8 gage), 4 ft. on center.

Carrying Channels (Main Runners): 1-1/2 inch, 4 ft. on center.

Rigid Furring Channels (Furring Members): 16 inches on center.

Installation Tolerances: Install steel framing components for suspended ceilings so that cross furring members or grid suspension members are level to within 1/8 inch in 12 ft. as measured both lengthwise on each member and transversely between parallel members.

Wire-tie or clip furring members to main runners and to other structural supports as indicated.

## **INSTALLATION OF STEEL FRAMING FOR WALLS AND PARTITIONS**

Install runners (tracks) at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other construction.

Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.

Installation Tolerances; Install each steel framing and furring member so that fastening surface do not vary more than 1/8 inch from plane of faces of adjacent framing.

Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

Install steel studs and furring in sizes and at spacings indicated but not less than that required by referenced steel framing installation standard.

For single and double layer construction: 16 inches on center.

Install steel studs so that flanges point in the same direction and gypsum boards can be installed in the direction opposite to that of the flange.

Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor chips on doorframes; install runner track section (for cripple studs) at head and secure to jamb studs.

Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

Install steel bridging channels in all walls/partitions as required and in accordance with manufacturer's recommendations.

Frame openings other than door openings to comply with details indicated, or if none indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

## **APPLICATION AND FINISHING OF GYPSUM BOARD, GENERAL**

Gypsum Board Application and Finishing Standard: Install and finish gypsum board to comply with ASTM C 840.

Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.

Install ceiling boards across framing in the manner which minimizes the number of end-butt joints and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches.

Install wall/partition boards in manner, which minimizes the number of end-butt joints or avoids them entirely where possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.

Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16-inch open space between boards. Do not force into place.

Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flange first.

Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

Form control joints at the head of all doorframes and windows, with space between edges of boards, prepared to receive trim accessories. Install on each side of the partitions.

Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls, which are braced internally.

Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4 inch to 1/2-inch space and trim edge with "U" bead edge trim. Seal joints with acoustical sealant.

## **METHODS OF GYPSUM BOARD APPLICATION**

Single-Layer Application: Install gypsum wallboard as follows:

On ceilings apply gypsum board prior to wall/partition board application to the greatest extent possible.

On partitions/walls apply gypsum board vertically (parallel to framing), unless otherwise indicated, and provide sheet lengths, which will minimize end joints.

Wall Tile Base: Where drywall is base for thin-set glazed tile and similar rigid applied wall finishes, install gypsum-backing board.

In "dry" areas install gypsum backing board or wallboard with tapered edges and finished to produce a flat surface.

At restrooms and similar "wet" areas, install water-resistant gypsum board to comply with ASTM C 840 and recommendations of gypsum board manufacturer.

Double-Layer Application: Install gypsum backing board for base layer and gypsum wallboard for face layer.

On ceilings apply base layer prior to application of base layer on wall/partitions; apply face layers in same sequence. Offset joints between layers at least 10 inches. Apply base layers at right angles to supports unless otherwise indicated.

On partitions/walls apply base layer and face layers vertically (parallel to framing) with joints of base layer over supports and face layer joints offset at least 10 inches with base layer joints.

Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:

Fasten with screws.

Double-Layer Fastening Methods: Apply base layer of gypsum board and face layer to base layer as follows:

Fasten both base layer and face layers separately to supports with screws.

## **INSTALLATION OF DRYWALL TRIM ACCESSORIES**

General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.

Install corner beads at external corners.

Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where "U" bead (semi-finishing type) is indicated.

Install "LC" bead where drywall construction is tightly abutted to other construction and back flange can be attached to framing or supporting substrate.

Install control joints at the head of all doorframes and windows – both sides.

## **FINISHING OF DRYWALL**

General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for decoration.

Prefill open joints and rounded or beveled edges, if any, using setting-type joint compound.

Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

Finish interior gypsum wallboard by applying the following joint compounds in 3 coats (not including prefill of openings in base), and sand between coats and after last coat:

Embedding and First Coat: Ready-mix drying-type all-purpose or taping compound.

Fill (Second) Coat: Ready-mix drying-type all-purpose or topping compound.

Finish (Third) Coat: Ready-mix drying-type all-purpose or topping compound.

**PROTECTION**

Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall construction being without damage or deterioration at time of Final Acceptance.

END OF SECTION 09250





## **SECTION 09300 - TILE**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section includes the following:

Porcelain Floor and Ceramic wall tile.

Stone thresholds.

#### **SUBMITTALS**

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data for each type of product specified.

Shop drawings indicating tile patterns and locations and widths of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

Locate precisely each joint and crack in tile substrates by measuring, record measurements on shop drawings, and coordinate them with tile joint locations.

#### **QUALITY ASSURANCE**

Single-Source Responsibility for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

Single-Source Responsibility for Setting and Grouting Materials: Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.

Installer Qualifications: Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.

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

Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

#### **PROJECT CONDITIONS**

Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

Maintain temperatures at 50 deg F (10 deg C) or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or

manufacturer's instructions.

## **PART 2 - PRODUCTS**

Floor and wall porcelain tile.

Reference the Finish Schedule on the Drawings for Manufacturers, material type, style and colors.

Dry-Set Mortars and Grouts:

Laticrete International Inc.  
Bostik Construction Products Div.  
Crossville Tile Co., Crossville, GA.

### **PRODUCTS, GENERAL**

ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated.

Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.

Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials compiling with the following requirements:

Provide tile trim and accessories that match color and finish of adjoining flat tile and/or as noted on the Color Schedule.

Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.

Basis of Design: American Olean; Unglazed Ceramic Mosaics. Color to be selected by the Architect

Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:

Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.

Shapes: As follows, selected from manufacturer's standard shapes:

Base for Thinset Mortar Installations: Coved.

Wainscot Cap for Thinset Mortar Installations: Surface bullnose.

External Corners for Thinset Installations: Surface bullnose.

Internal Corners: Field-buttet square corners, except use coved base and cap angle pieces designed to member with stretcher shapes.

### **STONE THRESHOLDS**

Marble Thresholds: Provide marble thresholds complying with ASTM C 503 requirements for exterior use and for abrasion resistance where exposed to foot traffic, a minimum hardness of 10 per ASTM C 241. Bevel the threshold to comply with the requirements of the ADA.

Provide honed marble complying with MIA Group "A" requirements for soundness.

## **SETTING MATERIALS**

Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1 and as specified below.

Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15), or polyethylene sheeting ASTM D 4397, 4.0 mils thick.

Dry-Set Portland Cement Mortar: ANSI A118.1.

Latex-Portland Cement Mortar: ANSI A118.4, composition as follows:

Prepackaged dry mortar mix composed of portland cement, graded aggregate, and the following dry polymer additive in the form of a reemulsifiable powder to which only water is added at job site.

Dry Polymer Additive: Manufacturer's standard.

Latex additive (water emulsion) of type described below, serving as replacement for part or all of gauging water, combined at job site with prepackaged dry mortar mix supplied or specified by latex additive manufacturer.

Latex Type: Manufacturer's standard.

## **GROUTING MATERIALS**

Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

Dry-Set Grout: ANSI A118.6, color as indicated.

Latex-Portland Cement Grout: ANSI A118.6, color as indicated, composition as follows:

Prepackaged dry grout mix composed of portland cement, graded aggregate, and the following dry polymer additive in the form of a reemulsifiable powder to which only water is added at job site.

Latex additive (water emulsion) serving as replacement for part or all of gauging water, added at job site with dry grout mixture, with type of latex and dry grout mix as follows:

Latex Type: Manufacturer's standard.

Dry Grout Mixture: Dry-set grout specified or supplied by latex additive manufacturer. Use latex additive without retarder with dry-set grout.

Application: Use dry-set grout combined with latex additive for grouting joints in glazed wall tile.

## **ELASTOMERIC SEALANTS**

General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with requirements of Division 7 Section "Joint Sealers," including ASTM C 920 as referenced by Type, Grade, Class, and Uses.

Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

One-Part Mildew-Resistant Silicone Sealant: 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 temperature extremes.

Multipart Pourable Urethane Sealant for Use T: Type M; Grade P; Class 25; Uses T, M, A, and as applicable to joint substrates indicated, O.

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

One-Part Mildew-Resistant Silicone Sealant:

"Dow Corning 786"; Dow Corning Corp.  
"SCS 1702"; General Electric Co.  
"863 #345 White"; Pecora Corp.  
"Rhodorsil 6B White"; Rhone-Poulenc Inc.  
"Proglaze White"; Tremco Corp.

Multipart Pourable Urethane Sealant:

"Chem-Calk 550"; Bostik Construction Products Div.  
"Vulkem 245"; Mameco International, Inc.  
"Urexpan NR-200"; Pecora Corp.  
"THC-900"; Tremco Corp.

## **MISCELLANEOUS MATERIALS**

Metal Edge Strips: Zinc alloy or stainless steel terrazzo strips, 1/8-inch wide at top edge with integral provision for anchorage to mortar bed or substrate; with style as indicated on the Drawings.

Temporary Protective Coating: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout, is compatible with tile and mortar/grout products, and is easily removable after grouting is completed without damaging grout or tile.

Petroleum paraffin wax, fully refined, tasteless, odorless, containing at least 0.5 percent oil with a melting point of 120 deg F (49 deg C) to 140 deg F (60 deg C) per ASTM D 87.

Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as a temporary protective coating for tile.

## **MIXING MORTARS AND GROUT**

Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

## **PART 3 - EXECUTION**

### **EXAMINATION**

Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.

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 before installing tile.

Do not proceed with installation until unsatisfactory conditions have been corrected.

## **PREPARATION**

**Blending:** For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in 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.

## **INSTALLATION, GENERAL**

**ANSI Tile Installation Standard:** Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.

**TCA Installation Guidelines:** TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated.

Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

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 that plates, collars, or covers overlap tile.

**Jointing Pattern:** Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.

For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.

Lay out tile wainscots to next full tile beyond dimensions indicated.

**Expansion Joints:** Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installation of tiles.

Locate joints in tile surfaces at all inside corners of tile work full height of tile. DO NOT grout in these joints. Install matching color sealant at all inside corners and/or expansion joints.

Prepare joints and apply sealants to comply with sealants specified above.

Grout tile to comply with the requirements of the following installation standards:

For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.

## **FLOOR INSTALLATION METHODS**

Ceramic Tile: Install tile to comply with requirements indicated below for setting bed methods, TCA installation methods related to types of subfloor construction, and grout types:

Portland Cement Mortar: ANSI A108.1

Bond Coat: Portland cement paste or dust coat on plastic bed or the following thin-set mortar on cured bed, ANSI A108.5, at Contractor's option:

Dry-set portland cement mortar.

Concrete Subfloors, Interior: TCA F101 (bonded).

Grout: Commercial portland cement.

Dry-Set Portland Cement Mortar: ANSI A108.5.

Concrete Subfloors, Interior: TCA F113.

Grout: Latex-portland cement.

Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile unless otherwise indicated.

Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.

Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

## **WALL TILE INSTALLATION METHODS**

Install types of tile designated for wall application to comply with requirements indicated below for setting-bed methods, TCA installation methods related to subsurface wall conditions, and grout types:

Dry-Set Portland Cement Mortar: ANSI A108.5.

Metal Studs, Interior: TCA W243.

Grout: Dry set.

Layout: Architect's Option – The wall tile shall be installed in a checkerboard layout with glazed and unglazed wall tile.

## **CLEANING AND PROTECTION**

Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

Remove latex-portland cement grout residue from tile as soon as possible.

Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.

Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Final Acceptance.

When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09300





## **SECTION 09511 - ACOUSTICAL PANEL CEILINGS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Ceilings composed of acoustical panels and exposed suspension systems.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 15 Section "Air Outlets and Inlets" for grilles, registers, and diffusers.
  - 2. Division 16 Section "Interior Lighting Fixtures" for lighting fixtures in acoustical ceilings.

#### **1.3 SUBMITTALS**

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified.
- C. Samples for verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
  - 1. 6" square samples of each acoustical panel type, pattern, and color.

#### **1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: Engage an experienced Installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

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

- A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected

against damage from moisture, direct sunlight, surface contamination, and other causes.

- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

## **PART 2 - PRODUCTS**

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

- 1. Acoustical Ceiling Panels:

Armstrong  
Certain-Teed  
Owens Corning  
Celotex Corp.  
USG Interiors, Inc.

- 2. Suspension Systems:

Armstrong  
Certain-Teed  
Owens Corning  
Chicago Metallic Corporation.  
USG Interiors, Inc.

### **2.1 ACOUSTICAL PANELS, GENERAL**

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

- 1. Mounting Method for Measuring Noise Reduction Coefficient (NRC): Type E-400 (plenum mounting in which face of test specimen is 15-3/4 inches [400 mm] away from the test surface) per ASTM E 795.

- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

### **2.2 CEILING TYPE: 24 x 24 LAY-IN ACOUSTICAL CEILING**

- A. Basis of Design: Armstrong Optima open plan ceilings.

- 1. Standard 15/16" grid.
- 2. Color: White.
- 3. Surface Finish: DuraBrite with vinyl latex paint
- 4. Material: Fiberglass with DuraBrite acoustically transparent membrane
- 5. Edge Detail: Square tegular

## 2.3 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 ASTM C 635 requirements.
- B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated in the Drawings.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated Carbon Steel Wire: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so that its stress at 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than the yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter (12 gage) wire.
- E. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.
- F. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide, formed with 0.0396-inch- (1-mm-) thick galvanized-steel sheet complying with ASTM A 446, G 90 (ASTM A 446M, Z 275) Coating Designation, with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
- G. Edge Moldings and Trim: Metal or extruded aluminum of type and profile indicated, or if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
  - 1. For lay-in panels with reveal edge details, provide stepped-edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
  - 2. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.
- H. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system design to absorb impact forces against acoustical panels. Provide typical at public restrooms.

## 2.4 DIRECT-HUNG SUSPENSION SYSTEMS

- A. Reference tile type for location of grids specified.

## 2.5 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. Acoustical Ceiling Units: Full-size tiles equal to 2.0 percent of quantity installed.
  - 2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 1.0 percent of quantity installed.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
- B. Measure each ceiling area and establish the layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans.

### 3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's instructions and CISCA "Ceiling Systems Handbook."
  - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of the supporting structure or of the 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 the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of 3 tight turns. Connect hangers either directly to structures or to inserts, eye screws, or other devices that are secure, that are appropriate for substrate, and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 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 attach hangers to steel deck tabs.
  - 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  - 8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise shown; and provide hangers not more than 8

inches (200 mm) from ends of each member.

9. Install a hanger at all 4 corners of 2 ft. x 4 ft. light fixtures.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  1. Screw attach moldings to substrate at intervals not over 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.18 mm in 3.66 m). Miter corners accurately and connect securely.
  2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide neat, precise fit.
  1. Arrange directionally patterned acoustical panels as follows:
    - a. Install panels with pattern running in one direction parallel to long axis of space.
  2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
  3. Paint the cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended for this purpose by acoustical panel manufacturer.

#### 3.4 **CLEANING**

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

END OF SECTION 09511



## **SECTION 09650 - RESILIENT TILE FLOORING AND BASE**

### **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 includes the following, as shown on the drawings and in schedules:
  - 1. Vinyl composition floor tile.
  - 2. Resilient wall base and accessories.

#### **1.3 QUALITY ASSURANCE**

- A. Manufacturer: Provide each type of resilient flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.

#### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical data for each type of resilient flooring and accessory.
- B. Samples for Verification Purposes: Submit the following samples of each type, color, and pattern of resilient flooring required, showing full range of color and pattern variations.
  - 1. Full size tile samples.
  - 2. 6" long samples of resilient flooring accessories.
- C. Maintenance data: For resilient floor tile to include in the maintenance manuals specified in Division 1.

#### **1.5 PROJECT CONDITIONS**

- A. Maintain minimum temperature of 65 deg F (18 deg C) in spaces to receive resilient flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 55 deg F (13 deg C) in areas where work is completed.
- B. Install resilient flooring and accessories after other finishing operations, including painting, have been completed. Do not install resilient flooring over concrete slabs until the latter have been cured and are sufficiently dry to achieve bond with adhesive as determined by resilient flooring manufacturer's recommended bond and moisture test. Contractor to secure the services of an independent testing lab and have them perform moisture vapor test and PH tests. A copy of the test results shall be forwarded to the General Contractor and the



Architect for their review. General Contractor to insure that the moisture content of the concrete slab is compatible with the moisture vapor test prior to installation of the resilient flooring.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F (10 and 32 deg C).
- C. Store tiles on flat surfaces.
- D. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

### **PART 2 - PRODUCTS**

#### 2.1 Manufacturer: Subject to compliance with requirements, provide products of one of the following:

- A. Manufacturers of Vinyl Composition Tile:
  - 1. Armstrong World Industries, Inc; "Silver Mist."
  - 2. Azrock Floor Products Div., Azrock Industries, Inc.; "Standard Pattern."
  - 3. Mannington Commercial; "Essentials".
- B. Manufacturers of Rubber Wall Base:
  - 1. Armstrong World Industries, Inc; "Silver Mist"
  - 2. Johnsonite
  - 3. Roppe Rubber Corp.

#### 2.2 RESILIENT FLOORING COLORS AND PATTERNS

- A. Provide color and pattern as indicated, or if not otherwise indicated, as selected by Architect from manufacturer's full range of colors to match tile at existing corridor.

#### 2.3 TILE FLOORING

- A. Vinyl Composition Tile: FS SS-T-312, Type IV; 12" X 12" unless otherwise indicated, and as follows:
  - 1. Composition 1 - asbestos-free as follows:
  - 2. Gage: 1/8 inch.
  - 3. Accent Tile: Accent tile as shown at locations on plans.

## 2.4 ACCESSORIES

- A. Rubber Wall Base: Provide rubber base complying with FS-SS-W-40, Type I, with matching end stops and preformed or molded corner units, and as follows:
  - 1. Height: 4 inches. Some 6" where indicated on drawings.
  - 2. Thickness: 1/8 inch gage.
  - 3. Style: Standard top-set cove.

## 2.5 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of tiles, and in maximum available lengths to minimize running joints.

# PART 3 - EXECUTION

## 3.1 INSPECTION

- A. Require Installer to inspect subfloor surfaces to determine that they are satisfactory. A satisfactory subfloor surface is defined as one that is smooth and free from cracks, holes, ridges, coatings preventing adhesive bond, and other defects impairing performance or appearance.
- B. Perform bond and moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry as well as to ascertain presence of curing compounds.
- C. Do not allow resilient flooring work to proceed until subfloor surfaces are satisfactory.

## 3.2 PREPARATION

- A. Prepare subfloor surfaces as follows:
  - 1. Use leveling and patching compounds as recommended by resilient flooring manufacturer for filling small cracks, holes and depressions in subfloors.
  - 2. Remove coatings from subfloor surfaces that would prevent adhesive bond, including curing compounds incompatible with resilient flooring adhesives, paint, oils, waxes and sealers.
- B. Broom clean or vacuum surfaces to be covered, and inspect subfloor.
- C. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

### 3.3 INSTALLATION, GENERAL

- A. Install resilient flooring using method indicated in strict compliance with manufacturer's printed instructions. Extend resilient flooring into toe spaces, door reveals, and into closets and similar openings.
- B. Scribe, cut, and fit resilient flooring to permanent fixtures, built-in furniture and cabinets, pipes, outlets and permanent columns, walls and partitions.
- C. Install resilient flooring on covers for telephone and electrical ducts, and similar items occurring within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly cement edges to perimeter of floor around covers and to covers.
- D. Tightly cement resilient flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand roll resilient flooring at perimeter of each covered area to assure adhesion.

### 3.4 INSTALLATION OF TILE FLOORS

- A. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room area of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.
- B. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered. Cut tile neatly around all fixtures. Broken, cracked, chipped, or deformed tiles are not acceptable.
- C. Prior to installation, verify with Architect direction of grain for installation as follows:
  - 1. Install tile floor grain in quarter turn.
  - 2. Install special color / pattern layouts where noted on the Drawings.
- D. Adhere tile flooring to substrates using full spread of adhesive applied in compliance with flooring manufacturer's directions.
- E. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

### 3.5 INSTALLATION OF ACCESSORIES

- A. Apply wall base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable, with preformed corner units, or fabricated from base materials with mitered or coped inside corners. Tightly bond base to substrate throughout length of each piece, with continuous contact at horizontal and vertical surfaces.
- B. On masonry surfaces, or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
- C. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at edges of flooring which would otherwise be exposed.

- D. Apply resilient products to stairs as indicated and according to manufacturer's written installation instructions.

### 3.6 CLEANING AND PROTECTION

- A. Perform following operations immediately upon completion of resilient flooring:
  - 1. Sweep or vacuum floor thoroughly.
  - 2. Do not wash floor until time period recommended by resilient flooring manufacturer has elapsed to allow resilient flooring to become well-sealed in adhesive.
  - 3. Damp-mop floor being careful to remove black marks and excessive soil.
  - 4. Remove any excess adhesive or other surface blemishes, using appropriate cleaner recommended by resilient flooring manufacturers.
- B. Protect flooring against damage during construction period to comply with resilient flooring manufacturer's directions.
  - 1. Apply protective floor polish to resilient flooring surfaces free from soil, excess adhesive or surface blemishes. Use commercially available metal cross-linked acrylic product acceptable to resilient flooring manufacturer.
  - 2. Cover resilient flooring with undyed, untreated building paper until inspection for Substantial Completion.
- C. Clean resilient flooring not more than 4 days prior to date scheduled for inspections intended to establish date of Substantial Completion in each area of project. Clean resilient flooring by method recommended by resilient flooring manufacturer.
  - 1. Strip protective floor polish, which was applied after completion of installation, prior to cleaning.
  - 2. Reapply a buffable hard wax after cleaning.
    - Minimum of 2 coats.

END OF SECTION 09650



## **SECTION 09651 - RESILIENT STAIR TREADS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Resilient Stair Treads

#### **1.2 SUBMITTALS**

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

#### **1.3 QUALITY ASSURANCE**

- A. 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.

#### **1.4 PROJECT CONDITIONS**

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Install resilient products after other finishing operations, including painting, have been completed.

### **PART 2 - PRODUCTS**

#### **2.1 RESILIENT STAIR TREADS**

- A. Resilient Stair Treads:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armstrong World Industries, Inc.
    - b. Roppe Corporation, USA.
    - c. Johnsonite

- B. Complies with ASTM F 2169, Type TS, Class 2 (Patterned)
- C. Basis of Design: Roppe's #97 Raised Circular Vantage Design Extended Depth Tread, color will be selected by architect by manufacturers list of standard colors. Provide matching Resilient stair risers and landings as an integral system.
- D. Length: 48 inches
- E. Depth: 12 inches nominal from inside of nose
- F. Thickness: 3/32" nominal
- G. Nose Length: 1 9/16" nominal
- H. Nose Thickness: 3/16" nominal
- I. Tapered Nose: Yes
- J. Relief Cut: Yes
- K. Limited Wear Warranty: Manufacturer's limited wear warranty of five years for normal commercial traffic.

## 2.2 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.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Treads and Accessories: 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.
  - 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 maximum 75 percent relative humidity level measurement.
- 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.

### 3.2 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.

### 3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
  - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
  - 2. Tightly adhere to substrates throughout length of each piece.
  - 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

END OF SECTION 09651





## SECTION 09652 – LUXURY VINYL TILE 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. Luxury vinyl floor tile.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, indicating VOC content.
  - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
  - 3. Laboratory Test Reports: For flooring products, indicating compliance with requirements for low-emitting materials.
- C. 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.
- D. Samples: Full-size units of each color and pattern of floor tile required.
- E. Product Schedule: For floor tile. **LVT**.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Floor Tile: Furnish one box for every **50** boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer with a minimum of 5 years commercial resilient flooring installation experience, and who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
  - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockups for floor tile including resilient base and accessories.
    - a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations as directed by architect.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.8 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.

## 1.9 FIELD CONDITIONS

- A. HVAC system should be operational and running for a minimum of 7 days prior to resilient tile installation and remain running after resilient tile installation.
- B. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F, in spaces to receive floor tile during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. Permanently after installation.
- C. Close spaces to traffic during floor tile installation.

- D. Close spaces to traffic, all heavy rolling loads, and point loads for 48 to 72 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

#### 1.10 WARRANTY

- A. Special Warranty for Resilient Tile; Manufacturer agrees to repair or replace defective material within specified warranty period.
  - 1. Warranty does not include installer's workmanship.
  - 2. Resilient tile must be installed and maintained according to manufacturer's recommendations.
  - 3. Warranty Period:
    - a. Manufacturing Defects Warranty: **10** years.
    - b. Limited Commercial Wear Warranty: **10** years.
    - c. Underbed Warranty: 10 years.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

#### 2.2 LUXURY VINYL FLOOR TILE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Shaw Contract Group; **Surface** or comparable product by one of the following:
  - 1. Shaw Contract Group
  - 2. Centiva
  - 3. Forbo
- B. Tile Standard: ASTM F 1700.
  - 1. Class: Class III, printed film vinyl tile.
  - 2. Type: A, smooth surface
- C. Overall Thickness: **0.098 inch**
- D. Wear Layer Thickness: **0.020 inch**

- E. Size: **18 by 36 inches**
- F. Colors and Patterns: **As selected by Architect from full range of manufacturer's designations.**
- G. Test Data:
  - 1. Slip Resistance: ASTM D 2047, ADA Compliant.
  - 2. Residual Indentation, ASTM F 1914 minimum
  - 3. Flexibility, ASTM F 137: Passes.
  - 4. Static Load: ASTM F 970. 1500psi
  - 5. Dimensional Stability: ASTM F 2199
  - 6. Resistance to Heat, ASTM F 1514: Passes.
  - 7. Resistance to Light, ASTM F 1515: Passes.
  - 8. Resistance to Chemicals, ASTM 925: Passes.
  - 9. Resistance to Fungi, ASTM G 21: Passes, Rate zero (Rate zero: Fungi Free).
  - 10. Antibacterial Activity, AATCC 147: Passes, resists the propagation of bacteria.
  - 11. Radiant Flux, ASTM E 648: greater than 0.45 watts/cm, NFPA Class I.
  - 12. Smoke Density, ASTM E 662: less than 450, Passes.

## 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 floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
  - 1. Adhesives shall have a VOC content of 50 g/L or less.
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Floor Polish: Provide protective, neutral pH liquid floor-polish products recommended by floor tile manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than **10** pH.
  - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
    - a. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates are below 90 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

### 3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  - 1. Lay tiles square with room axis
- 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 as directed by architect.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Optional Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
- E. Cover floor tile until Substantial Completion.

END OF SECTION 09652

## **SECTION 09681 - CARPET**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes Carpet Tile, Wall Carpet, and Broadloom.

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

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

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show the following:
  - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
  - 2. Type of subfloor.
  - 3. Type of installation.
  - 4. Pattern of installation.
  - 5. Pattern type, location, and direction.
  - 6. Pile direction.
- C. Samples: For each exposed product and for each color and texture specified.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Product test reports.
- B. Sample warranty.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance data.

#### **1.6 QUALITY ASSURANCE**

- A. 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.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with CRI 104.



## 1.8 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

## 1.9 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
  - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2. Failures include, but are not limited to, more than 10 percent 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

- A. Products: Subject to compliance with manufacturer's requirements, provide carpets from one of the following. Prior approved equals can be used as directed by the architect prior to bidding.

- B. Basis of design:

#### CPT-1: Orchestra Pit Wall's

- 1. Soundfold - **Acoustical Wall Carpet** – color will be selected by architect from list of standard colors. (this is basis of design)
- 2. Liberty Theatrical
- 3. Everything Cinema's

#### CPT-2: Orchestra Pit Floor

- 1. Shaw – **Carpet Tile** – style number 59479 groundworks III tile, EcoWorx secondary backing, 3.50 TARR Rating, use Parkway 79380 or Water Course 79420. (this is basis of design)
- 2. J&J Commercial
- 3. Patcraft
- 4. Bigelow
- 5. Tandus
- 6. Interface

CPT-3    Theater and theater balcony

1. Shaw – **Standard Cut Pile tip sheared** – Scepter II, color as selected by architect.

Fiber Content: Unbranded

Gauge: 1/10

Stitches: 11.75/in

Width: 144in

Primary Backing: Woven Polypropylene

Secondary Backing: Uloc MPC

(this is basis of design)

2. J&J commercial

3. Patcraft

INSTALLATION ACCESSORIES

- C. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- D. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended by carpet manufacturer for releasable installation.

**PART 3 - EXECUTION**

3.1        INSTALLATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Preparation: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.
- E. Installation: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet manufacturer's written installation instructions.
- F. Installation Method: As recommended in writing by carpet manufacturer.

- G. Maintain dye lot integrity. Do not mix dye lots in same area.
- H. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- I. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- J. 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.
- K. Install pattern parallel to walls and borders.
- L. Perform the following operations immediately after installing carpet:
  - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
  - 2. Remove yarns that protrude from carpet surface.
  - 3. Vacuum carpet using commercial machine with face-beater element.
- M. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."

END OF SECTION 09681

## **SECTION 09900 - PAINTING**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section includes surface preparation, painting, and finishing of exposed exterior and interior items and surfaces.

Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other section.

Paint 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.

Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

Painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, and labels.

#### **DEFINITIONS**

"Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

#### **SUBMITTALS**

Product Data: Manufacturer's technical data information, label analysis, and application instructions for each material proposed for use.

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.

Samples for initial color selection in the form of manufacturer's color charts.

After color selection, the Architect will furnish color chips for surfaces to be coated.

#### **QUALITY ASSURANCE**

Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

MPI Standards:

Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

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.

Notify the Architect of problems anticipated using the materials specified.

Field Samples: On wall surfaces and other exterior and interior components, duplicate finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface until required sheen, color and texture are obtained; simulate finished lighting conditions for review of in-place work.

Final acceptance of colors will be from job-applied samples.

The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. Apply coatings in this room or surface in accordance with the schedule or as specified. After finishes are accepted, this room or surface will be used for evaluation of coating systems of a similar nature.

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.

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.

## **EXTRA MATERIALS**

Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

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

Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

Product name or title of material.  
Product description (generic classification or binder type).  
Federal Specification number, if applicable.  
Manufacturer's stock number and date of manufacture.  
Contents by volume, for pigment and vehicle constituents.  
Thinning instructions.  
Application instructions.  
Color name and number.

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.

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.

## **JOB CONDITIONS**

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).

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).

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.

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.

## **PART 2 - PRODUCTS**

### **PAINT, GENERAL**

#### **Material Compatibility:**

Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

**VOC Content of Field-Applied Interior Paints and Coatings:** Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.

Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.

Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.

Floor Coatings: VOC not more than 100 g/L.

Shellacs, Clear: VOC not more than 730 g/L.

Shellacs, Pigmented: VOC not more than 550 g/L.

**Chemical Components of Field-Applied Interior Paints and Coatings:** Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

**Aromatic Compounds:** Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

**Restricted Components:** Paints and coatings shall not contain any of the following:

- Acrolein.
- Acrylonitrile.
- Antimony.
- Benzene.
- Butyl benzyl phthalate.
- Cadmium.
- Di (2-ethylhexyl) phthalate.

Di-n-butyl phthalate.  
Di-n-octyl phthalate.  
1,2-dichlorobenzene.  
Diethyl phthalate.  
Dimethyl phthalate.  
Ethylbenzene.  
Formaldehyde.  
Hexavalent chromium.  
Isophorone.  
Lead.  
Mercury.  
Methyl ethyl ketone.  
Methyl isobutyl ketone.  
Methylene chloride.  
Naphthalene.  
Toluene (methylbenzene).  
1,1,1-trichloroethane.  
Vinyl chloride.

## **MANUFACTURER**

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

ICI Paint Stores (ICI)  
Benjamin Moore and Co. (Moore).  
PPG Industries, Pittsburgh Paints (Pittsburgh).  
The Sherwin-Williams Company (S-W).

## **PRIMERS / UNDER COAT MATERIALS**

Synthetic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming ferrous metal on the exterior under high-gloss alkyd enamel and on the interior under odorless alkyd semigloss or alkyd gloss enamels:

ICI:	4160-7100 Devguard Primer, Red.
Moore:	Ironclad Retardo Rust-Inhibitive Paint #163.
Pittsburgh:	6-208 Red Inhibitive Metal Primer.
S-W:	Kem Kromik Metal Primer B50N2/B50W1.

Alkyd-Type Zinc Chromate Primer: Primers used for priming ferrous metals on the exterior under high-gloss alkyd enamels.

ICI:	4160-6120 Devguard Primer (Gray).
Pittsburgh:	6-204 Zinc Chromate Primer.
S-W:	Zinc Chromate Primer B50Y1.

Galvanized Metal Primer: Primer used to prime interior and exterior zinc-coated (galvanized) metal surfaces:

ICI:	4120-1000 Devguard Galvanized Metal Primer.
Moore:	Ironclad Galvanized Metal Latex Primer #155.
Pittsburgh:	6-215/16 Speedhide Galvanized Steel Primer.
S-W:	Galvite B50W3.

Interior Block Filler: Ready-mixed block filler for use on the interior as a filler on concrete masonry under High Performance, Polyamide Epoxy Coating:

ICI: 4000 Bloxfil Interior/Exterior Heavy Duty Acrylic Block Filler.  
Pittsburgh: 16-90 High Performance Acrylic Block Filler.  
S-W: Heavy Duty Block Filler, B42W46.

Interior Latex Block Filler: Ready-mixed block filler for use on the interior as a filler on concrete masonry under semi-gloss latex acrylic finish:

ICI: 1120-1200 Alkyd Enamel Undercoat.  
Moore: Moorcraft Interior/Exterior Block Filler #173.  
Pittsburgh: 6-7 Speedhide Interior/Exterior Masonry Latex Block Filler.  
S-W: Pro-Mar 200 Alkyd Enamel Undercoater B49W200.

Interior Primer / Sealer: Ready-mixed drywall sealer for use as an undercoat on gypsum board:

ICI: 1030 Ultra Hide PVA Interior Sealer.  
Moore: Regal First Coat Interior Latex Primer.  
Pittsburgh: 17-10 Quick Dry Interior Latex Primer Sealer.  
S-W: Pro-Mar 200 Interior Latex Wall Primer B28W200.

Interior Semi-Gloss Acrylic Enamel Finish: Alkyd or acrylic latex based interior wood undercoater:

ICI: 1020 Ultra Hide Latex Interior Wood Undercoater.  
Moore: Moore's Alkyd Enamel Underbody #217.  
Pittsburgh: 6-755 Speedhide Interior Water based undercoater.

## **EXTERIOR FINISH PAINT MATERIAL**

Alkyd Gloss Enamel: Weather-resistant high-gloss enamel for use over primed ferrous metal surfaces:

ICI: 4328XXXX Alkyd Gloss Enamel.  
Moore: Impervo High-Gloss Enamel #133.  
Pittsburgh: 54 Line Quick-Dry Enamel.  
S-W: Industrial Enamel B-54 Series.

Alkyd Gloss Enamel: Weather-resistant high-gloss enamel for use over primed, zinc-coated (galvanized) metal surfaces:

ICI: 4328 XXXX Alkyd Gloss Enamel.  
Moore: Impervo High-Gloss Enamel #133.  
Pittsburgh: 54 Line Quick-Dry Enamel.  
S-W: Metalastic II Enamel B-53 Series.

High Performance, Polyamide-Epoxy Coating: High gloss epoxy coating for use over an undercoat on concrete masonry block:

ICI: 4408 XXXX Tru-Glaze WB Waterborne Epoxy Gloss Coating.  
Moore: Ironclad Chemical & Water Resistant Epoxy Enamel #182.  
Pittsburgh: 97-1 Series Aquapon Polyamide-Epoxy.  
S-W: Tile -Clad II Epoxy Enamel B62 Series B60V70.

## **INTERIOR FINISH PAINT MATERIAL**

High Performance, Polyamide-Epoxy Coating: High gloss epoxy coating for use over an undercoat on concrete masonry block:

ICI: 4408 XXXX Tru-Glaze WB Waterborne Epoxy Gloss Coating.  
Moore: Ironclad Chemical & Water Resistant Epoxy Enamel #182.



Pittsburgh: 97-1 Series Aquapon Polyamide-Epoxy.  
S-W: Tile -Clad II Epoxy Enamel B62 Series B60V70.

Acrylic Latex Finish: Semi-gloss exterior acrylic latex paint for use over primed concrete block surfaces:

ICI: 1416 XXXX Ultra Hide Latex Wall Finish.  
Moore: Moore's Regal Aqua-Glo Vinyl - Acrylic latex Enamel #333.  
Pittsburgh: 88-110 Satin hide Interior Enamel Wall & Trim Lo-Lustre Semi-gloss Latex Paint.

Alkyd Gloss Enamel: Weather-resistant high-gloss enamel for use over primed ferrous metal surfaces:

ICI: 4328XXXX Alkyd Gloss Enamel.  
Moore: Impervo High-Gloss Enamel #133.  
Pittsburgh: 54 Line Quick-Dry Enamel.  
S-W: Industrial Enamel B-54 Series.

Alkyd Gloss Enamel: Weather-resistant high-gloss enamel for use over primed, zinc-coated (galvanized) metal surfaces:

ICI: 4328 XXXX Alkyd Gloss Enamel.  
Moore: Impervo High-Gloss Enamel #133.  
Pittsburgh: 54 Line Quick-Dry Enamel.  
S-W: Metalastic II Enamel B-53 Series.

Low Luster Acrylic Enamel: Low Luster acrylic latex interior enamel for use over primed interior gypsum board:

ICI: 1512 XXXX Ultra-hide Alkyd Eggshell Interior Wall and Trim Enamel.  
Moore: Moore's Regal Aqua-Velvet #319.  
Pittsburgh: 89 Line Manor Hall Eggshell Latex Wall and Trim Enamel.  
  
S-W Pro-Mar 200 Interior Latex Eg-Shel Enamel B20W200 Series.

Semi-Gloss Acrylic Finish: Semi-gloss exterior latex paint for use over primed wood surfaces:

ICI: 1416 XXXX Ultra-hide latex Semi-gloss Wall and Enamel Paint.  
Moore: Moore's Regal Aqua-Glo Vinyl-Acrylic Latex Enamel #333.  
Pittsburgh: 88-110 Satin hide Interior Enamel Wall & Trim Lo-Lustre Semi-gloss Latex Paint.

### **PART 3 - EXECUTION**

#### **EXAMINATION**

Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin application until unsatisfactory conditions have been corrected.

Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

Concrete: 12 percent.  
Masonry (Clay and CMU): 12 percent.  
Wood: 15 percent.  
Gypsum Board: 12 percent.  
Plaster: 12 percent.

Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

## **PREPARATION**

General Procedures: Remove 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.

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.

Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.

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.

Cementitious Materials: Prepare concrete and concrete masonry block 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.

Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

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.

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.

Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.

Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

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.

Use only thinners approved by the paint manufacturer, and only within recommended limits.

**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.

**Wood:** Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

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.

## **APPLICATION**

Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

Paint colors, surface treatments, and finishes are indicated in "schedules."

Provide finish coats that are compatible with primers used.

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.

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.

The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.

Apply block filler and epoxy paint at all exposed CMU walls and concrete walls at stairwells at the Ground Floor.

Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.

Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.

Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.

Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

Finish exterior doors on tops, bottoms, and side edges same as exterior faces.

Finish interior doors on tops and bottoms upon arrival to the jobsite.

Finish exposed millwork on all faces and/or edges.

Sand lightly between each succeeding enamel or varnish coat.

Omit primer on metal surfaces that have been shop-primed and touch up painted.

**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.

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.

**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.

**Mechanical and Electrical Work:** Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.

Mechanical items to be painted include but are not limited to:

- Piping, pipe hangers, and supports.
- Ductwork.
- Insulation.
- Supports.
- Motors and mechanical package equipment.
- Accessory items.

Electrical items to be painted include but are not limited to:

- Conduit and fittings.
- Switchgear.

**Block Fillers:** Apply block fillers to concrete masonry block and concrete walls at a rate to ensure complete coverage with pores filled.

**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 and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.

**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.

**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.

**Completed Work:** Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

## **CLEANING**

Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

## **PROTECTION**

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.

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.

At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

## **EXTERIOR PAINT SCHEDULE**

General: Provide the following paint systems for the various substrates indicated.

Ferrous Metal: Primer is not required on shop-primed items.

Primer: Synthetic Rust-Inhibiting Primer.  
First Coat: Alkyd Gloss Enamel .  
Second Coat: Alkyd Gloss Enamel .

Galvanized Metal:

Primer: Galv. Metal Primer.  
First Coat: Alkyd Gloss Enamel.  
Second Coat: Alkyd Gloss Enamel.

Concrete Block:

Primer: Heavy Duty Block Filler.  
First Coat: High Performance Polyamide Epoxy Coating.  
Second Coat: High Performance Polyamide Epoxy Coating.

## **INTERIOR PAINT SCHEDULE**

General: Provide the following paint systems for the various substrates, as indicated.

Gypsum Drywall or Plaster Systems:

Primer: Low-Luster Interior Latex Primer/Sealer.  
First Coat: Acrylic Latex Interior Enamel.  
Second Coat: Acrylic Latex Interior Enamel.

Concrete Block:

Primer: Heavy Duty Block Filler.  
First Coat: High Performance Polyamide Epoxy Coating.  
Second Coat: High Performance Polyamide Epoxy Coating.

Concrete Block:

Primer: Latex Block Filler.  
First Coat: Semi-gloss Acrylic Latex Paint.  
Second Coat: Semi-gloss Acrylic Latex Paint.

Ferrous Metal:

Primer: Synthetic Rust-inhibiting Primer .  
Undercoat: Interior Enamel Undercoat .  
Finish Coat: Interior Semigloss Odorless Alkyd Enamel .

Zinc-Coated Metal:

Primer: Galvanized Metal Primer .  
Undercoat: Interior Enamel Undercoat .  
Finish Coat: Interior Semigloss Odorless Alkyd Enamel .

Wood:

Primer: Alkyd or Acrylic Latex Undercoater.  
First Coat: Semi-gloss Acrylic Enamel Paint  
Second Coat: Semi-gloss Acrylic Enamel Paint.

Concrete Substrates, Traffic Surfaces: Ground Floor & Penthouse: Seal all concrete floors in the Mechanical and Equipment Rooms.

Clear Sealer System: MPI EXT 3.2G.

Prime Coat: Interior/exterior clear concrete floor sealer (solvent based).  
Intermediate Coat: Interior/exterior clear concrete floor sealer (solvent based).  
Topcoat: Interior/exterior clear concrete floor sealer (solvent based).

**MISCELLANEOUS WOOD FINISHING MATERIALS**

Oil-Type Interior Wood Stain: Slow-penetrating oil-type wood stain for general use on interior wood surfaces under varnishes or wax finishes:

ICI:	1700-XXXX Alkyd Stain.
Moore:	241 Moore's Interior Wood Finishes Penetrating Stain.
Pittsburgh:	77-302 Rez Medium Tint Base.
S-W:	Oil Stain A-48 Series.

Cut Shellac: Quick-drying, rosin-free, clear, general-purpose shellac varnish for use on the interior over stained and natural-finished woodwork for a clear finish:

ICI:	1916-XXXX Clear Stain
Moore:	413 Moore's Interior Wood Finishes Quick-Dry Sanding Sealer.
Pittsburgh:	77-30 Quick Drying Sanding Sealer.
S-W:	Pro-Mar Varnish Sanding Sealer V26V3.

Oil Rubbing Varnish: Clear, oil-type rubbing varnish for use on interior stained or natural-finished woodwork:

ICI:	1916-XXXX Wood Pride Polyurethane Satin
Moore:	Benwood Satin Finish Varnish #404.
Pittsburgh:	77-7 Rez Satin Varnish.

S-W: Oil Vase Varnish, Gloss A66V91.

Paste Wax: Provide paste wax as recommended by the coating manufacturer for use on interior stained and natural-finished woodwork.

END OF SECTION 09900

## **SECTION 10155 - TOILET COMPARTMENTS**

### **PART 1 - GENERAL**

#### **SUMMARY**

Section Includes:

Stainless-steel toilet compartments configured as toilet enclosures and urinal screens.

#### **SUBMITTALS**

Product Data: For each type of product indicated.

Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

Product certificates.

Maintenance data.

#### **QUALITY ASSURANCE**

Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame-Spread Index: 25 or less.

Smoke-Developed Index: 450 or less.

Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" for toilet compartments designated as accessible.

### **PART 2 - PRODUCTS**

#### **STAINLESS-STEEL UNITS**

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

Accurate Partitions Corporation.  
All American Metal Corp.  
American Sanitary Partition Corporation.  
Ampco, Inc.  
Bradley Corporation; Mills Partitions.  
General Partitions Mfg. Corp.  
Hadrian Metal Toilet Partitions.

Toilet-Enclosure Style: Overhead braced.

Urinal-Screen Style: Wall hung with integral flanges and Overhead braced.

Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured



by welding or clips and exposed welds ground smooth. Provide with no-sightline system. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.

Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch for doors and panels and 1-1/4 inches for pilasters.

Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.

Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

#### Urinal-Screen Construction:

Flat-Panel Urinal Screen: Matching panel construction.

Integral-Flange, Wall-Hung Urinal Screen: Similar to panel construction, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches thick.

Facing Sheets and Closures: 22 gage stainless-steel sheet:

Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 3 inches high, finished to match hardware.

Urinal-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters; with shoe and sleeve (cap) matching that on the pilaster.

#### Brackets (Fittings):

Stirrup Type: Ear or U-brackets; stainless steel.

Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

Stainless-Steel Finish: Type 304, No. 4 bright, directional polish on exposed faces. Protect exposed surfaces from damage by application of strippable, temporary protective covering before shipment.

#### ACCESSORIES

Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

Material: Stainless steel.

Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.

Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.

Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.

Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

Anchorage and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

## FABRICATION

Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.

Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

## PART 3 - EXECUTION

### INSTALLATION

General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

Clearances: Maximum 1/2 inch between pilasters and panels; 1 inch between panels and walls.

Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

### ADJUSTING

Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10155



## **SECTION 10425 - SIGNS**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section includes the following types of signs:

Panel signs.

#### **SUBMITTALS**

General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.

Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.

Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

Provide message list for each sign required, including large-scale details of wording and layout of lettering.

#### **QUALITY ASSURANCE**

Single-Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.

Design Criteria: The drawings indicate size, profiles, and dimensional requirements of signs and are based on the specific type and model indicated. Signs by other manufacturers may be considered provided that deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

### **PART 2 - PRODUCTS**

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

Manufacturers of Panel Signs:

Andco Industries Corp.  
ASI Sign Systems, Inc.  
Best Manufacturing co.  
Mohawk Sign Systems.

#### **MATERIALS**

**Cast Acrylic Sheet:** Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested in accordance with ASTM D 790, a minimum allowable continuous service temperature of 176 deg F (80 deg C), and of the following types:

**Opaque Sheet:** Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.

**Plastic Laminate:** Provide high-pressure plastic laminate engraving stock with face and core plies in contrasting colors, in finishes and color combinations indicated or, if not indicated, as selected from the manufacturer's standards.

**Aluminum Extrusions:** Provide aluminum extrusions of alloy and temper recommended by the aluminum producer or finisher for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 221 for 6063-T5.

**Bronze Plate:** Provide bronze plate, copper alloy UNS C28000, Muntz metal, 60 percent copper.

**Fasteners:** Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

**Anchors and Inserts:** Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into masonry work.

## PANEL SIGNS

**Panel Signs:** Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.

**Framed Panel Signs:** Fabricate frames to profile indicated; comply with the following requirements for materials and corner conditions:

**Materials:** Aluminum, extruded or cast.

**Corner Condition:** Square corners.

**Laminated Sign Panels:** Permanently laminate face panels to backing sheets of material and thickness indicated using the manufacturer's standard process.

**Brackets:** Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit sign panel construction and mounting conditions indicated. Factory-paint brackets in a color matching the background color of the sign panel.

**Graphic Content and Style:** Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

**Engraved Copy:** Machine-engrave letters, numbers, symbols, and other graphic devices into sign panel on the face indicated to produce precisely formed copy, incised to uniform depth. Use high-speed cutters mechanically linked to master templates in a pantographic system or equivalent process capable of producing characters of the style indicated with sharply formed edges.

Engraved Plastic Laminate: Engrave through the exposed face ply of the plastic laminate sheet to expose the contrasting core ply.

ADA Compliance: All signs supplied on this project shall be in compliance with the requirements of the ADA.

Required Panel Signs: Provide the following panel signs:

Mohawk Sign Systems for Toilet Rooms:

Series 200A, Sand Carved.

ADA symbol signage; DS Design symbols: VM and W/C; 3 inches.

Size: 8" x 8".

Lettering: Helvetica Medium; 3/4"; with braille raised characters.

Frame: Series M-201-15; anodized aluminum frame.

Mounting: Mechanically fastened; concealed mounting into walls.

Quantity / Location: Provide signage at every door at every toilet room. Provide "Men", "Women" or a "Unisex" sign where applicable and shown on the Drawings.

Mohawk Sign Systems for EXITS:

Series 200A, Sand Carved.

ADA symbol signage; DS Design symbols: VM and W/C; 3 inches.

Size: 8" x 8".

Lettering: Helvetica Medium; 3/4"; with braille raised characters.

Frame: Series M-201-15; anodized aluminum frame.

Mounting: Mechanically fastened; concealed mounting into walls.

Quantity / Location: Provide signage at every exterior door and at stairs doors as required by the code.

### **PART 3 - EXECUTION**

#### **INSTALLATION**

General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

Wall Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:

Shim Plate Mounting: Provide concealed aluminum shim plates 1/8 inch thick, with predrilled and

countersunk holes, at locations indicated and where other mounting methods are not practicable. Attach the plate with fasteners and anchors suitable for secure attachment to the substrate. Attach panel sign units to the plate using the method specified above.

Panel signage shall be mounted in accordance with the ADA code, which requires the signage to be mounted on the wall adjacent to the latch side of the door. Where there is no wall to the latch side of the door, including double leaf doors, signs shall be mounted on the nearest adjacent wall. Mounting height shall be 60 inches above the finish floor to the center line of the sign.

#### CLEANING AND PROTECTION

At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION 10425

## **SECTION 10800 - TOILET AND BATH ACCESSORIES**

### **PART 1 - GENERAL**

#### **RELATED DOCUMENTS**

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

#### **SUMMARY**

This Section includes the following toilet accessory items:

- Toilet tissue dispensers
- Sanitary napkin disposals
- Surface mounted towel dispensers
- Electric hand dryers
- Soap dispensers
- Grab bars
- Stainless steel framed mirror units
- Robe hooks
- Baby changing stations

#### **SUBMITTALS**

General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections.

Product Data for each toilet accessory item specified, including details of construction relative to materials, dimensions, gages, profiles, method of mounting, specified options, and finishes.

#### **QUALITY ASSURANCE**

Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

#### **PROJECT CONDITIONS**

Coordinate accessory locations, installation, and sequencing with other work to avoid interference and to assure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

#### **WARRANTY**

Special Project Warranty; Provide manufacturer's written 5-year warranty against silver spoilage of mirrors, agreeing to replace any mirrors that develop visible defects within warranty period.



## **PART 2 - PRODUCTS**

Manufacturers: Subject to compliance with requirements, provide toilet accessories by one of the following:

Basis of Design: Bobrick Washroom Equipment, Inc.; S.S. Contura Series.

Additional Manufacturers:

Bradley Corporation.

General Accessory Manufacturing Company (GAMCO)

### **MATERIALS, GENERAL**

Stainless Steel: AISI Type 302/304, with polished No. 4 finishes, 22-gage (.034-inch) minimum thickness, unless otherwise indicated.

Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 20-gage (.040-inch) minimum, unless otherwise indicated. Surface preparation and metal pretreatment as required for applied finish.

Chromium Plating: Nickel & chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

Mirror Glass: Nominal 6.0 mm (0.23 inch) thick, conforming to ASTM C 1036, Type I, class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.

Fasteners: Screws, bolts, and other devices of same material as accessory unit.

Keys: Unless otherwise indicated, provide universal keys for access to toilet accessory units requiring internal access for servicing, re-supply, etc. Provide minimum of four (4) keys to Owner's representative and obtain receipt.

### **TOILET TISSUE DISPENSERS:**

Multi-Roll Toilet Tissue Holder / Dispenser: Fabricate of Type 304 stainless steel with sating finish. It shall accommodate two (2) standard core tissue rolls, be vandal-proof, and shall include one piece molded polyethylene spindles with 1/8" wall thicknesses.

Model: PH, Bobrick Washroom Equipment, Inc.; B-4288.

Mounting: Surface mounted.

Number required: Reference Drawings for quantities.

### **SANITARY NAPKIN DISPOSALS:**

Surface mounted sanitary napkin disposal: Fabricate of Type 304 stainless steel with sating finish. Provide all welded construction and cover shall be drawn, one-piece, seamless construction and secured to container with a full-length stainless steel piano-hinge. Container shall have integral finger depression for opening cover.

Model: Bobrick Washroom Equipment, Inc.; B-270.

Mounting: Surface mounted.

Number required: Reference Drawings for quantities.

## **SURFACE MOUNTED TOWEL DISPENSERS:**

Surface mounted towel dispenser: Fabricate of Type 304 stainless steel with satin finish. Provide all welded construction.

Model: Bradley; 250-15.

Mounting: Surface mounted.

Number required: Reference Drawings for quantities.

## **ELECTRIC HAND DRYER**

Surface-Mounted Electric Hand Dryer:

Model: Dyson Airblade dB hand dryer, AB14, gray, high voltage (hv) item number: AB14-G-HV manufacturer part no: 304663-01

Number required: Reference Drawings for quantities.

## **SOAP DISPENSERS**

Automatic wall mounted foam soap dispenser, Wall Mounted Soap Dispenser Fabricate for surface mounting, sized for 27-fluid-ounce minimum capacity. No touch soap valve.

Model: Bobrick Washroom Equipment, Inc., B-2013. Reference Drawings for quantities.

## **GRAB BARS**

Stainless Steel Type: Provide grab bars with wall thickness not less than 18 gage (.050 inch) and as follows:

Mounting: Concealed, manufacturer's standard flanges and anchorages.

Clearance: 1-1/2 inches clearance between wall surface and inside face of bar.

Gripping Surfaces: Manufacturer's standard peened gripping surface.

Medium-Duty Size: Outside diameter of 1-1/4 inches.

Model: Bobrick Washroom Equipment, Inc.; B-550X36".

Number: Reference Drawings for quantities.

Model: Bobrick Washroom Equipment, Inc.; B-550X42".

Number: Reference Drawings for quantities.

Model: Bobrick Washroom Equipment, Inc.; B-58616.99. 24" x 36" Shower Grab Bar.

Number: Reference Drawings for quantities.

## **MIRROR UNITS**

Standard Stainless Steel Framed Mirror Units: Fabricate frame with channel shapes of not less than 20-gage (.040 inch), with square corners carefully mitered to hairline joints and mechanically interlocked. Provide in Type 430 bright polished finish. Mirror shall be No. 1 quality, 1/4" float/plate glass selected for silvering, electrolytically copper-plated by the galvanic process, with a 10 years

guarantee against silver spoilage.

Model: Bobrick Washroom Equipment, Inc.

Size and Number: Reference Drawings.

## **ROBE HOOKS**

Heavy Duty Clothes Hook with Concealed Mounting: Locks to wall plate with 3 stainless steel set screws for theft-resistant mounting. Hook and flange are one piece brass casting with satin nickel plated finish to match stainless steel.

**Model:** Equal to Bobrick Washroom Equipment, Inc.: B-2116.

**Number and Locations:** See Drawings for locations and quantities.

## **BABY CHANGING STATIONS**

Horizontal wall mounted stainless steel finish baby changing station: 18 gauge, type 304 satin stainless steel exterior finish with FDA approved blow molded high-density grey polyethylene with Microban antimicrobial interior. Reinforced full-length steel-on-steel hinge mechanism, with 11-gauge steel mounting plates and mounting hardware included. Molded-in graphics and safety messages in six languages. Contoured changing surface area is 442 sq. in. and comes complete with nylon safety straps and bag hooks.

**Model:** Equal to Koala Kare Products; KB110-SSWM .

**Number and Locations:** See Drawings for locations and quantities.

## **FABRICATION**

General: Only a maximum 1-1/2 inch diameter, unobtrusive stamped logo of manufacturer, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by means of either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.

Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage where possible.

Framed Mirror Units, General: Fabricate frames from glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent accumulation of moisture, as follows:

Provide galvanized steel backing sheet, not less than 22 gage (.034 inch) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

Mirror Unit Hangers: Provide system of mounting mirror units that will permit rigid, tamperproof, and theft proof installation, as follows:

One-piece galvanized steel wall hanger device with spring action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring special tool to remove.

## **PART 3 - EXECUTION**

### **INSTALLATION**

Install toilet accessory units in accordance with manufacturer's instructions, using fasteners appropriate to substrate and recommended by manufacturer of unit. Install units plumb and level, firmly anchored in locations and at heights indicated.

Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, in accordance with manufacturer's instructions for type of substrate involved.

### **ADJUSTING AND CLEANING**

Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items. Clean and polish all exposed surfaces in strict accordance with manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 10800



## **SECTION 12481 - ENTRANCE FLOOR MATS AND FRAMES**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. This section includes the following types of entrance flooring systems:
  - 1. Floor Mats & Frame Assemblies
  - 2. Floor Grids & Frame Assemblies
- B. Related Sections: The following sections contain requirements related to this section:
  - 1. Grouting frames into recess; refer to sections 03300 "Cast-In-Place Concrete" and section 03600 "Grout"
  - 2. Special requirements of various flooring types; refer to section 09400 "Terrazzo"

#### **1.02 References**

- A. American Society for Testing and Materials (ASTM)
- B. The Aluminum Association
- C. The Carpet and Rug Institute (CRI)
- D. The National Floor Safety Institute (NFSI)
- E. International Organization for Standardization (ISO)
- F. Cradle to Cradle Products Innovation Institute (C2C)

#### **1.03 Submittals**

- A. General: Submit the following in accordance with conditions of contract and Division 1 specification section 01300.
- B. Product data for each type of floor mat/grid and frame specified including manufacturer's specifications and installation instructions.
- C. Shop drawings in sufficient detail showing layout of mat/grid and frame specified including details indicating construction relative to materials, direction of traffic, spline locations, profiles, anchors and accessories.
- D. Samples for verification purposes: Submit an assembled section of floor mat/grid and frame members with selected tread insert showing each type of color for exposed floor mat/grid, frame and accessories required.
- E. Maintenance data in the form of manufacturer's printed instructions for cleaning and maintaining floor mats/grids.

#### **1.04 Quality Assurance**

We recommend that splices in wider units (above 12') not be positioned in the middle of a door opening wherever possible.

- A. Flammability in accordance with ASTM E648, Class 1, Critical Radiant Flux, minimum 0.45 watts/m<sup>2</sup>.
- B. Slip resistance in accordance with ASTM D-2047-96, Coefficient of Friction, minimum 0.60 for

accessible routes. Slip and fall accidents are a major concern in commercial entranceways. We recommend that approved systems be certified by the manufacturer as meeting a minimum coefficient of friction, when tested in wet conditions, of 0.60.

- C. Standard rolling load performance to be 750 lb./wheel (load applied to a solid 5" x 2" wide polyurethane wheel, 1000 passes without damage).
- D. Single Source Responsibility: Obtain floor mats/grids and frames from one source of a single manufacturer.
- E. Utilize superior structural aluminum alloy 6105-T5 for rail components.
- F. Utilize a manufacturer that is ISO 9001 & 14001 certified.

#### 1.05 Delivery, Storage and Handling

- A. Deliver materials to the project site ready for use and fabricated in as large sections and assemblies as practical, in unopened original factory packaging clearly labeled to identify manufacturer.

#### 1.06 Project Conditions

- A. Field measurements: Check actual openings for mats/grids by accurate field measurements before fabrication. Record actual measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.
- B. Recessed Conditions: **IMPORTANT:** Coordination with Division 03 00 00 Concrete specifications is required. For proper installation, the concrete recess must be flat and smooth throughout. If the recess is formed by a concrete contractor, the pour dimensions may require leveling grout to achieve the proper depth and a smooth finish. The final recess depth will match the specified product and must be field verified. For proper frame installation, the side walls of the concrete recess must also be straight and smooth. Inconsistencies with the recess and side walls must be remediated prior to product installation.

## **PART 2 - PRODUCTS**

#### 2.01 Manufacturers

- A. Drawings and specifications are based on manufacturer's literature from Construction Specialties, Inc. unless otherwise indicated. Other manufacturers must comply with the minimum levels of material and detailing indicated on the drawings and specified herein.

#### 2.02 Materials

- A. Aluminum - 6105-T5 for extrusions.
- B. Flexible and prime EPDM extrusions.
- C. Tread insert options - refer to section 2.05.

## **END OF SECTION 12481**

## 2.03 Floor Mats/Grids

- A. Basis of Design - G3 PediTred LP -Cradle 2 Cradle Silver certified (carpet insert only). Shall be extruded 6105-T5 aluminum alloy, multiple tread planks which are joined by an EPDM hinge to comprise the overall grid length (traffic-direction). All material shall be perforated to allow drainage, unless otherwise specified. Supplied in mill (standard) or one of 9 optional colors as offered by manufacturer. (Call factory for custom colors.) Choose from anodized or heavy-duty powder coat finish. Units must withstand 750 lb. wheel loads (load applied to a solid 5" x 2" wide polyurethane wheel, 1000 passes without damage).

## 2.04 Mat/Grid Frames

- A. LB - Level Base Frame shall be a 3/4" (19.05mm) deep recessed frame in 6063-T6 aluminum alloy with a 1/4"(6.35mm) wide exposed surface. Black EPDM filler trims shall be furnished as required, when standard 1 1/2" (38.1mm) tread spacing cannot be maintained. Installer shall use recommended latex screed to ensure level base. Frame color shall be supplied in standard mill or one of 9 optional colors as offered by manufacturer. (Custom colors are available.) Choose from anodized or heavy-duty powder coat finish.

## 2.05 Tread Insert Options

- A. EC - Exterior Carpet shall be solution dyed polypropylene fibers with 50/50 blend of 600/12-denier multi filament and 595/D1 monofilament, available in one of 4 standard colors as offered by manufacturer. The texturized fibers have ultraviolet blockers and color as an integral part of the filament. Each carpet fiber and monofilament shall be fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths. Waterproof fibers do not get soggy, rot, fade or stain. Carpet weight shall be 32-oz./yd<sup>2</sup>.

# PART 3 - EXECUTION

## 3.01 Examination

- A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
  - 1. Do not proceed until unsatisfactory conditions have been corrected.

## 3.02 Preparation

- A. Manufacturer shall offer assistance and guidance to provide a template of irregular shaped mat/grid assemblies to ensure a proper installation.

## 3.03 Installation

- A. Install the work of this section in strict accordance with the manufacturer's recommendations.
- B. Set mat/grid at height recommended by manufacturer for most effective cleaning action.
- C. Coordinate top of mat/grid surfaces with bottom of doors that swing across to provide ample clearance between door and mat/grid.

## 3.04 Cleaning

- A. It is important to the life cycle of the entrance mat that a maintenance schedule be developed which includes regular vacuuming and extraction that correctly matches the amount of traffic the mat incurs.



### 3.05 Protection

- A. After completing required frame installation and concrete work, provide temporary filler of plywood or fiberboard in recess, and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and project is near time of substantial completion.
- B. Defer installation of floor mats/grids until time of substantial completion of project.

## **SECTION 12610 - FIXED AUDIENCE SEATING**

### **PART 1 GENERAL**

#### **1.01 SUMMARY**

- A. Section Includes: Fixed upholstered chairs with self-rising seat mechanisms, aisle and intermediate standards.
  - 1. Typical applications include the following
    - a. Floor mounted chairs.
- B. Related Sections:
  - 1. Division 16 Electrical sections for electrical wiring and connections for aisle lights.
- C. Alternates: This section specifies alternates for audience seating products. Refer to Part 2 products for alternate products, and to Division 1 Alternates sections and other bid documents, if any, for alternate requirements.
- D. Product Improvements: Hussey Seating Company strives to continuously improve its products and manufacturing methods. The company reserves the right to make changes without notice when, in the opinion of the company, such changes improve the product or its performance.

#### **1.02 REFERENCES**

- A. American Welding society (AWS):
  - 1. AWS D1.1 Structural Welding Code - Steel.
  - 2. AWS D1.3 Structural Welding Code - Sheet Steel.
- B. American Institute of Steel Construction (AISC):
  - 1. AISC - Design of Hot Rolled Steel Structural Members.
- C. American National Standards Institute (ANSI).
- D. American Iron & Steel Institute (AISI):
  - 1. AISI - Design Cold Formed Steel Structural Members.
- E. Aluminum Association (AA):
  - 1. AA - Aluminum Structures, Construction Manual Series.
- F. American Society for Testing Materials (ASTM)
  - 1. ASTM - Standard Specification for Properties of Materials.
- G. National Forest Products Association (NFPA):
  - 1. NFPA - National Design Specification for Wood Construction.
- H. National Bureau of Standards/Products Standard (NBS/PS):
  - 1. PS1 - Construction and Industrial Plywood.
- I. Americans with Disability Act (ADA)
  - 1. ADA - Standards for Accessible Design.

#### **1.03 MANUFACTURER'S SYSTEM ENGINEERING DESCRIPTION**

- A. Structural Performance: Engineer, fabricate and install fixed audience seating to the following structural loads without exceeding allowable design working stresses of materials involved, including anchors and connection. Apply each load to produce maximum stress in each respective component of each audience seat unit.
- B. Manufacturer's System Design Criteria:
  - 1. Seats and Backs:

- a. Shall embody a timeless sculptured appearance to harmonize with any architectural form or room decor.
  - b. Shall exhibit moderate compound contours for supportive comfort avoiding excess anatomical pressures.
  - c. Seat shall be semi-cantilevered, self-centering, automatic three-quarter (3/4) lift with over center retract feature, for ease of passage and janitorial access.
  - d. Seat shall be tested and professionally certified through an independent testing laboratory to support and withstand an evenly distributed 600 lb.[272 Kg] static load without failure or irregularities that would impair usefulness.
  - e. Self-lifting seat shall be tested and professionally certified through an independent testing laboratory to withstand 350,000 operating cycles without failure of seat mechanism or measurable component wear.
  - f. Seat shall be tested and professionally certified to withstand 10,000 impacts of a 40 lb.[18 Kg] sandbag dropped on the center of the seat from each of the following heights: 6"[152mm], 8"[203mm], 10"[254mm], and 12"[305mm]. The rate of impacts shall be approximately 18 per minute with the total quantity of impacts equaling 40,000.
  - g. Back shall withstand an evenly distributed front or rear static load of 450 lbs.[205 Kg].
  - h. Back shall be tested and professionally certified to withstand, without failure, 40,000 swinging impacts each to the front and rear of the back by means of two opposing 40 lb.[18 Kg] sandbags. The sandbags shall be moved horizontally and equally for 10,000 cycles each at the following distances of 6"[152mm], 8"[203mm], 10"[254mm], and 12"[305mm] at a rate of 35 cycles per minute.
  - i. Back shall withstand, without failure, an evenly distributed Horizontal Traverse Static Load of 200 lbs.[90.70Kg]. The load shall be applied to the top of the back at a 45-degree angle to the row of seats.
  - j. Armrests shall be tested and professionally certified to withstand, without failure, a 200 lb.[91 Kg] static load applied both perpendicular to and vertically down on the arm.
2. Materials (Flammability) shall satisfy applicable test, codes, standards, or requirements as follows:
- a. Copolymer polypropylene shall have a burn rate of 1 inch [25.4mm] or less per ASTM 635.
  - b. Upholstery materials shall meet requirements as set forth in the state of California Bureau of Home Furnishings Technical Bulletin 117.
  - c. Fire-performance Characteristics of Seat Padding: Provide seating that complies with test method: California Technical Bulletin 117
  - d. Cushioning and padding shall be self-extinguishing as defined in the requirements as set forth in the State of California Bureau of Home Furnishings Technical Bulletin 117.
  - e. Full Scale Fire Performance Characteristics of Finished Chair: Provide seating that complies with test method: California Technical Bulletin 133 or British Standard CRIB 5

#### **1.04 SUBMITTALS**

- A. Section Cross-Reference: Submit required submittals in accordance with "Conditions of the Contract" and Division
  - 1. General Requirements sections of this "Project Manual."
- B. Project Data: Manufacturer's product data for each system. Include the following:
  - 1. Project list: Ten (10) seating projects of similar size, complexity and in service for at least five (5) years.
  - 2. Deviations: List of deviations from these project specifications.
- C. Shop Drawings: Indicate fixed upholstered chair seating layout. Show all equipment to be furnished with details of accessories to be supplied including necessary electrical service to be provided by others.

- D. Samples: Seat materials and color finish as selected by Architect from manufacturers standard color finishes.
- E. Manufacturer Qualifications: Certification of insurance coverage and manufacturing experience of manufacturer.
- F. Installer Qualifications: Installer qualifications indicating capability, experience, and manufacturer acceptance.
- G. Engineer Qualifications: Certification by a professional engineer registered in the state of manufacturer that the equipment to be supplied meets or exceeds the design criteria of this specification.
- H. Owners Manuals: Provide Owner's maintenance manual and demonstrate operating procedures.
- I. Warranty: Manufacturers standard five-year warranty documents.

#### **1.05 QUALITY ASSURANCE**

- A. Welding Standards & Qualification: Comply with AWS D1.1 Structural Welding Code - Steel and AWS D1.3 Structural Welding Code - Sheet Steel.
- B. Insurance Qualifications: Mandatory that each bidder submit with his bid an insurance certificate from the manufacturer evidencing the following insurance coverage:
  - 1. Workers Compensation - including Employers Liability with the following limits:
    - a. \$500,000.00 Each Accident
    - b. \$500,000.00 Disease - Policy Limit
    - c. \$500,000.00 Disease - Each Employee
  - 2. Commercial General Liability - including premises/ operations, independent contractors and products completed operations liability. Limits of liability shall not be less than \$2,000,000.00
- C. Manufacturer Qualifications: Manufacturer who has 10 years of experience manufacturing spectator seating equipment.
- D. Installer Qualifications: Engage experienced Installer who has specialized in installation of audience seating similar to types required for this project and who is acceptable to, or certified by, fixed upholstered chair seating manufacturer.
- E. Engineer Qualifications: Engage professional licensed engineer experienced in providing engineering services of the kind indicated that have resulted in the successful installation of audience seating similar in material, design, fabrication, and extent to those types indicated for this project.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- A. Deliver fixed upholstered chair seating in manufacturers packaging clearly labeled with manufacturer name and content.
- B. Handle seating equipment in a manner to prevent damage.
- C. Deliver the seating at a scheduled time for installation that will not interfere with other trades operating in the building.

#### **1.07 PROJECT CONDITIONS**

- A. Field Measurements: Coordinate actual dimensions of construction affecting fixed upholstered chair seating installation by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid delay of Work.

## 1.08 WARRANTY

- A. Manufacturer's Product Warranty: Submit manufacturer's standard warranty form for fixed upholstered chairs. This warranty is in addition to, and not a limitation of other rights Owner may have under Contract Documents.
  - 1. Warranty Period: Five years from Date of Substantial Completion.
  - 2. Beneficiary: Issue warranty in legal name of project Owner.
  - 3. Warranty Acceptance: Owner is sole authority who will determine acceptance of warranty documents.

## 1.09 MAINTENANCE AND OPERATION

- A. Instructions: An owners manual shall be transmitted to the Owner by the manufacturer of the seating or his representative.
- B. Service: Maintenance and operation of the seating system shall be the responsibility of the Owner or his duly authorized representative, and shall include the following:
  - 1. Only attachments specifically approved by the manufacturer for the specific installation shall be attached to the seating.
  - 2. Periodic annual inspections and required maintenance of each seating system shall be performed according to the owners manual to assure safe conditions.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturer: Hussey Seating Company, U.S.A.
  - 1. Address: 38 Dyer St Ext., North Berwick, Maine, 03906
  - 2. Telephone: (207) 676-2271; Fax: (207) 676-9690
  - 3. email: info@hussyseating.com
  - 4. Product: Hussey Quattro Chair System
    - a. Model: **QUATTRO**
    - b. Series: Classic
    - c. Back Foam: 3"
    - d. Seat Type: Standard upholstery
    - e. Armrest Type: Plastic
    - f. Standards: Cast Aluminum or cast iron is acceptable. (steel is not acceptable)
    - g. Chair Mount: Floor Mount and riser mount
  - 5. **End Panels: None needed with the cast products**
  - 6. Approved Manufacturers
    - a. American Seating Co.
    - b. Irwin Seating Co.
  - 7. Product Description/Criteria:
    - a. Number of Chairs: See Floor Plan
    - b. Number of Rows: See Floor Plan
    - c. Number of Wheelchair Locations: See Floor Plan
    - d. Number of ADA Easy Access End Standards: See Floor Plan
    - e. Row Spacing: See Floor Plan
    - f. Rise: See Floor Plan
    - g. Fabric: Standard Grades

## 2.03 MATERIALS

- A. Cast Aluminum: AA - 380
- B. Steel Tubing: ASTM A513
- C. Steel Sheet/Coil: ASTM A607
- D. Mechanical or Adhesive Concrete Anchors: SAE grade 2
- E. Exposed Hardwood Lumber: Wood Species: Birch
- F. Concealed Plywood: Engineered Wood Association PS1-95 2000: Poplar
- G. Exposed Plywood: Hardwood Plywood ANSI/HPVA-1 2000: Birch
- H. Medium Density Fiberboard: ANSI A208-2-1986
- I. Plastic Laminate: NEMA LD3.1-1985, GP 48
- J. Polyurethane Foam Padding: ASTM D-3574
- K. Fabric: 100% Marquesa Lana continuous filament Olefin in the following standard selections:
  - 1. Fabric shall have 13 fill picks per inch, 13 warp ends per inch, weighing 16 oz. [454grams] per linear yard including backing.
  - 2. Fabric shall have 13 fill picks per inch, 13 warp ends per inch, weighing 18 oz. [510grams] per linear yard including backing.
  - 3. Fabric shall have 16 fill picks per inch, 19 warp ends per inch, weighing 12 oz. [340grams] per linear yard including backing.
- L. Molded plastic: Injection Molded copolymer polypropylene or nylon 6/6.

**2.04 DESIGN AND CONCEPT:** Auditorium chairs shall be designed to exhibit a modern appearance that will enhance any auditorium's décor. Seats, backs, and standards shall complement each other without the need for end panels or other adornments. Superior comfort will be derived through careful ergonomic engineering, selection of materials, and design of supportive structures.

## 2.05 FABRICATION

- A. Upholstered Seats:
  - 1. The seat assembly shall consist of a stylish padded and upholstered top surface, a polypropylene bottom shell with dual contours, and a dual sprung lifting mechanism. Seat shall have the ability to achieve a full fold position when rearward pressure is applied. Superior comfort shall be derived through careful ergonomic engineering.
  - 2. Upholstery Pad: The upholstered seat topper shall consist of a 5/8" thick formed ply form base with contoured molded polyurethane foam padding and fabric upholstered cover. Seat padding shall be properly contoured to support the body without causing discomfort. The upholstered seat cover shall exhibit a high degree of tailoring and will be affixed to the base with upholstery staples.
  - 3. Seat Mechanism: Seat lifting mechanism shall use lubricated lifting springs to provide whisper quiet fail-safe operation. The seat structure shall rotate on a 3/4" [19mm] spanner bar to assure shaft alignment and eliminate binding due to irregular floor conditions. Seats shall be certified to withstand 350,000 lifting cycles and a 600lb static load without failure.
  - 4. Standard Bottom Cover: Seat shell/bottom shall be constructed of polypropylene plastic to provide a durable yet aesthetic design. The cover shall protect the mechanical parts of the lifting hinge and upholstered seat topper. The shell / bottom shape shall compliment the overall design of the chair.
  - 5. **SEAT FOAM OPTION.** Standard

6. **SEAT COVER TAILORING. (Standard) Waterfall**

B. Classic Series Back (Plastic Outer Back Cover)

1. The outer back panel shall be constructed of injection molded polypropylene Plastic. The panel shall be no less than 27" in length and conceal the rear and sides of the upholstered inner panel. **The panel shall extend below the rear of the seat to protect the chair occupant's back.**
2. The inner upholstered panel shall be 5/8" (15mm) 11 ply thick-formed hardwood with an ergonomically engineered contour. The wings for attachment of chair back to standard shall be not less than 14 ga (1.9mm) and will be attached via concealed fasteners. Wings shall position the chair back at one of three positions: 15, 18, or 21 degrees. There shall be no exposed fasteners above the seat. Chair back upholstery shall exhibit a high degree of workmanship and customization.
  - a. Soft Square - 33": The top corners of the back are conically shaped for stylish looks and a timeless appearance. Overall back height is 33" above the floor allowing proper shoulder support of the chair occupant. The back surface shall be contoured to facilitate proper posture of a seated individual.

3. **SELECT BACK FOAM TYPE. 3"**,

4. **SELECT BACK COVER TAILORING. Waterfall**,

C. Cast Aluminum Standards: Cast Iron is acceptable **(Steel standards are not acceptable)**

1. Standards shall be die cast Aluminum AA380 grade.
2. **FLOOR MOUNT STANDARDS** Standards shall be floor attached, designed to maintain a constant seat height to floor.
3. Cast Aluminum Standards shall be an integral aesthetic part of the chair's appearance and do not require the use of end panels.

D. Seat Hinges:

1. Seat hinges shall be fully contained within the seat pan and fitted with a pair of independent nylon bushings.
2. Each of the independent seat hinges shall be fitted with double acting; self-centering, pre-loaded coiled seat return spring.
3. Seat hinge and spring installation shall be designed not to require periodic adjustment or lubrication.

E. Finish:

1. Finish for Steel / Aluminum Components: (Indoor) Material shall be pre-treated in an iron phosphate wash system prior to finish application. Finish shall be a specially blended polyester T.G.I.C./Epoxy powder coating with a minimum dry film thickness of 1.5 mils.
2. Injection molded polypropylene or nylon: Shall be pigmented, in one of manufacturers standard colors and have a textured surface.
3. Fabric: Upholstery material shall be 100% Marquesa Lana continuous filament Olefin yarn with one of manufacturer's standard fabric offerings.
4. Color: Shall be per manufacturer's standards. Seating Contractor shall submit color samples for owner's approval prior to manufacture.

F. Armrests:

5. Armrests, Injection Molded Plastic: Armrests shall be of injection molded, textured polypropylene. Armrest to be secured to standard with concealed fasteners.

- G. Aisle Lights: Aisle lights will operate from 24 volts (low voltage) requiring a transformer system
1. (supplied by Hussey). "Low Voltage Luminaire" electrical system approved by Underwriters Laboratories Inc. Aisle lights to be mounted onto end panel or aisle standard and will be furnished with cover as an integral part of the chair standard. Select: Low or High Mount)

## 2.05 FASTENINGS

A. Chair Assembly

1. All welds shall be made at the factory by welders that are certified on the equipment and process used.
2. All structural connections shall be made with S.A.E. stress rated zinc plated or, black oxide steel bolts, washers and nuts.

B. Concrete Floor Attachment

1. Chair stanchions shall each be attached by means of two 1/4"[6mm] mechanical wedge anchors set in holes drilled to a minimum depth of 2"[50mm] in the concrete.
  - a. Wedge anchors shall be tested to ASTM E488 criteria and listed by ICBO and SBCCI. Wedge anchors feature a type 18-8 stainless steel split expansion ring and a threaded stud bolt body and integral cone expander, and a nut and washers. Stanchion shall be placed on the bolts, stanchions to be permanently secured with a flat washer, lock washer and nut.

B. Concrete Riser Attachment

1. Chair stanchions shall each be attached by means of two 3/8"[10mm] threaded rods secured into concrete with a fast curing acrylic adhesive. Adhesive and rods are set in holes drilled to a minimum depth of 2 1/2"[64mm] in the concrete.
2. Threaded rods shall be of approved type with zinc-plate finish or made of stainless steel to suit environmental conditions.
3. Acrylic Adhesive shall be in conformance with ASTM Type IV, Grade 3, and covered by ICBO evaluation.
4. Stanchion to be placed on the bolts, stanchions to be permanently secured with a flat washer, lock washer and nut.

## 2.06 ACCESSORIES

- A. Row letters and Seat numbers

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verification of Conditions: Verify areas to receive fixed upholstered chair seating are free of impediments interfering with installation and condition of installation substrates are acceptable to receive audience seats in accordance with seating manufacturer's recommendations. Do not commence installation until conditions are satisfactory.

### 3.02 INSTALLATION

- A. Manufacturer's Recommendations: Comply with seating manufacturer's recommendations for product installation requirements.



- B. General: Install fixed upholstered chair system in accordance with manufacturer's installation instructions and final shop drawings. Provide accessories, anchors, fasteners, inserts and other items for installation of seating and for permanent attachment to adjoining construction.

### **3.03 ADJUSTMENT AND CLEANING**

- A. Adjustment: After installation completion, all equipment is to be adjusted for smooth and proper operation.
- B. Cleaning: Clean work area and remove debris from site.

### **3.04 PROTECTION**

- A. General: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer to ensure audience seats are without damage or deterioration at time of substantial completion.

END OF SECTION 12610

## **SECTION 14210 - ELECTRIC TRACTION PASSENGER ELEVATORS**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Electric traction passenger elevators.

#### **1.2 RELATED SECTIONS**

- A. Section 01500 – Temporary Facilities and Controls: Protection of floor openings and personnel barriers; temporary power and lighting.
- B. Section 03300 – Cast-in-Place Concrete: Elevator pits.
- C. Section 03600 – Grouts (Grouting): Grouting door frames and sills.
- D. Section 04200 – Masonry Units (Unit Masonry): Setting sleeves, inserts, and anchoring devices in masonry for guide-rail brackets.
- E. Section 05120 – Metal Stairs Structural Steel (Structural Steel Framing): Support steel, divider beams, and hoist beams.
- F. Section 06105 – Miscellaneous Rough Carpentry: Temporary platform assembly.
- G. Section 07160 – Cementitious Waterproofing: Waterproofing of elevator pit.
- H. Section 09900 – Paints and Coatings (Painting and Coating): Field painting of elevator entrances over primer.
- I. Section 28310 – Detection and Alarm (Fire Detection and Alarm): Heat, smoke, and products of combustion sensing devices, fire alarm signal lines to contacts in machine space.
- J. Section 23000 – Heating, Ventilating, and Air Conditioning Equipment (Heating, Ventilating, and Air-Conditioning (HVAC)): Heating, cooling, and ventilation of control and machinery space.
- K. Section 26050 – Wiring Methods (Common Work Results for Electrical): Light outlets, convenience outlets, light switches, and conduits.
- L. Section 26240 – Switchboards, Panelboards, and Control Centers (Switchboards and Panelboards): Disconnect switches.
- M. Section 26500 – Lighting: Light fixtures.
- N. Section 22142 – Sump Pumps: For sump pumps, sumps, and sump covers in elevator pits.
- O. Section 27150 – Communications Horizontal Cabling: For Telephone service for elevators and for Internet connection to elevator controllers for remote monitoring.
- P. Section 27300 – Telephone and Intercommunication Equipment (Voice Communications): Telephone outlets and elevator telephones.
- Q. Section 31000 – Earthwork: Excavation of elevator pit.

#### **1.3 REFERENCES**

- A. ANSI/ASME A17.1/CAN/CSA B44 – Safety Code for Elevators and Escalators.

- B. ADAAG – Americans with Disabilities Act Accessibility Guidelines.
- C. ANSI/NFPA 70 – National Electrical Code.
- D. ANSI/NFPA 80 – Fire Doors and Windows.
- E. ANSI/UL 10B – Fire Tests of Door Assemblies.
- F. CAN/CSA C22.1 – Canadian Electrical Code.
- G. Model and Local Building CodesH. ISO 9001: 2000 - Quality Management Systems - Requirements.

#### 1.4 DESIGN REQUIREMENTS

- A. Arrange elevator components in control closet or machinery space so equipment can be removed for repairs or replaced with minimal disturbance to other equipment and components.
- B. Where permitted by code, provide all elevator equipment including controls, drives, transformers, and rescue features within the elevator hoistway.

#### 1.5 SUBMITTALS

- A. Comply with Section 013300 – Submittal Procedures.
- B. Product Data: Submit manufacturer/installer's product data, including,
  - 1. Descriptive brochures or detail drawings of car and hall fixtures, cab ceilings, and product features.
  - 2. Power Information: Horsepower, starting current, running current, machine and control heat release, and electrical requirements.
- C. Shop Drawings: Submit manufacturer/installer's shop drawings, including plans, elevations, sections, and details, indicating location of equipment, loads, dimensions, tolerances, materials, components, fabrication, fasteners, hardware, finish, options, accessories, and other information to render totally functional elevators.
- D. Samples: Submit manufacturer/installer's samples of standard colors and finishes of finish materials.
- E. Operation and Maintenance Manual: Submit manufacturer/installer's operation and maintenance manual; including operation, maintenance, adjustment, and cleaning instructions; trouble shooting guide; renewal parts catalogs; and electrical wiring diagrams.
- F. Warranty: Submit manufacturer/installer's standard warranty.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer/Installer's Qualifications: Specialize in manufacturing and installing elevator equipment, with a minimum of 10 years successful experience.
- B. Regulatory Requirements:
  - 1. Elevator design, clearances, construction, workmanship, materials, and installation, unless specified otherwise, shall be in accordance with ANSI/ASME A17.1, handicap accessibility, Americans with Disabilities Act, and other codes having legal jurisdiction.
  - 2. ANSI/ASME A17.1 shall govern, except where codes having legal jurisdiction include more rigid requirements or conflict with ANSI/ASME A17.1.

3. Elevator shall follow design and manufacturing procedures certified in accordance with ISO 9001-2000 to meet product and service requirements for quality assurance for new products.
  4. Where product is in variance to the published ANSI/ASME A17.1 model code, provide a 3rd party AECO certification demonstrating equivalent function, safety, and performance.
- C. Pre-installation Meeting:
1. Convene pre-installation meeting before start of installation of elevators.
  2. Require attendance of parties directly affecting work of this section, including Contractor, Architect, and elevator manufacturer/installer.
  3. Review examination, installation, field quality control, adjusting, cleaning, protection, and coordination with other work.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer/installer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer/installer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer/installer's instructions.
- C. Handling: Protect materials during handling and installation to prevent damage.

#### 1.8 PROJECT CONDITIONS

- A. Temporary Electrical Power:
1. Owner will arrange for temporary 220 VAC, single-phase, 60 Hz., GFCI-protected electricity to be available for installation of elevator components.
  2. Comply with Section 015100 – Temporary Utilities.
- B. Installation of the Elevator:
1. General Contractor will provide permanent three-phase power prior to installation start.
  2. General Contractor will provide clear, rollable access to a 20' x 10' secure and dry storage area prior to delivery.
  3. General Contractor will provide a clean, dry, and complete hoistway along with temporary installation platform and all required OSHA-compliant barricades prior to delivery.
- C. Temporary Use of Elevator:
1. Owner will negotiate with manufacturer/installer for temporary use of elevator, if required.
  2. Temporary use of elevator shall be in accordance with terms and conditions of manufacturer/installer's temporary acceptance form.

#### 1.9 SCHEDULING

- A. Coordinate elevator work with work of other trades, for proper time and sequence to avoid construction delays.

#### 1.10 WARRANTY

- A. Manufacturer/installer shall guarantee materials and workmanship of equipment installed under these specifications and make good, defects not due to ordinary wear or to improper use, which may develop within 1 year after completion of installation or acceptance thereof by beneficial use, whichever is earlier.

#### 1.11 MAINTENANCE SERVICE

- A. Elevator maintenance service shall be performed by elevator manufacturer/installer.

- B. Elevators shall receive regular maintenance on each unit for period of 12 months after completion of work specified herein or acceptance thereof by beneficial use, whichever is earlier.
- C. Trained employees shall make periodic examinations and perform work including necessary adjusting, greasing, oiling, and replacing parts to keep elevators in operation, except parts that require replacement because of accidents, vandalism, misuse, or negligence by parties other than manufacturer/installer.
- D. Manufacturer/installer shall perform all Work, except emergency minor adjustment call-back service, during regular working hours. Manufacturer/installer shall provide emergency minor adjustment call-back service, 24 hours 7 days a week.
- E. Should Owner request that examinations, cleaning, lubrication, adjustments, repairs, replacements, or emergency minor adjustment call-back service, unless specified herein, be performed on other than manufacturer/installer's regular working hours of regular working days, manufacturer/installer shall absorb straight-time labor charges and Owner will compensate manufacturer/installer for overtime premium, travel time, and expense at normal billing rates.
- F. Elevator Control System:
  - 1. Include built-in remote diagnostic module to relay constant status of elevators and control system to a 24-hour, 7-days-a-week central-monitoring facility.
  - 2. Remote Monitoring Device: Transmit information on current status of elevators, including malfunctions, system errors, and shutdown.

## **PART 2 - PRODUCTS**

### **1.12 MANUFACTURER/INSTALLER**

- A. Schindler Elevator Corporation, Website [www.us.schindler.com](http://www.us.schindler.com).
- B. Elevator shall be installed by elevator manufacturer.

### **1.13 ELEVATOR SYSTEM AND COMPONENTS**

- A. Electric Traction Passenger Elevators: Basis of design is the Schindler 3300 Gearless Traction Elevator.
- B. Elevator Equipment Summary:
  - 1. Application: Machine Room Less (MRL)
  - 2. Counterweight Location: Side
  - 3. Machine Location: Top of the hoistway mounted on car and counterweight guide rails
  - 4. Control Space Location: Top landing entrance frame or entrance frame at one floor below the top landing
  - 5. Service: General Purpose Passenger
  - 6. Quantity: 1 Unit
  - 7. Capacity: 2100 lbs
  - 8. Speed: 100 fpm
  - 9. Travel: 12' 2"
  - 10. Landings: 3
  - 11. Front Openings: 2
  - 12. Rear Openings: 1
  - 13. Door Hand: Left
  - 14. Rear Door Hand: Right
  - 15. Operation: Microprocessor Single Car Automatic Operation
  - 16. Clear Inside Dimensions: 5' 9-3/8" Wide X 4' 4-7/8" Deep
  - 17. Cab Height: 7' 9"
  - 18. Guide Rails: Equivalent to 12 lb. per foot

19. Entrance Type and Width: Two Speed Side Opening 3' 0" Wide X 7' 0" High doors
20. Entrance Height: 7'-0"
21. Power Supply: 480 Volts 3 Phase 60 Hz

C. Performance:

1. Car Speed: -10% to +5% of contract speed under any loading condition or direction of travel.
2. Car Capacity: Safely lower, stop and hold up to 125% of rated load per code.

D. Ride Quality:

1. Vertical Vibration (maximum): 25 mg
2. Horizontal Vibration (maximum): 15 mg
3. Vertical Jerk (maximum): 2 ft/sec<sup>3</sup>
4. Acceleration (maximum): 1.6 ft/sec<sup>2</sup>
5. In Car Noise: 53-60 dB(A)
6. Stopping Accuracy: ±5mm
7. Starts per hour (maximum): 180

E. Elevator Operation:

1. Simplex Collective Operation: Using a microprocessor based controller, operation shall be automatic by means of the car and hall buttons. When all calls have been answered, the car shall park at the last landing served.
2. Group Automatic Operation with Demand-Based Dispatching: Provide reprogrammable group automatic system that assigns cars to hall calls based on a dispatching algorithm designed to minimize passenger waiting time.

F. Operating Features - Standard:

1. Door Light Curtain Protection
2. Static AC Drive
3. Phase Monitor Relay
4. Cab Overload with Indicator
5. Load-weighing
6. Central Alarm
7. Remote Monitoring
8. Firefighter's Operation
9. Automatic Evacuation
  - a. When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. If the car is at a floor when the power fails, it remains at that floor, opens its doors, and shuts down. If the car is between floors, it is raised or lowered to the first available landing, opens its doors, and shuts down.
10. Independent Service

G. Operating Features - Optional:

#### 1.14 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microprocessor based control system to perform all of the functions of safe elevator operation, as well as perform car and group operational control.

1. All high voltage (110v or above) contact points inside the inspection and test panel shall be protected from accidental contact in a situation where the access panels are open.
2. The controller shall be distributed throughout the elevator system located in the overhead, cab and inspection and test panel. The inverter will be mounted in the overhead adjacent to the hoist machine and an inspection and test panel will be located in the door jamb at the top floor or one floor below the top floor. No elevator equipment mechanical rooms or closets are required.
3. Provide multi-bus control architecture to reduce cabling, material and waste.

- B. Drive: Provide a Variable Voltage Variable Frequency AC Closed Loop drive system. Provide stable start without high peak current, quickly reaching a low energy consumption level.
- C. Inspection and Test Panel: Integrated control equipment, main inspection and test panel in door frame at top level served or at one floor below the top level served.

#### 1.15 EQUIPMENT: HOISTWAY COMPONENTS

- A. Machine:
  - 1. Gearless asynchronous AC motor with integral drive sheave, service and emergency brakes.
  - 2. Design machine to enable direct power transfer, thereby avoiding loss of power.
  - 3. Design machine to be compact, lightweight and durable to optimize material usage and save space.
  - 4. Mount to structural support channels on top of guide rail system as applicable in hoistway overhead.
- B. Governor:
  - 1. Tension type over-speed governor with remote manual reset.
  - 2. Mount to structural support channels as applicable in hoistway overhead.
- C. Buffers, Car and Counterweight: Compression spring type buffers to meet code.
- D. Hoistway Operating Devices:
  - 1. Emergency Stop switch in the pit.
  - 2. Terminal stopping switches.
  - 3. Emergency stop switch on the machine.
- E. Positioning System: System consisting of proximity sensors and door zone vanes.
- F. Guide Rails and Attachments: Provide Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening.
- G. Suspension System: Non circular Elastomeric coated suspension media with high tensile grade steel cords.
- H. Governor rope: Steel wire rope with 6 mm diameter.

#### 1.16 EQUIPMENT: HOISTWAY ENTRANCES

- A. Hoistway Doors and Frames:
  - 1. UL rated with required fire rating.
  - 2. Doors: Rigid flush panel construction with reinforcement ribs.
  - 3. Frames: Securely fasten at corners to form unit frame. Frames shall be bolted.
- B. Finish:
  - 1. Exposed Areas of Corridor Frames: Stainless Steel - All Floors
  - 2. Doors: Stainless Steel - All Floors
  - 3. Sills: Aluminum - All Floors
- C. Entrance Markings and Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

#### 1.17 EQUIPMENT: CAR COMPONENTS

- A. Car Frame and Safety: Provide car frame with adequate bracing to support the platform and car enclosure. The safety shall be integral to the car frame and shall be flexible guide clamp type.

- B. Platform: Provide platform of steel construction with plywood subfloor and aluminum threshold.
- C. Car Guides: Provide sliding guide shoes mounted to top and bottom of both car and counterweight frame. Arrange each guide shoe assembly to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.
- D. Provide central guiding system to reduce mechanical friction and energy consumption.
- E. Steel Cab:
  - 1. Fire rating: Provide Class B fire rating for cab, or Class A fire rating where required by local Code.
  - 2. Design cab to comply with LEED Indoor Environmental Quality requirements through use of Low-Emitting Materials on walls, ceiling and subflooring.
  - 3. Car wall finish: Steel Plastic Laminate Finish selected from manufacturer's standard selections.
  - 4. Base and frieze: Aluminum.
  - 5. Car front finish: Brushed stainless steel.
  - 6. Car door finish: Brushed stainless steel.
  - 7. Ceiling: Canopy ceiling, finished in #4 Stainless Steel With Down Lit Led Lighting. Provide lighting consisting of four compact fluorescent energy saving lights located in two semi-oval lateral cutouts located on the center-sides of the cab ceiling, Lexan lens cover.
  - 8. Handrail: 1-3/8" Round And Curved Brushed Aluminum. Locate on Side Walls.
  - 9. Flooring: By others. Not to exceed 3/8" finished depth.
  - 10. Ventilation: Provide one-speed fan in canopy.
  - 11. Emergency Car Lighting: Provide an emergency power unit employing a 12 volt sealed rechargeable battery and static circuits to illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
  - 12. Emergency Siren: Provide siren mounted on top of the car that is activated when the Alarm button in the car operating panel is engaged.
  - 13. Emergency Exit Switch: Provide an electrical contact to open the safety circuit when the emergency car top exit is opened. When the exit door is opened, the top exit switch shall signal the control and the car will be unable to move.
  - 14. Emergency Exit Lock: Provide an emergency exit lock where required by local code.
  - 15. Emergency Exit Guard: Provide emergency exit guard on top of car when required for hoistway wall to platform clearance exceeds 12" or for multiple cars in hoistway.

#### 1.18 DOOR OPERATOR AND REOPENING DEVICES

- A. Door Operator: Provide a closed loop VVVF high performance door operator with frequency controlled drive for fast and reliable operation to open and close the car and hoistway doors simultaneously.
- B. In case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Provide emergency devices and keys for opening doors from the landing as required by local code.
- C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. Provide door open button in the car operating panel. Momentary pressing of this button shall reopen the doors and reset the time interval.
- D. Provide door hangers and tracks for each car and hoistway door. Contour tracks to match the hanger sheaves. Design hangers for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed for life bearings.



- E. Electronic Door Safety Device: Equip car doors with concealed transmitter and receiver infrared beam devices to detect presence of object in process of passing through hoistway entrance and car doorway (light curtain device).
  - 1. Use multi-beam scanning without moving parts to detect obstructions in door opening.
  - 2. Detector Device: Prevent doors from closing, or if they have already started closing, cause doors to reopen and remain open while object is within detection zone.
  - 3. Horizontal Beams: Minimum of 33 infra red beams to fill doorway from ground level to a height of 6 feet.

#### 1.19 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

- A. Car Operating Panel: Provide a car operating panel with all push buttons, key switches and message indicators for elevator operation.
  - 1. Full height car operating panel shall be surface-mounted on front return.
  - 2. Comply with handicap requirements.
  - 3. Push Buttons: Mechanical, illuminating using long-lasting LEDs for each floor served.
  - 4. Emergency Buttons: Provide in accordance with code. Emergency alarm button, door open and door close buttons.
- B. Features of the Car Operating Panel Shall Include:
  - 1. Audible chime to signal that the car is either stopping at or passing a floor served by the elevator.
  - 2. Raised markings and Braille provided to the left hand side of each push button.
  - 3. Car Lantern: Provide LED illuminated car lantern with direction arrows to comply with local code when hall lanterns are not provided.
  - 4. Door open and close push buttons.
  - 5. Firefighter's hat and Phase 2 Key-switch
  - 6. Inspection key-switch.
  - 7. Key-switch for optional Independent Service Operation
  - 8. Illuminated alarm button with raised marking.
  - 9. Elevator Data Plate marked with elevator capacity and car number.
  - 10. Help Button: Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
- C. Hall Fixtures: Provide hall fixtures with necessary push buttons and key switches for elevator operation.
  - 1. Push buttons: Metallic tactile push buttons, up button and down button at intermediate floors, single button at each terminal floor.
  - 2. Height: Comply with handicap requirements.
  - 3. Illumination: Illuminating using long-lasting low power LEDs.
- D. Hall Lanterns and Position Indicators.
  - 1. LED illuminated direction arrows with audible and visible call acknowledgement.
- E. Hoistway access switches: Provide key-switch at top and/or bottom floor in entrance jamb as required by local code.
- F. Firefighter's Phase 1 Service: Key switch in brushed stainless steel cover plate.
- G. Fixture Cover Plates: For push buttons, hall lanterns and position indicators, resistant white back-printed glass, no screws required for mounting. Provide stainless steel cover plates for Firefighter's Phase I switch and hoistway access switches, with tamper resistant screws in same finish.
- H. Mounting: Mount hall fixtures in entrance frames.

## **PART 3 - EXECUTION**

### **1.20 EXAMINATION**

- A. Examine hoistways, hoistway openings, and pits before starting elevator installation.
- B. Verify hoistway, pit, overhead, and openings are of correct size, within tolerances, and are ready for work of this section.
- C. Verify walls are plumb where openings occur and ready for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.
- D. Verify hoistway is clear and plumb, with variations not to exceed -0 to +1 inch at any point. Verify projections greater than 4" must be beveled not less than 75 degrees from horizontal. No negative tolerance is permitted for minimum hoistway dimensions.
- E. Verify minimum 2-hour fire-resistance rating of hatch walls.
- F. Notify Architect in writing of dimensional discrepancies or other conditions detrimental to proper installation or performance of elevators.
- G. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to manufacturer/installer.

### **1.21 INSTALLATION**

- A. Install elevators in accordance with manufacturer/installer's instructions and ANSI/ASME A17.1.
- B. Set entrances in vertical alignment with car openings, and aligned with plumb hoistway lines.

### **1.22 FIELD QUALITY CONTROL**

- A. Perform tests of elevator as required by ANSI/ASME A17.1 and governing codes.

### **1.23 ADJUSTING**

- A. Adjust elevators for proper operation in accordance with manufacturer/installer's instructions.
- B. Adjust elevators for smooth acceleration and deceleration of car so not to cause passenger discomfort.
- C. Adjust doors to prevent opening of doors at landing on corridor side, unless car is at rest at that landing, or is in leveling zone and stopping at that landing.
- D. Adjust automatic floor leveling feature at each floor to within 1/4 inch of landing.
- E. Repair minor damages to finish in accordance with manufacturer/installer's instructions and as approved by Architect.
- F. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

### **1.24 CLEANING**

- A. Clean elevators promptly after installation in accordance with manufacturer/installer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

#### 1.25 PROTECTION

- A. Protect installed elevators from damage during construction in accordance with the negotiated temporary use agreement between Owner and manufacturer's installer.

END OF SECTION

## **SECTION 14421 – ANGLED WHEELCHAIR PLATFORM LIFT**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Indoor inclined platform wheelchair lifts.
- B. Portable emergency evacuation device.

#### **1.2 RELATED SECTIONS**

- A. Section 03300 - Cast-In-Place Concrete: Anchor placement in concrete.
- B. Section 06100 - Rough Carpentry: Blocking in framed construction for lift attachment.
- C. Section 09260 - Gypsum Board Assemblies: Stair walls.
- D. Section 13650 - Fire Alarm System: Building Fire Alarm Integration system to connect the lift control system with the building fire alarm system.
- E. Division 16 - Electrical: Electrical power service and wiring connections.

#### **1.3 REFERENCES**

- A. ASME A17.5 - Elevator and Escalator Electrical Equipment.
- B. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
- C. CSA B44.1 - Elevator and Escalator Electrical Equipment.
- D. CSA B355 - Lifts for Persons with Physical Disabilities.
- E. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- F. NFPA 70 - National Electric Code.
- G. CSA - National Electric Code.

#### **1.4 SUBMITTALS**

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Submit manufacturer's installation instructions, including preparation, storage and handling requirements.
  - 2. Include complete description of performance and operating characteristics.
- C. Shop Drawings:
  - 1. Show typical details of assembly, erection and anchorage.
  - 2. Include wiring diagrams for power, control, and signal systems.
  - 3. Show complete layout and location of equipment, including required clearances.

- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, representing actual product, color, and patterns.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm with minimum 10 years documented experience in manufacturing of inclined wheelchair platform lifts of installations of type specified.
- B. Installer Qualifications: Firm licensed to install equipment of this scope, with evidence of experience with specified equipment. Installer shall maintain an adequate stock of replacement parts and have qualified people available to ensure timely maintenance and callback service at the project site.

## 1.6 REGULATORY REQUIREMENTS

- A. Provide platform lifts in compliance with:
  - 1. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
  - 2. ASME A17.5 - Elevator and Escalator Electrical Equipment.
  - 3. NFPA 70 - National Electric Code.
- B. Provide platform lifts in compliance with:
  - 1. CSA B355 - Lifts for Persons with Physical Disabilities.
  - 2. CSA B44.1/ASME A17.5 - Elevator and Escalator Electrical Equipment.
  - 3. CSA - National Electric Code.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store components off the ground in a dry covered area, protected from adverse weather conditions.

## 1.8 PROJECT CONDITIONS

- A. Do not use wheelchair lift for hoisting materials or personnel during construction period.

## 1.9 WARRANTY

- A. Warranty: Manufacturer shall warrant the wheelchair lift materials and workmanship for two years following completion of installation.
- B. Extended Warranty: Provide an extended manufacturer's warranty for the entire warranty period covering the wheelchair lift materials and workmanship for the following additional extended period beyond the initial warranty. Preventive Maintenance agreement required.
  - 1. Five additional years.

# PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Garaventa Lift; U.S. Address: P.O. Box 1769, Blaine, WA 98231-1769. Toll-Free 1-800-663-6556 Tel: (604) 594-0422. Fax: (604) 594-9915. Email: [productinfo@garaventalift.com](mailto:productinfo@garaventalift.com). Web: [www.garaventalift.com](http://www.garaventalift.com)
- B. Substitutions: manufacturer's products considered equal by architect will be acceptable.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

## 2.2 STAIR LIFT FOR STRAIGHT STAIRWAYS

- A. Garaventa Inclined Platform Lift: Stair-Lift Model XPRESS II to serve one flight of straight stairs, with two landings and two stops. Lift consists of an extruded aluminum guide rail, a folding platform that is moved along the guide rail by an integrated rack and pinion drive system, overspeed safety system and call stations at each landing. Conform to the following design requirements:
  - 1. Application:
    - a. Indoor.
  - 2. Platform Load Rating: 225 kg (495 lb) with minimum safety factor of 5.
  - 3. Travel Speed: 4m/min (13 fpm) traveling up; 5 m/min (16 fpm) traveling down.
  - 4. Platform Deck: Surface shall be slip resistant with the following features:
    - a. Platform Size A (ADA Compliant): 800 mm (31 1/2 in.) wide by 1250mm (49 1/4") long.
  - 5. Platform Operation:
    - a. Automatic Fold: Folded and unfolded electrically from the call station.
    - b. Emergency Manual Fold: When unit is left in the open position, the platform may be manually folded and retained in the closed position.
  - 6. Under Platform Obstruction Sensing:
    - a. Provide an under-platform sensing device to stop the platform from traveling in the downward direction when encountering 20N (4 lbf) of pressure.
    - b. Platform is permitted to travel in the opposite direction of the obstruction to allow clearing.
  - 7. Passenger Restraining Arms:
    - a. Platform equipped with retractable passenger restraining arms in compliance with ASME A18.1a – 2001 or more recent edition.
    - b. Arms stop moving when an obstruction causing 20 N (4 lbf) of pressure is encountered and will immediately retract when the signal is removed.
    - c. Provide with means to manually unlock and open the restraining arms for passenger emergency evacuation.
    - d. Arms are folded and unfolded electrically from the call stations or platform controls.
    - e. Top of arms mounted 800 mm (32 in.) to 1000 mm (38 in.) above the platform deck. When in the guarding position the arms are located above the perimeter of the platform.
    - f. The gaps between the ends of the arms shall not exceed 100 mm (4 in.).
  - 8. Boarding Ramps:
    - a. Provide boarding sides of platform with retractable ramps positioned for travel at a height of 150 mm (6 in.) measured vertically above the platform deck.
    - b. Lock ramps in their guarding positions during travel. When the platform is at the landing, only the retractable ramp servicing the landing shall be operable.
    - c. Ramps shall be folded and unfolded electrically.
    - d. Retractable ramps, in the guarded position, shall withstand a force of 550 N (125 lbf) applied on any 100 mm (4 in.) by 100 mm (4 in.) area. This force shall not cause the height of the ramp, at any point in its length, to be less than 150 mm (6 in.) measured vertically above the platform deck.

- e. Provide a means to manually unlock the ramps for emergency evacuation when the platform is located at a landing.
  - f. Provide with a bi-directional obstruction sensitive device on the travel direction end of the platform to stop the lift when 20 N (4 lbf) of pressure is encountered on either the outside or inside of the platform. Platform is permitted to travel in the opposite direction of obstruction to allow clearing.
9. Platform Kick Plate:
- a. Provide on the non-boarding and non-guide rail side of the platform a kick plate of not less 150 mm (6 in.) in height, measured vertically from the platform deck.
  - b. When the platform is folded the kick plate shall cover the platform controls, providing protection from vandalism.
10. Hand Grips:
- a. Equip platform with a 32 mm (1-1/4 in.) tubular steel hand grip or grab bar at the top of the platform. The hand grip is to cover the entire width of the platform.
11. Clearances Dimensions:
- a. The platform shall not protrude more than 260 mm (10 1/4 in.) from the mounting surface when folded and stored.
  - b. The platform shall not protrude more than 1020 mm (40 1/4 in.) from the mounting surface when unfolded and in use.
12. Controls:
- a. Controls: 24 VDC Low Voltage type.
  - b. Platform equipped with emergency stop switch located within reach of the passenger. When activated the emergency stop button shall cause electric power to be removed from the drive system stopping lift immediately.
  - c. Operating controls shall be two separate 36 mm (1 1/2) diameter round constant pressure buttons with directional arrows, mounted on the front surface of the platform control panel.
  - d. When the platform arrives at landing and the user releases the directional control button, the passenger restraining arms and boarding ramp shall unfold automatically allowing passenger to disembark.
  - e. Platform control panel shall include a receptacle for an optional plug-in hand-held attendant pendant control.
  - f. Platform shall be equipped for:
  - g. Keyless Operation.
  - h. Keyed Operation.
  - i. Provide control wiring to allow the platform to be folded into the storage position from the opposite call station.
  - j. Provide control wiring to allow the platform to be called to the opposite landing in the folded open position.
13. Passenger Seat: Fold-down type with safety belt.
14. Side Loading Platform: Provide with automatic folding ramps and kick plates at boarding sides of platform.
15. Platform Security Lock: Provide to prevent unauthorized unfolding of the platform.
16. Attendant Hand-Held Pendant Control: Provide lift with a plug-in pendant control for attendant operation.
17. Autofold Platform: Automatically fold platform into storage position when left unused in open position at any landing for:
- a. 3 minutes (recommended)
  - b. A specified delay of 3 minutes (1 to 10 minutes, factory set)
18. Platform on-Board Emergency Alarm: Provide platform with an on-board alarm that sounds when emergency stop button is pushed. The alarm shall have a battery back-up so that it will continue to function if lift power is lost.
- B. Drive and Guide Rail System:

1. Operation:
    - a. Motor: 0.6 kW (3/4 HP) electric motor with an integrated brake.
    - b. Required power: 208-240 VAC, single phase, 50/60 Hz. on a dedicated 20 amp circuit. Power Transmission: Worm gear reduction to a pinion moving on a fixed gear rack.
    - c. A frequency inverter shall be used to smoothly start and stop the platform motion.
    - d. Drive carriage and associated control devices to be located within the platform conveyance.
    - e. An upper final limit switch shall be provided to stop the lift in the event of a failure of the primary limit switch.
    - f. Drive system shall be equipped with an hour counter.
  2. Guide Rail System:
    - a. Two-part guide rail system consisting of:
      - 1) Main Upper Rail: Anodized aluminum extrusion weighing 11.9 kg/m (8 lb/ft) with integrally mounted zinc plated gear rack.
      - 2) Lower Rail: 38 mm (1 1/2 in.) by 64mm (2 1/2 in.) anodized aluminum extrusion.
    - b. Rail Mounting:
      - 1) Rails shall be directly mounted to the stairway wall.
      - 2) Upper rail shall be attached to a 2 by 8 inch board that is secured to the wall. Lower rail shall be attached to a 2 by 4 inch board that is secured to the wall. Each board shall be fastened to every available stud with a minimum of two fasteners.
      - 3) Rails shall be mounted to steel support posts that are secured to the lower landing floor and stair treads. Support posts shall be 64 mm (2 1/2 in.) by 64 mm (2 1/2 in.) hollow structural steel.
    - c. Provide a mechanical stop at the upper landing to prevent over-travel of the drive carriage in the event of a switch failure.
  3. Provide overspeed governor and brake on upper carriage drive, containing mechanical overspeed sensor and lock, with electrical drive cut-out protection.
  4. Provide with manual handwheel for emergency operation.
  5. Emergency Battery Operation:
    - a. Auxiliary Power: Provide an external battery back-up system for normal up/down lift operation during a power failure for a minimum period of one hour with rated load.
    - b. Emergency battery lowering: provide an on-board battery system to allow the user to lower the platform during a power failure.
- C. Pedestrian Handrail Integrated with Guide Rail:
1. Provide a pedestrian handrail to be mounted to the top of the upper rail.
  2. The top of the handrail gripping surface shall be between 785 mm (31 in.) and 1270 mm (50 in.) above the stair nosing and have a smooth gripping surface 38 mm (1-1/2 in.) in diameter.
  3. Handrail will be on the same plane as the upper rail of the lift.
- D. Call Stations:
1. Provide surface mounted call stations at both landings.
  2. Call station operating voltage to be 24V.
  3. Call stations shall be provided with constant pressure directional control buttons for call and send.
  4. A one-touch control system shall be used to automatically fold/unfold the platform, boarding ramps and passenger restraining arms.
  5. Call stations shall be equipped for:
    - a. Keyed Operation.



- b. Keyless Operation.
- 6. Provide constant pressure Attendant Call buttons on each call station.
- 7. Mounting:
  - a. Lower landing call station:
    - 1) Surface mounted call station.
    - 2) Flush mounted call station: Provide powder-coated trim collar.
    - 3) Pedestal mounted call station: Provide free-standing mounting pedestal.
  - b. Upper landing call station:
    - 1) Surface mounted call station.
    - 2) Flush mounted call station: Provide powder-coated trim collar.
    - 3) Pedestal mounted call station: Provide free-standing mounting pedestal.
- E. Additional Safety or Code Requirements:
  - 1. Wall Mounted Audio-Visual Alert: Provide wall mounted audio-visual alter(s) with adjustable volume control tht sound while the lift is in operation and are visible by pedestrian traffic from all flights and landings.
  - 2. Building Fire Alarm Integration: Coordinate with Section 13650 Building Fire Alarm System to connect the lift control system with the building fire alarm system. If the lift is not in operation when the building fire alarm system is activated power will be cut to the lift preventing use during fire evacuation. If the lift is in use when the building fire alarm system is activated, the lift shall only allow the passenger to travel to the designated landing with the emergency exit.
- F. Finish Environment Requirement:
  - 1. Design and fabricate lift to manufacturer's standard design for indoor and outdoor locations.
    - a. Aluminum guide rails and ramps to be anodized aluminum. Steel components shall be painted with electrostatically applied and baked powder coat as follows:
      - 1) Fine Textured Satin Grey (RAL 7030).
      - 2) Custom color as selected by Architect from an RAL color chart.
    - b. Electrical printed circuit boards and control transformers to be treated with a conformal coating for resistance to ambient moisture.
  - 2. Platform Cover: Provide a durable and weather resistant nylon platform cover for protection.

## 2.3 EMERGENCY EVACUATION DEVICE

- A. Portable evacuation chair, Garaventa "Evacu-Trac" with steel storage enclosure:
  - 1. Capacity: 1 person, 136 kg (300 lbs.) with minimum 1.5 times safety factor.
  - 2. Maximum Stair Angle: 40 degrees.
  - 3. Speed Governor: Piston brake.
  - 4. Brake: By manual mechanical brake, attendant must release for descent.
  - 5. Surface Mount Cabinet:
    - a. Steel cabinet and door panel. Available only in Satin Grey, left hinged only.
    - b. Size: Height 1151mm (45 3/8 in.) width 508 mm, (20 in.) depth 279mm (11 in.)

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.

- B. Verify electrical rough-in is at correct location.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION

- A. Install platform lifts in accordance with in compliance with regulatory requirements specified and the manufacturer's instructions.
- B. Install system components and connect to building utilities.
- C. Accommodate equipment in space indicated.
- D. Startup equipment in accordance with manufacturer's instructions.
- E. Adjust for smooth operation.

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests in compliance with regulatory requirements specified and as required by authorities having jurisdiction.
- B. Schedule tests with agencies and Architect, Owner, and Contractor present.

### 3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 14421



## **SECTION 15010 - GENERAL PROVISIONS**

### **PART 1 - GENERAL**

#### **1.1 SCOPE**

1. The mechanical portion of this project includes all labor, materials, equipment, etc., required to provide the complete mechanical work to fulfill the intent of the Contract Documents.

#### **1.2 RELATED DOCUMENTS**

1. All applicable provisions of Division 0 and 1 govern work under this division. Refer to these articles in the specifications for additional information.
2. All work shall be in compliance with the currently enforced edition of the applicable state, national, and local ordinance and building codes. No additional compensation shall be granted for work which must be changed as a result of the work not originally complying with the codes and standards, etc.
3. Refer to each section for additional applicable codes and reference standards.

#### **1.3 FEES AND TAXES**

1. This Contractor is responsible for all inspection fees required by local authorities having jurisdiction. Local building permits shall not be required for this project. The Contractor is also responsible for all taxes levied for labor and materials associated with the mechanical portion of the work. After completion of the work, a certificate of final inspection shall be provided showing approval from the local Inspector.

#### **1.4 SUBMITTALS**

1. Submittals shall be provided for all equipment, fixtures and other items indicated. Product data shall be from published manufacturer=s data. Data shall include enough information so that the Engineer can verify compliance with codes, standards, and the contract documents. Submittal shall not contain data that is not relevant to the equipment being submitted. The data shall be highlighted by arrows, underlining, etc. Broad, general data, is not acceptable. Data shall be presented at one time, in a neatly bound and organized manner.
2. Submit a minimum of 5 copies of each required submittal. The Engineer will return the copies marked with action taken and corrections or modifications required. Unless resubmittal is requested, the submittal may serve as the final submittal.
3. The contractor shall provide and maintain at the site a set of prints which accurately represent the actual installation of all work under this Division. Any changes in sizes, locations, dimensions, etc. shall be shown.
4. At the completion of the Project, a set of marked-up drawings, including DIMENSIONED, location of all underground piping shall be provided to the owner.

## 1.5 OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS

1. Operating and Maintenance Data includes printed information, such as manufacturer's installation instructions, manufacturer's service manuals, manufacturer's lubrication charts, standard wiring diagrams, and a parts list including the price of each item.
2. Mark each copy to show applicable choices and options. Where printed Operating and Maintenance Data includes information on several products that are not required, mark copies to indicate the applicable information.
3. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
  1. Operation Data:
    1. Emergency instructions and procedures.
    2. System, subsystem, and equipment descriptions, including operating standards.
    3. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
    4. Description of controls and sequence of operations.
    5. Piping and wiring diagrams.
  2. Maintenance Data:
    1. Manufacturer's information, including list of spare parts.
    2. Name, address, and telephone number of Installer or supplier.
    3. Maintenance procedures.
    4. Maintenance and service schedules for preventive and routine maintenance.
    5. Maintenance record forms.
    6. Sources of spare parts and maintenance materials.
    7. Copies of maintenance service agreements.
    8. Copies of warranties and bonds.
4. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.
5. Do not submit Operating and Maintenance Data until compliance with requirements of the Contract Documents has been confirmed.

## 1.6 PRIOR APPROVAL

1. The drawings and specifications are intended to indicate a standard of quality for items by identifying manufacturer's names and model numbers. It is the responsibility of the contractor to prove equality for any substitutions.

The contractor shall submit a list of proposed substitutions to the Engineer. All proposed substitutions shall be in writing to the Engineer, at least, ten (10) calendar days prior to bid opening. The submittal will list the proposed substitutions from published manufacturer's data, which cover the applicable features of the submitted equipment. Any approvals shall be issued in writing.

## 1.7 GUARANTEE

1. The contractor shall fully guarantee the installation against defects in materials and workmanship which may occur under normal usage for a period of one year after owner=s acceptance. Defects shall be promptly remedied at no cost to the owner. This guarantee is in addition to, and not a limit to, any other guarantees or warranties.

## 1.8 DEFINITIONS. The following words and phases are defined:

1. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.
2. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect/Engineer, requested by the Architect/Engineer, and similar phrases.
3. "Approved": The term "approved," when used in conjunction with the Architect's/Engineer=s action on the Contractor's submittals, applications, and requests, is limited to the Architect's/Engineer=s duties and responsibilities as stated in the Conditions of the Contract.
4. "Regulations": 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.
5. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
6. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
7. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
8. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform
9. "Project site" is the space available to the Contractor for performing 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 on which the Project is to be built.
10. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

## 1.9 INSPECTION OF THE SITE

1. The drawings are prepared from the most accurate information available. However, in order to insure responsible bidding by the contractor, he shall, prior to placing any bids, visit the site to verify existing conditions, the locations, sizes, depths, pressures, etc., of all existing utilities and become familiar with working conditions, hazards, existing grades, obstructions, local requirements involved, etc.
2. All proposals shall take these existing conditions and any speculated revisions needed into account. The contractor shall be fully responsible for his bid regardless of any additional site information which may be uncovered after a contract is signed.

## 1.10 CONSTRUCTION SAFETY

1. The plans and specifications do not include items necessary for the contractor to insure the safety of his personnel on the project construction site. Construction site safety for the project is the responsibility of the contractor. Reference other sections of these specifications for any additional information.

## 1.11 DAMAGE

1. The contractor shall be held accountable to repair, at no cost to the owner, any damage to existing wiring, piping, or other materials and equipment intended to remain.
2. The contractor shall be held accountable to repair, at no cost to the owner, any damage to project due to failure to recognize associated hazards such as leaks, scheduling of work, poor workmanship, excessive cutting, etc.

## 1.12 DRAWINGS AND SPECIFICATIONS

1. Should be considered as complimentary to each other. What is required by one shall be binding as if required by both. If conflicts between plans and specifications are found, the Engineer shall be contacted to secure clarification, prior to bidding. The contractor shall verify all dimensions and existing conditions.

# PART 2 - EXECUTION

## 2.1 WORKMANSHIP

1. All work shall be done in a professional and complete manner by experienced craftsmen. Unsatisfactory workmanship shall be duly noted and corrected at the contractor's expense.
2. Only new materials shall be used, unless otherwise indicated on plan or prior approved.

## 2.2 MANUFACTURER'S INSTALLATION INSTRUCTIONS

1. All equipment shall be installed in accordance with manufacturer's installation instructions.

## 2.3 PROTECTION OF EQUIPMENT

1. The contractor shall provide protection of stored material and installed equipment against dirt, rust, moisture, and abuse from other trades. Where tarps or other cover is used, provide air circulation to prevent condensate build up. No materials or equipment shall be stored directly on the ground. Ductwork, piping and equipment are prohibited from use as scaffolding or personnel supports.
2. Upon completion of work, all equipment, fixtures, piping, etc., shall be cleaned to the satisfaction of the Architect. All repairs due to damage shall be at the Contractor=s expense.

## 2.4 CONFLICTS, INTERFERENCES AND COORDINATION BETWEEN TRADES

1. Coordinate work so as to conform with the progress of the work of others. The drawings are only intended to indicate the extent, general location and arrangement, of piping systems, ductwork and equipment. The drawings are not to be construed as shop drawings. Any questions regarding the information given on the plans shall be directed to the Engineer for clarification. The contractor shall refer to other sections of the specifications and other drawings such as structural, electrical, etc., in order to eliminate conflicts when laying out his work. The contractor shall be responsible for the proper coordination of the mechanical work with the installations under other Divisions for clearances, etc. Any changes required to avoid interferences shall be submitted to the Architect for approval and shall be made, as approved, without additional cost to the Owner.
2. Code requirements shall have precedence over plans or specifications in the event of a conflict. If a discrepancy or conflict exists between specifications and drawings, drawings shall take precedence over specifications except as pertaining to quality. Manufacturer=s installation instructions shall govern the installation of all equipment.
3. The contractor shall coordinate with equipment suppliers for any requirements specific to the equipment provided which may not be shown on the plans or given in the specifications. The contractor shall include the provision and installation of such requirements in his bid. The contractor shall coordinate with equipment suppliers, prior to bid, to determine what ancillary equipment is or is not provided with the equipment, such as bolts, gaskets, oils, drive belts, etc. Coordinate with Owner for owner supplied equipment.
4. Equipment requiring set grades or elevations and piping has precedence over ductwork, conduit, boxes, etc. as to location.
5. The contractor shall coordinate with other equipment providers to insure correct operation of the equipment, such as, phase rotation, interlocking, accessibility, etc.
6. The contractor shall examine the plans for the location of suitable openings and aisles for the passage of equipment to be installed under this Division. The contractor shall be responsible for having suitable openings and aisles left open until his equipment has been properly installed.
7. Except as otherwise noted, it shall be understood that the indication and/or description of any item, in the drawings or specifications, or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
8. The right is reserved to make reasonable changes in locations of equipment indicated in Drawings prior to installation without an increase in the contract cost.
9. The drawings and specifications do not undertake to indicate every item required to produce a complete and properly operational installation. Material, equipment or labor not indicated, but which can be reasonably inferred to be necessary for a complete installation shall be provided.

## 2.5 CUTTING AND PATCHING



1. Every effort shall be made to build-in the work as the job progresses. As required, cutting and patching for the installation of sleeves, piping, equipment, etc., shall be coordinated with the General Contractor. Do not cut any structural element without written permission from the Structural Engineer.

## 2.6 EQUIPMENT CONNECTIONS

1. The contractor shall make final connection of all required services to all equipment items furnished, including that provided by others or by the owner. Equipment shall be left in a ready to operate state.

## 2.7 FLASHING AND WATERPROOFING

1. All building penetrations to outside shall be flashed, as required, to prevent leaks.

**END OF SECTION 15010**

## **SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS**

### **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 basic mechanical materials and methods.
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Concrete base construction requirements.
  - 3. Escutcheons.
  - 4. Dielectric fittings.
  - 5. Flexible connectors.
  - 6. Mechanical sleeve seals.
  - 7. Equipment nameplate data requirements.
  - 8. Labeling and identifying mechanical systems and equipment.
  - 9. Nonshrink grout for equipment installations.
  - 10. Field-fabricated metal and wood equipment supports.
  - 11. Installation requirements common to equipment specification sections.
  - 12. Mechanical demolition.
  - 13. Cutting and patching.
  - 14. Touchup painting and finishing.

#### **1.3 DEFINITIONS**

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

4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene propylene diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.
- B. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.
- C. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment rooms in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
1. Planned piping layout, including valve and specialty locations and valve-stem movement.
  2. Required clearances for installing, servicing and maintaining equipment, insulation, accessories, and specialties, including space for disassembly required for periodic maintenance.
  3. Equipment and accessory service connections and support details.
  4. Exterior wall and foundation penetrations.
  5. Fire-rated wall and floor penetrations.
  6. Sizes and location of required concrete pads and bases.
  7. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

#### 1.5 QUALITY ASSURANCE

- A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be incorporated into contract price. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.

- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.7 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces.
- G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

#### A. STEEL PIPING

1. Steel Pipe: ASTM A 53, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
2. 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.
3. 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.
4. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
5. Cast-Iron Flanges: ASME B16.1, Class 125.
6. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
7. Grooved-End Fittings: ASTM A 47, malleable-iron casting; ASTM A 106, galvanized, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
8. 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.
9. 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.
10. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating

temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

## B. DUCTILE-IRON PIPING

1. Piping for fire-suppression applications shall be listed for fire-protection service.
2. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell- and plain-spigot end, unless grooved or flanged ends are indicated.
3. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint, bell- and plain-spigot end, unless grooved or flanged ends are indicated.
4. 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.
5. 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.
6. Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536 ductile-iron castings with dimensions matching pipe.
  - a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
7. Flexible Expansion Joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed, ball-joint sections and one or more gasketed, sleeve section. Assemble components for offset and expansion indicated. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.
8. Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.
9. Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.

## C. COPPER TUBING AND FITTINGS

1. DWV Copper Tube: ASTM B 306, drainage tube, drawn temper.
2. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
3. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
4. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
5. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
6. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
7. 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.
8. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.

9. 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.

#### D. CAST-IRON SOIL PIPING AND FITTINGS

1. Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.
2. Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.
3. Gaskets: ASTM C 564, rubber.
4. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.
5. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.
  - a. NPS 1-1/2 to NPS 4: 3-inch-wide shield with 4 bands.
  - b. NPS 5 to NPS 10: 4-inch-wide shield with 6 bands.
6. Heavy-Duty, Cast-Iron Couplings: ASTM A 48, 2-piece, cast-iron housing; stainless-steel bolts and nuts; and sleeve.
7. Heavy-Duty, Type 301, Stainless-Steel Couplings: ASTM A 666, Type 301, stainless-steel shield; stainless-steel bands; and sleeve.
  - a. NPS 1-1/2 to NPS 4: 3-inch-wide shield with 4 bands.
  - b. NPS 5 to NPS 10: 4-inch-wide shield with 6 bands.
8. 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.
  - a. NPS 1-1/2 to NPS 4: 2-1/8-inch-wide shield with 2 bands.
  - b. NPS 5 and NPS 6: 3-inch-wide shield with 4 bands.
  - c. NPS 8 and NPS 10: 4-inch-wide shield with 4 bands.
  - d. NPS 12 and NPS 15: 5-1/2-inch-wide shield with 6 bands.

#### E. CORRUGATED, STAINLESS-STEEL TUBING SYSTEMS

1. Description: Comply with AGA LC 1 and include the following:
  - a. Tubing: Corrugated stainless steel with plastic jacket or coating.
  - b. Fittings: Copper alloy with ends made to fit corrugated tubing. Include ends with threads according to ASME B1.20.1 if connection to threaded pipe or fittings is required.
  - c. Striker Plates: Steel, designed to protect tubing from penetrations.
  - d. Manifolds: Malleable iron or steel with protective coating. Include threaded connections according to ASME B1.20.1 for pipe inlet and corrugated tubing outlets.

## 2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32.
  1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
  2. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.
- E. Brazing Filler Metals: AWS A5.8.
  1. BAg1: Silver alloy.
- F. Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
- G. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- H. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

## 2.3 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.

## 2.4 FLEXIBLE CONNECTORS

- A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
  1. 2-Inch NPS and Smaller: Threaded.
  2. 2-1/2-Inch NPS and Larger: Flanged.
- B. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.
- C. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 deg F. Units may be straight or elbow type, unless otherwise indicated.

## 2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

## 2.6 PIPING SPECIALTIES

- A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
  - 1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
  - 2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
  - 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
  - 4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
    - a. Underdeck Clamp: Clamping ring with set screws.
  - 5. PVC Pipe: ASTM D 1785, Schedule 40.
- B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
  - 1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
  - 2. OD: Completely cover opening.
  - 3. Cast Brass: One piece, with set screw.
    - a. Finish: Polished chrome-plate.
  - 4. Cast Brass: Split casting, with concealed hinge and set screw.
    - a. Finish: Polished chrome-plate.
  - 5. Cast-Iron Floor Plate: One-piece casting.

## 2.7 IDENTIFYING DEVICES AND LABELS

- A. General: Manufacturer's standard products of categories and types required for each application. If more than one type is specified for application, selection is Installer's option, but provide one selection for each product category.
- B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.
  - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
  - 2. Location: Accessible and visible location.
- C. Stencils: Standard stencils, prepared for required applications with letter sizes complying with recommendations of ASME A13.1 for piping and similar applications, but not less than 2-inch-high letters for ductwork and not less than 1-1/4-inch-high letters for access door signs and similar operational instructions.
  - 1. Material: Fiberboard or Brass.



2. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicated; either brushing grade or pressurized spray-can form and grade.

## 2.8 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
  1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  2. Design Mix: 5000-psig, 28-day compressive strength.
  3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General: Install piping as described below, unless piping Sections specify otherwise.
- B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved by the Engineer in writing.
- C. Install piping at slope indicated on plan, in these specifications, or as required by governing codes.
- D. Install components with pressure rating equal to or greater than system operating pressure.
- E. Install piping in concealed locations, except in equipment rooms and service areas.
- F. Install piping free of sags and bends. Decrease hanger spacing if required.
- G. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- I. Install piping to allow application of insulation plus 1-inch clearance around insulation.
- J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- K. Install fittings for changes in direction and branch connections.
- L. Install couplings according to manufacturer's written instructions.
- M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
  1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
  2. Uninsulated Piping Wall Escutcheons: Cast brass, with set screw.
  3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
  4. Insulated Piping: Cast brass; with concealed hinge, spring clips, and chrome-plated finish.

5. Piping in Utility Areas: Cast brass, with set-screw or spring clips.
- N. Sleeves are not required for core drilled holes.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  2. Build sleeves into new walls and slabs as work progresses.
  3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
    - b. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
      - 1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.
  4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
  5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.
- P. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter.
- Q. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials.
- S. Verify final equipment locations for roughing-in.
- T. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
  2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
  4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    - a. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
    - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
  6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
  7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
- U. Piping Connections: Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
  2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
  3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Engineer.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- E. Install equipment giving right of way to piping installed at required slope.
- F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

### 3.3 LABELING AND IDENTIFYING

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
  1. Stenciled Markers: According to ASME A13.1.

2. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior nonconcealed locations:

- a. Near each valve and control device.
- b. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
- c. Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible enclosures.
- d. At access doors, manholes, and similar access points that permit view of concealed piping.
- e. Near major equipment items and other points of origination and termination.
- f. Spaced at maximum of 25-foot intervals along each run. Reduce intervals to 15 feet in congested areas of piping and equipment.
- g. Pipe Identification – Coordinate exact piping colors with GSU facilities Management and Campus Services prior to installation; otherwise colors shall be as follows:
  - 1) Fuel Gas Pipe: Yellow.
  - 2) Domestic Water: Grey.
  - 3) Chilled Water: Blue.
  - 4) Heating Water: Orange.

B. Equipment: Install equipment marker on or near each major item of mechanical equipment.

1. Stenciled Markers: According to ASME A13.1
2. Lettering Size: Minimum 1-inch-high lettering for name of unit if viewing distance is less than 24 inches, 2-inch-high lettering for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
3. Text of Signs: Provide name of identified unit to match name of unit indicated on plan. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with stenciled signs and arrows, showing duct system service and direction of flow.

1. Location: In each space, if ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 25 feet.

### 3.4 PAINTING AND FINISHING

A. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior, Ferrous Piping and Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Exterior, Ferrous Piping and Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
  - a. Primer shall be a different color than undercoat and undercoat shall be a different color than the finish coat.
  - b. Allow sufficient time for each coat to fully dry prior to applying the next coat.

B. Do not paint piping specialties with factory-applied finish.

C. Damage and Touch-up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.5 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 3 inches larger, unless noted otherwise, in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi, 28-day compressive-strength concrete and reinforcement.

### 3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

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

### 3.7 DEMOLITION

- A. Disconnect, demolish, and remove Work indicated on plans.
- B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.
- E. Removal: Remove indicated equipment from Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

### 3.8 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

### 3.9 GROUTING

- A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placing of grout.
- E. Place grout, completely filling equipment bases.

- F. Place grout on concrete bases to provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's written instructions.

**END OF SECTION 15050**



## **SECTION 15060 - HANGERS AND SUPPORTS**

### **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 hangers and supports for mechanical system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Fiberglass pipe hangers.
  - 4. Metal framing systems.
  - 5. Thermal-hanger shield inserts.
  - 6. Fastener systems.
  - 7. Pipe stands.
  - 8. Pipe positioning systems.
  - 9. Equipment supports.

#### **1.3 DEFINITIONS**

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

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

#### **1.5 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
  - 2. Fiberglass pipe hangers.
  - 3. Thermal-hanger shield inserts.
  - 4. Powder-actuated fastener systems.
  - 5. Pipe positioning systems.



- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

- C. Welding certificates.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

- B. Welding: Qualify procedures and personnel according to the following:

1. ASME Boiler and Pressure Vessel Code: Section IX.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. 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 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

- B. Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

## 2.3 TRAPEZE PIPE HANGERS

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

## 2.4 METAL FRAMING SYSTEMS

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

## 2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
  1. Carpenter & Paterson, Inc.
  2. ERICO/Michigan Hanger Co.
  3. PHS Industries, Inc.
  4. Pipe Shields, Inc.
  5. Rilco Manufacturing Company, Inc.
  6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

- G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

## 2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

- 1. Manufacturers:

- a. Hilti, Inc.
- b. ITW Ramset/Red Head.
- c. Masterset Fastening Systems, Inc.
- d. MKT Fastening, LLC.
- e. Powers Fasteners.

- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

- 1. Manufacturers:

- a. B-Line Systems, Inc.; a division of Cooper Industries.
- b. Empire Industries, Inc.
- c. Hilti, Inc.
- d. ITW Ramset/Red Head.
- e. MKT Fastening, LLC.
- f. Powers Fasteners.

## 2.7 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

- B. Manufacturers:

- 1. C & S Mfg. Corp.
- 2. HOLDRITE Corp.; Hubbard Enterprises.
- 3. Samco Stamping, Inc.

## 2.8 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## 2.9 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

## **PART 3 - EXECUTION**

### **3.1 HANGER AND SUPPORT APPLICATIONS**

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
  2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
  3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
  4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
  5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
  6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).
  7. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
  8. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
  9. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
  10. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
  11. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  12. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
  13. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

14. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
  15. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  16. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
  17. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  18. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  19. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.
- E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- F. Fastener System Installation:
  - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 15 Section "Plumbing Fixtures" for plumbing fixtures.
- H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.

- L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- O. 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 B31.1 for power piping and ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2 : 12 inches (305 mm) long and 0.048 inch thick.
    - b. NPS 4 : 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6 : 18 inches long and 0.06 inch thick.
  - 5. Insert Material: Length at least as long as protective shield.
  - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.



### 3.4 METAL FABRICATIONS

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

### 3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal as necessary.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION 15060**

## **SECTION 15080 - MECHANICAL 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.

#### **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. 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 size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping installer for insulation application.
- C. Coordinate installation and testing of electric heat tracing.

#### 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:
  1. Mineral-Fiber Insulation:
    - a. CertainTeed Manson.
    - b. Knauf FiberGlass GmbH.
    - c. Owens-Corning Fiberglas Corp.
    - d. Schuller International, Inc.
  2. Cellular-Glass Insulation:
    - a. Pittsburgh-Corning Corp.
    - b. Cell-U-Foam Corp.
  3. Flexible Elastomeric Thermal Insulation:
    - a. Armstrong World Industries, Inc.
    - b. Rubatex Corp.

#### 2.2 INSULATION MATERIALS

- A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
  2. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
  3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
    - a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
    - b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
  4. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
  5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
  6. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
  7. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- B. Cellular-Glass Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.
1. Preformed Pipe Insulation, without Jacket: Comply with ASTM C 552, Type II, Class 1.
  2. Preformed Pipe Insulation, with Jacket: Comply with ASTM C 552, Type II, Class 2.
- C. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
1. Adhesive: As recommended by insulation material manufacturer.
  2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.
- D. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

## 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: Color-code piping jackets based on materials contained within the piping system.
- D. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- thick, high-impact, ultraviolet-resistant PVC.
1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
  2. Adhesive: As recommended by insulation material manufacturer.

- E. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209, 3003 alloy, H-14 temper.

## 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. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, 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 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- 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 o.c.
  - 3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. 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 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. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.
- Q. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.
- R. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
- S. Floor Penetrations: Apply insulation continuously through floor assembly.
  - 1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

### 3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
  - 1. Secure each layer of preformed pipe 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. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
  - 3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches 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 mineral-fiber blanket insulation.
  - 4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.
- C. Apply insulation to fittings and elbows as follows:
  - 1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  - 2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe 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 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 premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation sections are not available, apply glass-fiber blanket 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 stainer 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.

### 3.5 CELLULAR-GLASS 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 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 cellular-glass block insulation of the same thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded sections of insulation are not available, apply mitered sections of cellular-glass 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 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 premolded segments of cellular-glass insulation or glass-fiber blanket 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.
2. Apply insulation to flanges as specified for flange insulation application.
3. 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.
4. 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.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

### 3.6 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.

### 3.7 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 overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- 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 laps at longitudinal seams and 3-inch- wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.
- C. Apply PVC jacket where indicated, with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
- D. Apply metal jacket where indicated, with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.8 FINISHES

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket.
- 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 Owner. Vary first and second coats to allow visual inspection of the completed Work.

### 3.9 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.

### 3.10 FIELD QUALITY CONTROL

- A. 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.
- B. 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.
- C. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

### 3.11 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.

### 3.12 INTERIOR INSULATION APPLICATION SCHEDULE

- A. Service: Condensate drain piping.
  1. Operating Temperature: 35 to 75 deg F.
  2. Insulation Material: Flexible elastomeric.
  3. Insulation Thickness: 1/2"
  4. Field-Applied Jacket: None.
  5. Vapor Retarder Required: Yes.
  6. Finish: None.
- B. Service: Chilled-water supply and return.
  1. Operating Temperature: 35 to 75 deg F.
  2. Insulation Material: Fiberglass.
  3. Insulation Thickness: Apply the following insulation thicknesses:
    - a. Pipe, 2" and smaller: 1" thick.
    - b. Pipe 2 1/2" to 4 1/2": diameter: 1 1/2" thick.
    - c. Pipe 6" to 8" diameter: 2" thick

4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.
6. Finish: None.

C. Service: Heating hot-water supply and return.

1. Operating Temperature: 100 to 200 deg F.
2. Insulation Material: Fiberglass.
3. Insulation Thickness: Apply the following insulation thicknesses:
  - a. Pipe, 2" and smaller: 1" thick.
  - b. Pipe, 2 1/2" and larger: 1 1/2" thick.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: No.
6. Finish: None.

D. Service: Domestic cold water.

1. Operating temperature: 45 to 80 deg F.
2. Insulation material: Mineral fiber.
3. Insulation thickness: 0.5 inch, Jacket: ASJ.
4. Vapor retarder required: Yes.
5. Finish: None.

### 3.13 EXTERIOR INSULATION APPLICATION

- A. All insulation outside, exposed to weather shall be covered with aluminum metal jacket.

## END OF SECTION 15080



## **SECTION 15081 - DUCT 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 semirigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

#### **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. Removable insulation sections at access panels.
  - 2. Application of field-applied jackets.
  - 3. Applications at linkages for control devices.
- 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. 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 duct installer for insulation application.

## 1.7 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. 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. Mineral-Fiber Insulation:
    - a. CertainTeed Manson.
    - b. Knauf FiberGlass GmbH.
    - c. Owens-Corning Fiberglas Corp.
    - d. Schuller International, Inc.
  - 2. Flexible Elastomeric Thermal Insulation:
    - a. Armstrong World Industries, Inc.
    - b. Rubatex Corp.

## 2.2 INSULATION MATERIALS

- A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- B. 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.
- C. 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.

## 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. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.
- D. 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.
- E. 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.
- F. 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. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- P. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.
- Q. 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 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 overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- thick coats of jacket manufacturer's recommended adhesive.
  3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

### 3.7 FINISHES

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

### 3.8 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.

### 3.9 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. Service: Round, supply-air ducts, concealed.
1. Material: Mineral-fiber blanket.
  2. Thickness: 2 inches.
  3. Number of Layers: One.
  4. Field-Applied Jacket: Foil and paper.
  5. Vapor Retarder Required: Yes.
- B. Service: Round, return-air ducts, concealed.
1. Material: Mineral-fiber blanket.
  2. Thickness: 2 inches.
  3. Number of Layers: One.
  4. Field-Applied Jacket: Foil and paper.
  5. Vapor Retarder Required: Yes.
- C. Service: Round, outside-air ducts, concealed.
1. Material: Mineral-fiber blanket.
  2. Thickness: 2 inches.
  3. Number of Layers: One.
  4. Field-Applied Jacket: Foil and paper.
  5. Vapor Retarder Required: Yes.
- D. Service: Rectangular, supply-air ducts, concealed.
1. Material: Mineral-fiber blanket.
  2. Thickness: 2 inches.
  3. Number of Layers: One.
  4. Field-Applied Jacket: Foil and paper.
  5. Vapor Retarder Required: Yes.
- E. Service: Rectangular, return-air ducts, concealed.
1. Material: Mineral-fiber blanket.
  2. Thickness: 2 inches.
  3. Number of Layers: One.
  4. Field-Applied Jacket: Foil and paper].
  5. Vapor Retarder Required: Yes.

F. Service: Rectangular, outside-air ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 2 inches.
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

**END OF SECTION 15081**



## **SECTION 15110 - 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 general-duty valves.

#### **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. SWP: Steam working pressure.
  - 6. 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.
- 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.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## **PART 2 - PRODUCTS**

### **2.1 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.
- J. Valve Bypass and Drain Connections: MSS SP-45.

## **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, gate, or plug valves.
  - 2. Throttling Service: Angle, ball, butterfly, or globe valves.
  - 3. Pump Discharge: Swing check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

### 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. End chains to 60 inches above finished floor elevation.
- 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 23 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 15110**

## **SECTION 15140 - DOMESTIC WATER PIPING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Water meters will be furnished and installed by Contractor.

#### **1.2 SUMMARY**

- A. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.

#### **1.3 DEFINITIONS**

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. PVC: Polyvinyl chloride plastic.

#### **1.4 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. Domestic Water Service Piping: 160 psig.
  - 2. Domestic Water Distribution Piping: 125 psig.

#### **1.5 SUBMITTALS**

- A. Product Data: Required where indicated only. Submittal of pipe and fittings not required unless a change from specification is proposed.

#### **1.6 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**

## 2.1 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.

## 2.2 DUCTILE-IRON PIPING

- A. Piping for fire-suppression applications shall be listed for fire-protection service.
- B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell- and plain-spigot end, unless grooved or flanged ends are indicated.
  - 1. 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. Ductile-Iron Piping, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536 ductile-iron castings with dimensions matching pipe.
    - a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606 for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint, bell- and plain-spigot end, unless grooved or flanged ends are indicated.
  - 1. 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.
  - 2. Ductile-Iron, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536 ductile-iron castings with dimensions matching pipe.
    - a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
  - 3. Ductile-Iron, Flexible Expansion Joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed, ball-joint sections and one or more gasketed, sleeve section. Assemble components for offset and expansion indicated. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.
  - 4. Ductile-Iron, Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111 ductile-iron glands, rubber

- gaskets, and steel bolts.
5. Ductile-Iron, Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.

## 2.3 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.

## 2.4 PE ENCASEMENT

- A. PE Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105 PE film, 0.008-inch minimum thickness, tube or sheet.

## 2.5 VALVES

- A. Refer to Division 15 Section "Valves" for bronze and cast-iron, general-duty valves.
- B. Refer to Division 15 Section "Plumbing Specialties" for balancing and drain valves.

## 2.6 WATER METERS

- A. Provide meter with Advanced Meter Reading Capability IAW with AF Facility Metering Policy. Meter shall be connected to FMCS.

## **PART 3 - EXECUTION**

### **3.1 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 Domestic Water Piping: Use any of the following piping materials for each size range:
  - 1. NPS 1-1/2 and Smaller: Soft copper tube, Type L; Pipe joints to be avoided and permitted only to the extent of run lengths exceeding that of a single roll length of tubing. Should joints be required use wrought copper pressure fittings and silver-fos soldered joints. Under building slab.
- F. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
  - 1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.

### **3.2 VALVE APPLICATIONS**

- A. Submittal required. 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.
- B. Cast-iron, grooved-end valves may be used with grooved-end piping.

### **3.3 PIPING INSTALLATION**

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.
- C. 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.
- D. Install aboveground domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- E. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
- F. 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.
- G. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
- H. Check plumbing specialties and verify proper settings, adjustments, and operation.
1. Water-Pressure Regulators: Set outlet pressure at 80 psig maximum, unless otherwise indicated.

### 3.4 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. Grooved Joints: Assemble joints with keyed-coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- D. 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.

### 3.5 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.
- 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.
- 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.

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices.
- 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 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.
- F. 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. 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 15 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.

### 3.8 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.
  - 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
  - 4. 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.

### 3.9 CLEANING

#### A. Clean and disinfect potable and nonpotable 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:
    - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 8 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 15140



## **SECTION 15150 - 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 and rubber piping materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. EPDM: Ethylene-propylene-diene terpolymer.
  - 3. NBR: Acrylonitrile-butadiene rubber.
  - 4. PE: Polyethylene plastic.
  - 5. 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 SUBMITTALS**

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings: For sovent drainage system, include plans, elevations, sections, and details.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

#### **1.6 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.

### **2.2 CAST-IRON SOIL PIPING**

- A. Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.
  - 1. Gaskets: ASTM C 564, rubber.

### **2.3 DUCTILE-IRON PIPING**

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
  - 1. 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. Ductile-Iron Piping, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
    - a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
  - 1. 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.
  - 2. Ductile-Iron, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.

- a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- 3. Ductile-Iron, Flexible Expansion Joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
- 4. Ductile-Iron, Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
- 5. Ductile-Iron, Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

## 2.4 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.

## 2.5 PE ENCASUREMENT

- A. PE Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

## PART 3 - EXECUTION

### 3.1 EXCAVATION

- A. Refer to Division 2 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 any of the piping materials allowed in accordance with governing Plumbing Code unless otherwise noted.
- D. Underground, Soil, Waste, and Vent Piping: Use any of the piping materials allowed in accordance with governing Plumbing Code unless otherwise noted.

### 3.3 PIPING INSTALLATION

- A. Refer to Division 2 Section "Sanitary Sewerage" for Project-site sanitary sewer piping.
- B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewer. Install as indicated and as required by governing Plumbing Code.
- 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 cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- F. 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.
- G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated or dictated by local plumbing code:
  - 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.
- H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.4 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

- B. 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.
- 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.
- D. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

### 3.5 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.
    - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. 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: 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 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.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.6 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 15 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 15 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.

### 3.7 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.

### 3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

**END OF SECTION 15150**



## **SECTION 15186 - REFRIGERANT PIPING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Piping.
- B. Moisture and liquid indicators.
- C. Valves.
- D. Strainers.
- E. Filter-driers.

#### **1.2 REFERENCE STANDARDS**

- A. AHRI 710 - Performance Rating of Liquid-Line Driers; 2009.
- B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- D. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2013.
- E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2013.
- F. ASME B31.9 - Building Services Piping; 2014.
- G. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.
- H. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.
- I. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2016.
- J. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
- K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

#### **1.3 SUBMITTALS**

- A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

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

- A. Deliver and store piping and specialties in shipping containers with labeling in place.
- B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

## **PART 2 PRODUCTS**

### **2.1 PIPING**

- A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
  - 1. Fittings: ASME B16.22 wrought copper.
  - 2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
- B. Copper Tube to 7/8 inch (22 mm) OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
  - 1. Fittings: ASME B16.26 cast copper.
  - 2. Joints: Flared.
- C. Pipe Supports and Anchors:
  - 1. Provide hangers and supports that comply with MSS SP-58.
    - a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
  - 2. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  - 3. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.
  - 4. Vertical Support: Steel riser clamp.
  - 5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
  - 6. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
  - 7. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

### **2.2 FILTER-DRIERS**

- A. Performance:
  - 1. Flow Capacity - Liquid Line: As indicated in schedule, minimum, rated in accordance with AHRI 710.
  - 2. Pressure Drop: 2 psi (14 kPa), maximum, when operating at full connected evaporator capacity.
  - 3. Design Working Pressure: 350 psi (2410 kPa), minimum.
- B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.
- C. Construction: UL listed.
  - 1. Connections: As specified for applicable pipe type.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### **3.2 INSTALLATION**

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Insulate piping and equipment; refer to Section and Section 23 0716.
- H. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

### **3.3 FIELD QUALITY CONTROL**

- A. Test refrigeration system in accordance with ASME B31.5.
- B. Pressure test system with dry nitrogen to 200 psi (1380 kPa). Perform final tests at 27 inches (92 kPa) vacuum and 200 psi (1380 kPa) using halide torch. Test to no leakage.

## **END OF SECTION**



## **SECTION 15410 - PLUMBING FIXTURES**

### **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 plumbing fixtures and related components.

#### **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, 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. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. 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.

## 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.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. For fixture descriptions refer to schedule on drawings.

## 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 where 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 with waste fitting and seal for back-outlet fixtures.
  - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

- C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-hanging fixtures with tubular waste piping attached to supports.
- F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- G. Install counter-mounting fixtures in and attached to casework.
- H. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
- I. 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.
  - 1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. 2. Refer to Division 15 Section "Valves" for general-duty valves.
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- 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. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- N. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- O. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- P. Install 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.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water supplies from water distribution piping to fixtures.
- C. Connect drain piping from fixtures to drainage piping.
- D. 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.
- E. 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, hot-water dispensers, and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals 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 15410**



## SECTION 15430 - PLUMBING SPECIALTIES

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following plumbing specialties:

1. Backflow preventers.
2. Outlet boxes.
3. Key-operation hydrants.
4. Trap seal primer valves.
5. Miscellaneous piping specialties.
6. Cleanouts.
7. Floor drains.

#### 1.3 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PE: Polyethylene plastic.
3. PUR: Polyurethane plastic.
4. PVC: Polyvinyl chloride plastic.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig.
2. Sanitary Waste and Vent Piping: 10-foot head of water.
3. Storm Drainage Piping: 10-foot head of water.

#### 1.5 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

1. Backflow preventers.
2. Water hammer arresters, air vents, and trap seal primer valves.
3. Drain valves and hydrants.
4. Outlet boxes.
5. Cleanouts, floor drains, and roof drains.

- B. Field test reports.

- C. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Backflow preventers.
2. Trap seal primer valves.
3. Hydrants.

## 1.6 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.
- C. 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.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.
- E. NSF Compliance:
  1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
  2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

## PART 2 PRODUCTS

### 2.1 BACKFLOW PREVENTERS

- A. Reduced Pressure Backflow Preventer: ASSE 1010 with strainer, test cocks, drain elbow and gate valves.

### 2.2 OUTLET BOXES

- A. General: Recessed-mounting outlet boxes with supply fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections, and wood-blocking reinforcement.
- B. Icemaker Outlet Boxes: With hose connection and the following:

### 2.3 Shutoff Fitting: Hose bibb.

- A. Supply Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

### 2.4 KEY-OPERATION HYDRANTS

- A. General: ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig.
- B. Inlet: NPS 3/4 or NPS 1 threaded or solder joint.
- C. Outlet: ASME B1.20.7, garden-hose threads.

- D. Operating Keys: One with each key-operation hydrant.

## 2.5 TRAP SEAL PRIMER VALVES

- A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:
- B. Manufacturers:
  - 1. Precision Plumbing Products, Inc.
- C. 125-psig minimum working pressure.
- D. Bronze body with atmospheric-vented drain chamber.
- E. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
- F. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
- G. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

## 2.6 MISCELLANEOUS PIPING SPECIALTIES

- A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.
- B. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.
- C. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig; integral or field-installed, nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.
  - 1. Include operating key with each operating-key hose bibb.
  - 2. Include integral wall flange with each chrome- or nickel-plated hose bibb.
- D. Air Vents: Float type for automatic air venting.
  - 1. Bolted Construction: Bronze body with replaceable, corrosion-resistant metal float and stainless-steel mechanism and seat; threaded NPS 3/8 minimum inlet; 125-psig minimum pressure rating at 140 deg F; and threaded vent outlet.
  - 2. Welded Construction: Stainless-steel body with corrosion-resistant metal float, stainless-steel mechanism and seat, threaded NPS 3/8 minimum inlet, 150-psig minimum pressure rating, and threaded vent outlet.
- E. Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting, joined with ASTM C 564, rubber gaskets.
- F. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.



1. NPS 2: 4-inch- minimum water seal.
  2. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- G. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.
- H. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.
- I. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

## 2.7 CLEANOUTS

- A. Cleanouts.
1. Application: Floor cleanout, Wall cleanout, For installation in exposed piping, and 2. Exterior cleanout.
  3. Products:
    - a. Floor Cleanout in finished areas: Tyler Pipe, Wade Div.; #W-7000 w/ satin nickel bronze top.
    - b. Floor Cleanout in tile floors: Tyler Pipe, Wade Div.; #W-7000-T.
    - c. Floor Cleanout in terrazzo floors: Tyler Pipe, Wade Div.; #W-7000-U.
    - d. Floor Cleanout in unfinished utility or storage areas: Tyler Pipe, Wade Div.; #W-8550-D.
    - e. Wall Cleanout: Tyler Pipe, Wade Div.; #W-8450-R w/ stainless steel cover plate.
    - f. Cleanout in exposed piping: Tyler Pipe, Wade Div.; #W-8550-R.
    - g. Exterior Cleanout: Tyler Pipe, Wade Div.; #W-7040-X w/ nickel bronze top.
  4. Cleanouts in waterproof floors shall have flashing flange and clamping device.
  5. Cleanouts in carpeted areas shall be provided with carpet makers (Wade option No. 72).

## 2.8 FLOOR DRAINS

- A. Floor Drains, Wade Div. #W-1100, shall be provided as indicated on drawings.
1. Body Material: Gray iron.
  2. Top or Strainer Material: Nickel bronze.
  3. Top of Body and Strainer Finish: Nickel bronze.
  4. Top Shape: Round.
  5. Trap Material: Cast iron.
  6. Trap Pattern: Deep-seal P-trap.
  7. Trap Features: Trap seal primer valve drain connection.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  - 1. Locate backflow preventers in same room as connected equipment or system.
  - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  - 3. Do not install bypass piping around backflow preventers.
- C. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- D. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- E. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 75 feet.
  - 4. Locate at base of each vertical soil and waste stack.
- F. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.
- G. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- H. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- I. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
- J. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- K. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
- L. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- M. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

- N. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
- O. Install air vents at piping high points. Include ball, gate, or globe valve in inlet .
- P. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- Q. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect plumbing specialties to piping specified in other Division 15 Sections.
- D. Ground equipment.
- E. 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.
- F. Connect plumbing specialties and devices that require power according to Division 16 Sections.

### 3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**END OF SECTION 15430**

## **SECTION 15815 - 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 metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg. Metal ducts include the following:
  - 1. Rectangular ducts and fittings.
  - 2. Single-wall, ducts and formed fittings.
  - 3. Double-wall, ducts and formed fittings.
  - 4. Duct liner.

#### **1.3 DEFINITIONS**

- A. FRP: Fiberglass-reinforced plastic.
- B. NUSIG: National Uniform Seismic Installation Guidelines.

#### **1.4 SYSTEM DESCRIPTION**

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. 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.

#### **1.5 SUBMITTALS**

- A. Welding certificates.
- B. Field quality-control test reports.

#### **1.6 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. 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 SHEET METAL MATERIALS**

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

### **2.3 DUCT LINER**

- A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.
  1. Manufacturers:
    - a. CertainTeed Corp.; Insulation Group.
    - b. Johns Manville International, Inc.
    - c. Knauf Fiber Glass GmbH.
    - d. Owens Corning.
  2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.
    - a. Thickness: 1 inch.
    - b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
    - c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
    - d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
    - e. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner

when applied as recommended by manufacturer and without causing leakage in duct.

- 1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
- 2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
- 3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

B. Flexible Elastomeric Duct Liner: Comply with NFPA 90A or NFPA 90B.

1. Manufacturers:

- a. Aeroflex USA, Inc.
- b. Armacell, LLC.
- c. Rubatex International, LLC.

2. Materials: Unicellular polyethylene thermal plastic, preformed sheet insulation complying with ASTM C 534, Type II, except for density.

- a. Thickness: 1 inch.
- b. Thermal Conductivity (k-Value): 0.24 at 75 deg F mean temperature.
- c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM C 411.
- d. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

## 2.4 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.
- B. Joint and Seam Tape: 2 inches wide; glass-fiber-reinforced fabric.
- C. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
- D. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- E. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
- F. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- G. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

## 2.5 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
  - 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
  - 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
  - 3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- 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.

## 2.6 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying 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 class.
  - 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Nexus Inc.
    - c. Ward Industries, Inc.
- C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.

- b. Lockformer.
- 2. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
- 3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.
- D. 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 nonbraced panel area unless ducts are lined.

## 2.7 APPLICATION OF LINER IN RECTANGULAR DUCTS (DOUBLE WALL DUCTS ONLY)

- A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
- B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
- E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.
- F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
- G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
- H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
  - 1. Fan discharges.
  - 2. Intervals of lined duct preceding unlined duct.
  - 3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.
- I. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell and mylar. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
  - 1. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
- J. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.



## **PART 3 - EXECUTION**

### **3.1 DUCT APPLICATIONS**

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
  - 1. Supply Ducts (before Air Terminal Units): 10-inch wg.
  - 2. Supply Ducts (after Air Terminal Units): 2-inch wg.
  - 3. Return Ducts (Negative Pressure): 2-inch wg.
  - 4. Exhaust Ducts (Negative Pressure): 2-inch wg.
- B. All ducts shall be galvanized steel.

### **3.2 DUCT INSTALLATION**

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install ducts with fewest possible joints.
- C. Install fabricated fittings for changes in directions, size, and shape and for connections.
- D. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- E. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- I. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- J. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- K. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- L. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

- M. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories."
- N. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."
- O. Paint interiors of metal ducts, that do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

### 3.3 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
  - 1. For pressure classes lower than 2-inch wg, seal transverse joints.
- B. Seal ducts before external insulation is applied.

### 3.4 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet and at each floor.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- D. Install concrete inserts before placing concrete.
- E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors.
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes 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.
3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg.
4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

**END OF SECTION 15815**

## **SECTION 15820 - 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. Volume dampers.
  - 3. Motorized control dampers.
  - 4. Turning vanes.
  - 5. Duct-mounting access doors.
  - 6. Flexible connectors.
  - 7. Flexible ducts.
  - 8. Duct accessory hardware.

#### **1.3 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Backdraft dampers.
  - 2. Volume dampers.
  - 3. Motorized control dampers.
  - 4. Turning vanes.
  - 5. Duct-mounting access doors.
  - 6. Flexible connectors.
  - 7. Flexible ducts.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Special fittings.
  - 2. Manual-volume damper installations.
  - 3. Motorized-control damper installations.
  - 4. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

#### 1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

#### 1.5 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

### **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 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 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Stainless Steel: ASTM A 480/A 480M.
- D. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

#### 2.3 BACKDRAFT DAMPERS

- A. Manufacturers:
  - 1. Air Balance, Inc.

2. American Warming and Ventilating.
  3. CESCO Products.
  4. Duro Dyne Corp.
  5. Greenheck.
  6. Penn Ventilation Company, Inc.
  7. Prefco Products, Inc.
  8. Ruskin Company.
  9. Vent Products Company, Inc.
- B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.
- C. Frame: 0.063-inch- thick extruded aluminum, with welded corners and mounting flange.
- D. Blades: 0.025-inch- thick, roll-formed aluminum.
- E. Blade Seals: Neoprene.
- F. Blade Axles: Galvanized steel.
- G. Tie Bars and Brackets: Aluminum.
- H. Return Spring: Adjustable tension.

## 2.4 VOLUME DAMPERS

- A. Manufacturers:
1. Air Balance, Inc.
  2. American Warming and Ventilating.
  3. Flexmaster U.S.A., Inc.
  4. McGill AirFlow Corporation.
  5. METALAIR, Inc.
  6. Nailor Industries Inc.
  7. Penn Ventilation Company, Inc.
  8. Ruskin Company.
  9. Vent Products Company, Inc.
- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
1. Pressure Classes 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.
- C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
  2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
  3. 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.
  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. Bearings: Stainless-steel sleeve.
  8. Tie Bars and Brackets: Aluminum.
  9. Tie Bars and Brackets: Galvanized steel.
- D. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
1. Steel Frames: Angle-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
  2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
  3. Aluminum Frames: U-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.
  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. Bearings: Stainless-steel sleeve thrust or ball.
  8. Blade Seals: Neoprene.
  9. Jamb Seals: Cambered aluminum.
  10. Tie Bars and Brackets: Galvanized steel.
- E. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- F. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

## 2.5 MOTORIZED CONTROL DAMPERS

- A. Manufacturers:
1. Air Balance, Inc.
  2. American Warming and Ventilating.
  3. CESCO Products.
  4. Duro Dyne Corp.
  5. Greenheck.
  6. McGill AirFlow Corporation.
  7. METALAIR, Inc.

8. Nailor Industries Inc.
9. Penn Ventilation Company, Inc.
10. Ruskin Company.
11. Vent Products Company, Inc.

- B. General Description: AMCA-rated, opposed-blade design; minimum of 0.1084-inch- thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch- thick, galvanized-steel damper blades with maximum blade width of 8 inches.
1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
  2. Operating Temperature Range: From minus 40 to plus 200 deg F.
  3. Provide opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is being held by torque of 50 in. x lbf; when tested according to AMCA 500D.

## 2.6 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
- B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.
1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Duro Dyne Corp.
    - c. METALAIRE, Inc.
    - d. Ward Industries, Inc.
- C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

## 2.7 DUCT-MOUNTING ACCESS DOORS

- A. General Description: Fabricate doors airtight and suitable for duct pressure class.
- B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.
1. Manufacturers:
    - a. American Warming and Ventilating.
    - b. CESCO Products.
    - c. Ductmate Industries, Inc.
    - d. Flexmaster U.S.A., Inc.
    - e. Greenheck.



- f. McGill AirFlow Corporation.
  - g. Nailor Industries Inc.
  - h. Ventfabrics, Inc.
  - i. Ward Industries, Inc.
- 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
- 3. Provide number of hinges and locks as follows:
  - a. Less Than 12 Inches Square: Secure with two sash locks.
  - b. Up to 18 Inches Square: Two hinges and two sash locks.
  - c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside.
  - d. Sizes 24 by 48 Inches and Larger: One additional hinge.
- C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Flexmaster U.S.A., Inc.
  - 2. Frame: Galvanized sheet steel, with spin-in notched frame.
- D. Pressure Relief Access Door: Double wall and duct mounting; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated, latches, and retaining chain.
  - 1. Manufacturers:
    - a. American Warming and Ventilating.
    - b. CESCO Products.
    - c. Ductmate Industries, Inc.
    - d. Greenheck.
    - e. KEES, Inc.
    - f. McGill AirFlow Corporation.
    - g. Nexus PDQ.
  - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
- E. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- F. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

## 2.8 FLEXIBLE CONNECTORS

- A. Manufacturers:
  - 1. Ductmate Industries, Inc.
  - 2. Duro Dyne Corp.
  - 3. Ventfabrics, Inc.
  - 4. Ward Industries, Inc.
- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 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- thick aluminum sheets. Select metal compatible with ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd..
  - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F.
- E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
  - 1. Minimum Weight: 24 oz./sq. yd..
  - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
  - 3. Service Temperature: Minus 50 to plus 250 deg F.

## 2.9 FLEXIBLE DUCTS

- A. Manufacturers:
  - 1. Flexmaster U.S.A., Inc.
  - 2. Hart & Cooley, Inc.
  - 3. McGill AirFlow Corporation.
- B. Noninsulated-Duct Connectors: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
  - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 10 to plus 160 deg F.
- C. Noninsulated-Duct Connectors: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.
  - 1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 20 to plus 175 deg F.
- D. Noninsulated-Duct Connectors: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.
  - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 20 to plus 210 deg F.
- E. Noninsulated-Duct Connectors: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire.
  - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 20 to plus 210 deg F.
- F. Noninsulated-Duct Connectors: UL 181, Class 0, interlocking spiral of aluminum foil.

1. Pressure Rating: 8-inch wg positive or negative.
  2. Maximum Air Velocity: 5000 fpm.
  3. Temperature Range: Minus 100 to plus 435 deg F.
- G. Insulated-Duct Connectors: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor barrier film.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  2. Maximum Air Velocity: 4000 fpm.
  3. Temperature Range: Minus 10 to plus 160 deg F.
- H. Insulated-Duct Connectors: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor barrier film.
1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
  2. Maximum Air Velocity: 4000 fpm.
  3. Temperature Range: Minus 20 to plus 175 deg F.
- I. Insulated-Duct Connectors: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor barrier film.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  2. Maximum Air Velocity: 4000 fpm.
  3. Temperature Range: Minus 20 to plus 210 deg F.
- J. Insulated-Duct Connectors: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor barrier film.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  2. Maximum Air Velocity: 4000 fpm.
  3. Temperature Range: Minus 20 to plus 210 deg F.
- K. Insulated-Duct Connectors: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; aluminized vapor barrier film.
1. Pressure Rating: 8-inch wg positive or negative.
  2. Maximum Air Velocity: 5000 fpm.
  3. Temperature Range: Minus 20 to plus 250 deg F.
- L. Flexible Duct Clamps: Nylon strap, in sizes 3 through 18 inches to suit duct size.

## 2.10 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## PART 3 - EXECUTION

### 3.1 APPLICATION AND INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.
- E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.
- F. Provide test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:
  - 1. On both sides of duct coils.
  - 2. Downstream from volume dampers and equipment.
  - 3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
  - 4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
  - 5. On sides of ducts where adequate clearance is available.
- H. Install the following sizes for duct-mounting, rectangular access doors:
  - 1. One-Hand or Inspection Access: 8 by 5 inches.
  - 2. Two-Hand Access: 12 by 6 inches.
  - 3. Head and Hand Access: 18 by 10 inches.
  - 4. Head and Shoulders Access: 21 by 14 inches.
  - 5. Body Access: 25 by 14 inches.
  - 6. Body Plus Ladder Access: 25 by 17 inches.
- I. Install the following sizes for duct-mounting, round access doors:
  - 1. One-Hand or Inspection Access: 8 inches in diameter.
  - 2. Two-Hand Access: 10 inches in diameter.
  - 3. Head and Hand Access: 12 inches in diameter.
  - 4. Head and Shoulders Access: 18 inches in diameter.
  - 5. Body Access: 24 inches in diameter.
- J. Install the following sizes for duct-mounting, pressure relief access doors:
  - 1. One-Hand or Inspection Access: 7 inches in diameter.
  - 2. Two-Hand Access: 10 inches in diameter.

- 3. Head and Hand Access: 13 inches in diameter.
- 4. Head and Shoulders Access: 19 inches in diameter.

- K. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
- L. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- M. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- N. Connect diffusers to low pressure ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- O. Connect flexible ducts to metal ducts with draw bands.
- P. Install duct test holes where indicated and required for testing and balancing purposes.

### 3.2 ADJUSTING

- A. Adjust duct accessories for proper settings.

**END OF SECTION 15820**

## **SECTION 15838 - 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. Centrifugal Fans.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- 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 thickness and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Roof curbs.
  - 7. Fan speed controllers.
- 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.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

## 1.5 QUALITY ASSURANCE

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

# PART 2 - PRODUCTS

## 2.1 CENTRIFUGAL FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Acme Engineering & Mfg. Corp.
  - 2. Greenheck.
  - 3. Loren Cook Company.
- B. Description: Direct-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
- C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. 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.
5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

G. Capacities as scheduled on plans.

## 2.2 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. Support units using elastomeric mounts having a static deflection of 1 inch.
- C. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch.
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Division 15 Section "Mechanical Identification."

### 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 according to Division 16 Section "Grounding and Bonding."
- D. Connect wiring according to Division 16 Section "Conductors and Cables."



### 3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 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. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.
  - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 10. Shut unit down and reconnect automatic temperature-control operators.
  - 11. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- C. Lubricate bearings.

**END OF SECTION 15838**

## **SECTION 15855 - 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 wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
  - 1. Division 15 Section "Duct Accessories" for fire dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### **1.3 SUBMITTALS**

- A. Product Data: For each product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Duct access panels.

### **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.

## 2.2 GRILLES AND REGISTERS

- A. As scheduled.
- B. Fixed Face Grille:
  - 1. Manufacturers:
    - a. Krueger.
    - b. Price Industries.
    - c. Titus.
    - d. Tuttle & Bailey.
  - 2. Material: Aluminum, except in the case of integral fire damper, in which case steel.
  - 3. Finish: Baked enamel, white.
  - 4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
  - 5. Frame: 1-1/4 inches wide.
  - 6. Mounting: Lay in.

## 2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

## 3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

# END OF SECTION 15855

## **SECTION 15950 - 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 TAB to produce design objectives for the following:
  - 1. Air Systems.
  - 2. Hydronic Piping Systems.
  - 3. HVAC equipment quantitative-performance settings.
  - 4. Verifying that automatic control devices are functioning properly.
  - 5. Reporting results of activities and procedures specified in this Section.

#### **1.3 DEFINITIONS**

- A. Adjust: To regulate fluid flow rate and air 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 indicated quantities.
- C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- D. 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.
- E. NC: Noise criteria.
- F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- G. RC: Room criteria.
- H. Report Forms: Test data sheets for recording test data in logical order.
- I. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- J. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

- K. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- L. 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.
- M. TAB: Testing, adjusting, and balancing.
- N. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- O. Test: A procedure to determine quantitative performance of systems or equipment.
- P. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

#### 1.4 SUBMITTALS

- A. Qualification Data: Within 45 days from Contractor's Notice to Proceed, submit 6 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 45 days from Contractor's Notice to Proceed, submit 6 copies of the Contract Documents review report as specified in Part 3.
- C. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- D. Warranties specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by NEBB.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems." Or TAB firm's forms approved by Architect.
- D. 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."
- E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

## 1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## 1.7 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

## 1.8 WARRANTY

- A. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
  1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
  2. Systems are balanced to optimum performance capabilities within design and installation limits.

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

## **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
  1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
  2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine strainers for clean screens and proper perforations.
- L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- M. Examine system pumps to ensure absence of entrained air in the suction piping.
- N. Examine equipment for installation and for properly operating safety interlocks and controls.
- O. Examine automatic temperature system components to verify the following:
  - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
  - 2. Dampers and valves are in the position indicated by the controller.
  - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
  - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
  - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.

6. Sensors are located to sense only the intended conditions.
  7. Sequence of operation for control modes is according to the Contract Documents.
  8. Controller set points are set at indicated values.
  9. Interlocked systems are operating.
  10. Changeover from heating to cooling mode occurs according to indicated values.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Complete system readiness checks and prepare system readiness reports. Verify the following:
1. Permanent electrical power wiring is complete.
  2. Hydronic systems are filled, clean, and free of air.
  3. Automatic temperature-control systems are operational.
  4. Equipment and duct access doors are securely closed.
  5. Balance and fire dampers are open.
  6. Isolating and balancing valves are open and control valves are operational.
  7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  8. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. For variable-air-volume systems, develop a plan to simulate diversity.
- C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.



- D. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- 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. Check for proper sealing of air duct system.

### 3.5 PROCEDURES FOR VARIABLE-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure fan static pressures to determine actual static pressure as follows:
    - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  - 2. Measure static pressure across each component that makes up an air-handling unit, and other air-handling and -treating equipment.
    - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
  - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
  - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
  - 5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
  - 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
  - 1. Measure 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 submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  - 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
  - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
  - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### 3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
  - 1. Open all manual valves for maximum flow.
  - 2. Check expansion tank liquid level.
  - 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
  - 4. Check flow-control valves for specified sequence of operation and set at indicated flow.
  - 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
  - 6. Set system controls so automatic valves are wide open to heat exchangers.
  - 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
  - 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

### 3.7 PROCEDURES FOR HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
  2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
  3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  4. Report flow rates that are not within plus or minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
1. Determine the balancing station with the highest percentage over indicated flow.
  2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
  3. Record settings and mark balancing devices.
- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

### 3.8 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer, model, and serial numbers.
  2. Motor horsepower rating.
  3. Motor rpm.
  4. Efficiency rating.
  5. Nameplate and measured voltage, each phase.
  6. Nameplate and measured amperage, each phase.
  7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

### 3.9 PROCEDURES FOR CHILLERS

- A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
  - 1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
  - 2. If water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
  - 3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
  - 4. Power factor if factory-installed instrumentation is furnished for measuring kilowatt.
  - 5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatt.
  - 6. Capacity: Calculate in tons of cooling.
  - 7. If air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

### 3.10 PROCEDURES FOR BOILERS

- A. If hydronic, measure entering- and leaving-water temperatures and water flow.

### 3.11 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

### 3.12 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.

- H. Check the interaction of interlock and lockout systems.
- I. Check main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

### 3.13 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:

- 1. Equipment with Fans: Plus 5 to plus 10 percent.
- 2. Air Outlets and Inlets: 0 to minus 10 percent.
- 3. Heating-Water Flow Rate: 0 to minus 10 percent.
- 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

### 3.14 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
  - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
  - 1. Pump curves.
  - 2. Fan curves.
  - 3. Manufacturers' test data.
  - 4. Field test reports prepared by system and equipment installers.
  - 5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
  - 1. Title page.
  - 2. Name and address of TAB firm.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB firm who certifies the report.
  - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 11. Summary of contents including the following:

- a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 12. Nomenclature sheets for each item of equipment.
  - 13. Data for terminal units, including manufacturer, type size, and fittings.
  - 14. Notes to explain why certain final data in the body of reports varies from indicated values.
  - 15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outside-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Fan drive settings including settings and percentage of maximum pitch diameter.
    - e. Inlet vane settings for variable-air-volume systems.
    - f. Settings for supply-air, static-pressure controller.
    - g. Other system operating conditions that affect performance.
- E. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
- 1. Unit Data: Include the following:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches (mm), and bore.
    - i. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
    - j. Number of belts, make, and size.
    - k. Number of filters, type, and size.
  - 2. Motor Data:
    - 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 (mm), and bore.
    - f. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
  - 3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm (L/s).
    - b. Total system static pressure in inches wg (Pa).
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg (Pa).
    - e. Cooling coil static-pressure differential in inches wg (Pa).
    - f. Heating coil static-pressure differential in inches wg (Pa).
    - g. Outside airflow in cfm (L/s).
    - h. Return airflow in cfm (L/s).
    - i. Outside-air damper position.
    - j. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Make and model number.
- e. Face area in sq. ft. (sq. m).
- f. Tube size in NPS (DN).
- g. Tube and fin materials.
- h. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm (L/s).
- b. Average face velocity in fpm (m/s).
- c. Air pressure drop in inches wg (Pa).
- d. Outside-air, wet- and dry-bulb temperatures in deg F (deg C).
- e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
- f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
- g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
- h. Water flow rate in gpm (L/s).
- i. Water pressure differential in feet of head or psig (kPa).
- j. Entering-water temperature in deg F (deg C).
- k. Leaving-water temperature in deg F (deg C).

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in inches (mm), and bore.
- h. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).

2. Motor Data:

- 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 (mm), and bore.
- f. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
- g. Number of belts, make, and size.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm (L/s).
- b. Total system static pressure in inches wg (Pa).
- c. Fan rpm.

- d. Discharge static pressure in inches wg (Pa).
- e. Suction static pressure in inches wg (Pa).

H. Air-Terminal-Device Reports:

- 1. Unit Data:
  - a. System and air-handling unit identification.
  - b. Location and zone.
  - c. Test apparatus used.
  - d. Area served.
  - e. Air-terminal-device number from system diagram.
  - f. Air-terminal-device size.
- 2. Test Data (Indicated and Actual Values):
  - a. Airflow rate in cfm (L/s).
  - b. Preliminary airflow rate as needed in cfm (L/s).
  - c. Final airflow rate in cfm (L/s).
  - d. Space temperature in deg F (deg C).

I. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

- 1. Unit Data:
  - a. System and air-handling unit identification.
  - b. Location and zone.
  - c. Room or riser served.
  - d. Coil make and size.
  - e. Flowmeter type.
- 2. Test Data (Indicated and Actual Values):
  - a. Airflow rate in cfm (L/s).
  - b. Entering-water temperature in deg F (deg C).
  - c. Leaving-water temperature in deg F (deg C).
  - d. Water pressure drop in feet of head or psig (kPa).
  - e. Entering-air temperature in deg F (deg C).
  - f. Leaving-air temperature in deg F (deg C).

J. Packaged Chiller Reports:

- 1. Unit Data:
  - a. Unit identification.
  - b. Make and model number.
  - c. Manufacturer's serial number.
  - d. Refrigerant type and capacity in gal. (L).
  - e. Starter type and size.
  - f. Starter thermal protection size.
  - g. Compressor make and model number.
  - h. Compressor manufacturer's serial number.
- 2. Evaporator Test Reports (Indicated and Actual Values):



- a. Refrigerant pressure in psig (kPa).
  - b. Refrigerant temperature in deg F (deg C).
  - c. Entering-water temperature in deg F (deg C).
  - d. Leaving-water temperature in deg F (deg C).
  - e. Entering-water pressure in feet of head or psig (kPa).
  - f. Water pressure differential in feet of head or psig (kPa).
3. Compressor Test Data (Indicated and Actual Values):
- a. Suction pressure in psig (kPa).
  - b. Suction temperature in deg F (deg C).
  - c. Discharge pressure in psig (kPa).
  - d. Discharge temperature in deg F (deg C).
  - e. Oil pressure in psig (kPa).
  - f. Oil temperature in deg F (deg C).
  - g. Voltage at each connection.
  - h. Amperage for each phase.
  - i. Kilowatt input.
  - j. Crankcase heater kilowatt.
  - k. Chilled-water control set point in deg F (deg C).
  - l. Condenser-water control set point in deg F (deg C).
  - m. Refrigerant low-pressure-cutoff set point in psig (kPa).
  - n. Refrigerant high-pressure-cutoff set point in psig (kPa).
4. Refrigerant Test Data (Indicated and Actual Values):
- a. Oil level.
  - b. Refrigerant level.
  - c. Relief valve setting in psig (kPa).
  - d. Unloader set points in psig (kPa).
  - e. Percentage of cylinders unloaded.
  - f. Bearing temperatures in deg F (deg C).
  - g. Vane position.
  - h. Low-temperature-cutoff set point in deg F (deg C).
- K. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
- a. Unit identification.
  - b. Location.
  - c. Service.
  - d. Make and size.
  - e. Model and serial numbers.
  - f. Water flow rate in gpm (L/s).
  - g. Water pressure differential in feet of head or psig (kPa).
  - h. Required net positive suction head in feet of head or psig (kPa).
  - i. Pump rpm.
  - j. Impeller diameter in inches (mm).
  - k. Motor make and frame size.
  - l. Motor horsepower and rpm.
  - m. Voltage at each connection.
  - n. Amperage for each phase.
  - o. Full-load amperage and service factor.
  - p. Seal type.

2. Test Data (Indicated and Actual Values):
  - a. Static head in feet of head or psig (kPa).
  - b. Pump shutoff pressure in feet of head or psig (kPa).
  - c. Actual impeller size in inches (mm).
  - d. Full-open flow rate in gpm (L/s).
  - e. Full-open pressure in feet of head or psig (kPa).
  - f. Final discharge pressure in feet of head or psig (kPa).
  - g. Final suction pressure in feet of head or psig (kPa).
  - h. Final total pressure in feet of head or psig (kPa).
  - i. Final water flow rate in gpm (L/s).
  - j. Voltage at each connection.
  - k. Amperage for each phase.

L. Boiler Test Reports:

1. Unit Data:
  - a. Unit identification.
  - b. Location.
  - c. Service.
  - d. Make and type.
  - e. Model and serial numbers.
  - f. Fuel type and input in Btuh (kW).
  - g. Number of passes.
  - h. Ignition type.
  - i. Burner-control types.
  - j. Voltage at each connection.
  - k. Amperage for each phase.
2. Test Data (Indicated and Actual Values):
  - a. Operating pressure in psig (kPa).
  - b. Operating temperature in deg F (deg C).
  - c. Entering-water temperature in deg F (deg C).
  - d. Leaving-water temperature in deg F (deg C).
  - e. Number of safety valves and sizes in NPS (DN).
  - f. Safety valve settings in psig (kPa).
  - g. High-limit setting in psig (kPa).
  - h. Operating-control setting.
  - i. High-fire set point.
  - j. Low-fire set point.
  - k. Voltage at each connection.
  - l. Amperage for each phase.
  - m. Draft fan voltage at each connection.
  - n. Draft fan amperage for each phase.
  - o. Manifold pressure in psig (kPa).

M. Instrument Calibration Reports:

1. Report Data:
  - a. Instrument type and make.
  - b. Serial number.
  - c. Application.

- d. Dates of use.
- e. Dates of calibration.

### 3.15 INSPECTIONS

#### A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:
  - a. Measure airflow of at least 10 percent of air outlets.
  - b. Measure water flow of at least 5 percent of terminals.
  - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
  - d. Measure sound levels at two locations.
  - e. Measure space pressure of at least 10 percent of locations.
  - f. Verify that balancing devices are marked with final balance position.
  - g. Note deviations to the Contract Documents in the Final Report.

#### B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

### 3.16 ADDITIONAL TESTS

- #### A.
- Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

## END OF SECTION 15950

## SECTION 16010 - GENERAL PROVISIONS

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. The electrical portion of this project includes all labor, materials, equipment, etc., required to provide the complete electrical work to fulfill the intent of the Contract Documents.

#### 1.2 RELATED DOCUMENTS

- A. All applicable provisions of Division 0 and 1 govern work under this division. Refer to these articles in the specifications for additional information.
- B. All work shall be in compliance with the currently enforced edition of the applicable state, national, and local ordinance and building codes, UFC's, and the National Electric Code. No additional compensation shall be granted for work which must be changed as a result of the work not originally complying with the codes and standards. etc.
- C. Refer to each section for additional applicable codes and reference standards.

#### 1.3 SUBMITTALS

- A. Submittals shall be provided for all items indicated. Product data shall be from published manufacturer's data. Data shall include enough information so that the Engineer can verify compliance with codes, standards, and the contract documents. Submittal shall not contain data that is not relevant to the equipment being submitted. The data shall be highlighted by arrows, underlining, etc. Broad, general data, is not acceptable. Data shall be presented at one time, in a neatly bound and organized manner.
- B. The contractor shall provide and maintain at the site a set of prints which accurately represent the actual installation of all work under this Division. Any changes in sizes, locations, dimensions, etc. shall be shown. Changes in circuitry shall be clearly and completely indicated as the work progresses.
- C. At the completion of the Project, a set of marked-up drawings, including DIMENSIONED, location of all underground conduit shall be provided to the owner. Drawing shall be submitted in AutoCad 2004 format.

#### 1.4 OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS

- A. Operating and Maintenance Data includes printed information, such as manufacturer's installation instructions, manufacturer's service manuals, manufacturer's lubrication charts, standard wiring diagrams, and a parts list including the price of each item.
- B. Mark each copy to show applicable choices and options. Where printed Operating and Maintenance Data includes information on several products that are not required, mark copies to indicate the applicable information.
- C. Do not submit Operating and Maintenance Data until compliance with requirements of the Contract

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Documents has been confirmed.

- D. Submittals: Submit 3 copies of each required submittal. The Engineer will return the copies marked with action taken and corrections or modifications required. Unless resubmittal is requested, the submittal may serve as the final submittal.

#### 1.5 PRIOR APPROVAL

- A. The contractor shall submit a list of proposed substitutions to the Engineer. All proposed substitutions shall be in writing to the Engineer, at least, ten (10) calendar days prior to bid opening. The submittal will list the proposed substitutions from published manufacturer's data, which cover the applicable features of the submitted equipment. Any approvals shall be issued in writing.

#### 1.6 GUARANTEE

- A. The contractor shall fully guarantee the installation against defects in materials and workmanship which may occur under normal usage for a period of one year after owner's acceptance. Defects shall be promptly remedied at no cost to the owner. This guarantee is in addition to, and not a limit to, any other guarantees or warranties.

#### 1.7 DEFINITIONS. The following words and phases are defined:

- A. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.
- B. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect/Engineer, requested by the Architect/Engineer, and similar phrases.
- C. "Approved": The term "approved," when used in conjunction with the Architect's/Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Architect's/Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- D. "Regulations": 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" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- F. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, 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. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform

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- I. "Project site" is the space available to the Contractor for performing 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 on which the Project is to be built.
- J. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

#### 1.8 INSPECTION OF THE SITE

- A. The drawings are prepared from the most accurate information available. However, the contractor shall, prior to placing any bids, visit the site to verify existing conditions, proposed conduit routings, etc.
- B. All proposals shall take these existing conditions and any speculated revisions needed into account. The contractor shall be fully responsible for his bid regardless of any additional site information which may be uncovered after a contract is signed.

#### 1.9 CONSTRUCTION SAFETY

- A. The plans and specifications do not include items necessary for the contractor to insure the safety of his personnel on the project construction site. Construction site safety for the project is the responsibility of the contractor. Reference other sections of these specifications for any additional information.

#### 1.10 DAMAGE

- A. The contractor shall be held accountable to repair, at no additional cost, any damage to existing wiring, piping, or other materials and equipment intended to remain.

#### 1.11 DRAWINGS AND SPECIFICATIONS

- A. Should be considered as complimentary to each other. What is required by one shall be binding as if required by both. If conflicts between plans and specifications are found, the Engineer shall be contacted to secure clarification, prior to bidding. The contractor shall verify all dimensions and existing conditions.

#### 1.12 MANUFACTURER'S DRAWINGS AND DATA

- A. Submit Shop Drawings for approval, for all items indicated below.
  - 1. Lighting Fixtures
  - 2. Wiring Devices
  - 3. Disconnect Switches
  - 4. Panelboards
  - 5. Fire Alarm & Mass Notification System Equipment
- B. Provide O&M Manuals i.a.w, Paragraph 1.5, for all items indicated below.

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1. Panelboards
2. Disconnect Switches
3. Fire Alarm & Mass Notification System Equipment

## PART 2 - EXECUTION

### 2.1 WORKMANSHIP

- A. All work shall be done in a professional and complete manner by experienced craftsmen. Unsatisfactory workmanship shall be duly noted and corrected at the contractors expense.
- B. Only new materials shall be used, unless otherwise indicated on plan or prior approved.

### 2.2 MANUFACTURER'S INSTALLATION INSTRUCTIONS

- A. All equipment shall be installed in accordance with manufacturer's installation instructions.

### 2.3 PROTECTION OF EQUIPMENT

- A. The contractor shall provide protection of stored material and installed equipment against dirt, rust, moisture, and abuse from other trades. Where tarps or other cover is used, provide air circulation to prevent condensate build up. No materials or equipment shall be stored directly on the ground.

### 2.4 CONFLICTS, INTERFERENCES AND COORDINATION BETWEEN TRADES

- A. Coordinate work so as to conform with the progress of the work of others. The drawings are only intended to indicate the extent, general location and arrangement, of conduit systems and equipment. Any questions regarding the information given on the plans shall be directed to the Engineer for clarification. The contractor shall refer to other sections of the specifications and other drawings such as structural, mechanical, etc., in order to eliminate conflicts when laying out his work. The contractor shall be responsible for the proper coordination of the electrical work with the installations under other Divisions for clearances, etc. Any changes required to avoid interferences shall be submitted to the Architect for approval and shall be made, as approved, without additional cost.
- B. Code requirements shall have precedence over plans or specifications in the event of a conflict. If a discrepancy or conflict exists between specifications and drawings, drawings shall take precedence over specifications except as pertaining to quality. Manufacturer's installation instructions shall govern the installation of all equipment.
- C. Control wiring, schematics, or logic shown on plan is only intended to show the general intent. Such plans are not to be considered "shop drawings". The contractor is responsible for determining and coordinating the detailed requirements, including but not limited to wiring, to interface systems and provide a fully functional system which follows the intent.
- D. The contractor shall coordinate with equipment suppliers for any requirements specific to the equipment provided which may not be shown on the plans or given in the specifications. The contractor shall include the provision and installation of such requirements in his bid. The contractor shall coordinate with equipment suppliers, prior to bid, to determine what ancillary equipment is or is

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not provided with the equipment, such as lugs, terminal blocks, etc.

- E. Equipment requiring set grades or elevations and piping has precedence over conduit, boxes, etc. as to location.
- F. The contractor shall coordinate with other equipment providers to insure correct operation of the equipment, such as, phase rotation, interlocking, accessibility, etc.
- G. Temperature control systems for HVAC systems including controls, relays, time clocks, wiring and devices will be furnished and wired under Division 15.
- H. The contractor shall examine the Architectural plans for the location of suitable openings and aisles for the passage of equipment to be installed under this Division. The contractor shall be responsible for having suitable openings and aisles left open until his equipment has been properly installed.
- I. Except as otherwise noted, it shall be understood that the indication and/or description of any item, in the drawings or specifications, or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
- J. It shall be understood that the plans are not intended to indicate exact raceway routings. Determination as to the routing shall be made in consideration of structural conditions and interferences with other trades or by terminal locations on apparatus.
- K. The right is reserved to make reasonable changes in locations of equipment indicated in Drawings prior to installation without an increase in the contract cost.
- L. The drawings and specifications do not undertake to indicate every item required to produce a complete and properly operating installation. Material, equipment or labor not indicated, but which can be reasonably inferred to be necessary for a complete installation shall be provided.

## 2.5 CUTTING AND PATCHING

- A. Every effort shall be made to build-in the work as the job progresses. As required, cutting and patching for the installation of sleeves, conduits, equipment, etc., shall be coordinated with the General Contractor. Do not cut any structural element without written permission from the Structural Engineer.

## 2.6 EQUIPMENT CONNECTIONS

- A. The contractor shall make final connection of all required services to all equipment items furnished, including that provided by others or by the owner. Equipment shall be left in a ready to operate state.

## 2.7 FLASHING AND WATERPROOFING

- A. Any building penetrations to outside shall be flashed, as required, to prevent leaks.

END OF SECTION 16010





## SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Work of this section includes specification of the following:

Wire and connectors.  
Electrical identification.  
Firestopping  
Demolition  
Cutting and patching for electrical construction.  
Touchup painting.

#### 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.

- B. Referenced standards include:

NFPA 70 – National Electric Code  
OSHA 1910 - Standards for General Industry  
UFC 3-501-01 Electrical Engineering  
UFC 3-520-01 Interior Electrical Systems  
UFC 3-530-01 Design: Interior and Exterior Lighting and Controls

#### 1.3 QUALITY ASSURANCE

- A. Provide electrical components, devices, and accessories specified in this section that are listed and labeled as defined in NFPA 70, Article 100.
- B. As defined in OSHA Regulation 1910.7, the Listing and Labeling Agency shall be a “Nationally Recognized Testing Laboratory”.
- C. The materials and methods used for all electrical components, devices, and accessories specified in this section shall comply with NFPA 70.

#### 1.4 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.

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- C. Coordinate electrical service connections.
  - 1. Coordinate installation and connection of exterior underground utilities and services, including provision for electricity-metering components.
  - 2. Comply with requirements of BAFB electrical shop.
- D. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- E. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.
- F. Verify characteristics, sizes, and ratings, of motors actually supplied prior to providing starter, overload protection and branch circuit wiring.

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS

- A. Acceptable 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. Wire/Cable
    - a. Anaconda
    - b. American Wire and Cable
    - c. Southwire
    - d. Okonite Company
  - 2. Wire/Cable Connectors
    - Split-Bolt Connectors
      - a. Appleton
      - b. Crouse-Hinds
      - c. Teledyne
    - Solderless Pressure Connectors
      - a. Burndy
      - b. Thomas and Betts
      - c. AMP
    - Spring Wire Connectors
      - a. Burndy
      - b. Thomas and Betts
      - c. Teledyne
    - Compression Connectors
      - a. Burndy
      - b. Crouse-Hinds
      - c. Teledyne
- B. All wire sizes specified shall be i.a.w. American Wire Gauge (AWG) designations.
- C. Conductors, No. 14 awg and smaller shall be solid or stranded copper. #12 awg and larger shall be stranded copper. Copper clad conductors are not permitted.

- D. Conductors shall be copper with not less than 95% conductivity.
- E. Insulation for power conductors shall be type THW or THHN, rated 600 volts, rated 75 deg. C minimum. Conductor insulation for feeders size 1/0 and larger may be type RHW moisture and heat resistant rubber. Conductor insulation shall have the manufacturers name, type insulation and conductor size imprinted on the jacket at regular intervals. Branch circuit conductors sizes #6 awg and smaller may be type TW. For conductors wired in fluorescent light fixture cable runs use type RHH or THHN insulation rated 90 deg. C.
- F. Conductor phasing shall be as follows. From left to right, the first bus in each panel shall be Phase "A", middle bus "B", and right bus "C".
- G. Insulation shall be color coded as required by NFPA 70, 210-5. Color coding shall be consistent throughout the project. Use white conductors only for circuit neutrals. When unable to provide a white conductor, the neutral shall be identified at switches, panelboards, junction boxes, etc. with white tape or paint. Equipment grounds shall be green. Isolated equipment grounds shall be green with yellow stripe.
- H. All materials used for wire connections and splices shall be of the size, ampacity, material type, and class suitable for the service.
- I. Provide wire and cable terminations made with UL-listed one-piece, compression deforming type, solderless high conductivity copper or copper alloy terminal lugs as follows:
  - 1. Terminal lugs shall have hole sizes and spacing i.a.w. NEMA standards.
  - 2. Terminal lugs on wire sizes 3/0 and smaller shall be single hole, single compression type. Wire and cable No. 6 awg and smaller may be terminated on mechanical type connections or terminal strips integral with the equipment or wiring device. The mechanical connector and terminal strip shall be UL-listed copper, either tubular type with a pressure plate or screw type with a wire clamp. The screw shall not directly compress the conductors.
  - 3. Terminal lugs for use on wire sizes 4/0 and larger shall be two-hole, long barrel, double compression type.
- J. In general, there shall be no splices from the power source to the load without written approval from the Engineer. If written approval is given, provide splices and taps which are made with solderless copper compression deforming connectors and which bear the UL label. All splices and taps shall be made in accordance with the manufacturer's written instructions. Any direct buried splices shall be protected with resin splice kit.
  - 1. A solid barrel crimped connector shall be used for splices and taps on wire sizes No. 8 AWG and smaller.
  - 2. A solid barrel compression connector or bolting solid barrel terminal lugs shall be used for splices and taps on wire sizes No. 6 AWG and larger.
- K. Connection to motors, solenoids and other devices with integral leads sized No. 4 AWG and smaller (including all current transformers) shall be made with ring-type pressure connectors. Provide connectors bolted together and taped with oil-resistant electrical tape. Soldered or insulation piercing type connectors shall not be used. No connection shall be inside a conduit fitting.

## 2.2 ELECTRICAL IDENTIFICATION

- A. Underground warning tape shall be a permanent, bright-colored, continuous-printed, vinyl tape with the following features:

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1. Not less than 6 inches wide by 4 mils thick.
  2. Compounded for permanent direct-burial service.
  3. Embedded continuous metallic strip or core.
- B. Wire markers shall be a vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- C. Engraved-Plastic labels, signs, and instruction plates shall be a melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.
- D. Nameplates and signs fasteners shall be self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.
- E. Transformers and panelboards shall be provided with appropriate arc flash and high voltage labels.

### 2.3 TOUCHUP PAINT

- A. Equipment touch-up paint shall be selected to match the installed equipment finish. For galvanized surfaces, a zinc-rich paint recommended by the equipment manufacturer shall be used.

## PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Materials and components shall be installed level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required. Wire and cable routing indicated on the Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.
- D. Branch circuit wiring is generally sized not to exceed a two-percent voltage drop, but in no case shall exceed a three-percent voltage drop.

### 3.2 WIRING INSTALLATION

- A. Install wiring in a conduit raceway with conductors of the types and sizes as shown on the drawings and specified in these specifications. Where no type or size is given install conductors as required by code.
- B. From panels extend a complete system of wiring to all fixtures, motors, devices, and other equipment. Employ multi-wire circuits as indicated. Connect circuits to panelboards to give an evenly balanced load. Secure approval for any departure from the circuit arrangement as shown.
- C. Numerals shown on the drawing "home-runs" indicate the circuit arrangement. Cross marks on branch circuit runs indicate the number of conductors required. Where no cross marks are shown, two conductors are indicated.

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- D. All home runs shall be 12 (twelve) awg or larger as indicated. Provide 10 (ten) awg where home runs exceed 60 feet in length. No wire smaller than #12 is permitted serving lighting or outlets.
- E. Do not pull conductors until the entire conduit system is complete and the building is "in the dry". Use only UL approved lubricants to facilitate conductor pulling.
- F. Furnish all switches, connections, branch circuits, wiring, etc. to HVAC equipment, as needed, to provide a complete power wiring system. Install and connect 120 Vac control devices which are to be included in power wiring.
- G. Furnish raceway, backboxes, wiring, connections, etc. for all equipment and systems furnished under this or other section(s) of these specifications, or by Owner, for a complete installation i.a.w. suppliers and manufacturers instructions. All equipment shall be connected ready for operation, i.a.w. detailed wiring diagrams furnished by the equipment manufacturer and in cooperation with the respective subcontractor or Owner. Provide receptacles to match equipment furnished plugs.
- H. Install wiring at outlets with a minimum of 8" of slack conductor.
- I. Install pre-finished cord sets where connection with an attachment plug is indicated or specified, or use attachment plug with suitable strain relief clamps.
- J. Solderless pressure connectors with insulating covers shall be used for copper conductor splices and taps, No. 8 awg and smaller.
- K. Insulation on approved splices and taps for wire sizes No. 8 AWG and smaller shall consist of:
  - 1. Half-lapped layers of all weather pvc tape installed to a thickness equivalent to the conductor insulation. Or
  - 2. An insulation system consisting of a heat shrink or cold shrink system properly sized for the application.
- L. Insulation on approved splices and taps for wire sizes No. 6 AWG and larger shall consist of:
  - 1. A minimum of three half-lapped layers of yellow, varnished cambric tape and three half-lapped layers of all weather pvc tape. An electrically insulating putty may be used over irregular shapes prior to application of the tape.
  - 2. An insulation system consisting of a heat shrink or cold shrink system properly sized for the application.
- M. Lighting and power branch circuits shall not share a neutral. Provide a dedicated neutral for each branch circuit.

### 3.3 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. Clean surfaces before applying self-adhesive identification products.

- D. 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.
- E. 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 below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.
- F. 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.
- G. Label raceway branch circuit junction boxes as to the panel(s) and circuit number(s) from which the circuit(s) originates. Use machine printed, pressure sensitive, abrasion resistant label tape on the faceplate and wiremarkers or tags within the box. Label outlets and wiring with respective branch circuit from which the circuit originates.
- H. Provide engraved nameplates to identify all electrical distribution and control equipment and loads served. Letter height shall be 1/8 inch for individual switches and loads served, 1/4 inch for distribution and control equipment identification.
- I. Panelboards, switchboards and motor control centers shall have 1/4 inch letter engraved nameplates to identify with the equipment designation, 1/8 inch lettering to identify the voltage rating and source.
- J. Provide an engraved nameplate with 1/8 lettering to identify the conductor color coding scheme at each panelboard and switchboard. Mount on the interior of the door if so equipped, otherwise on the back of the trim.

#### 3.4 FIRESTOPPING

- A. Penetrations of fire rated floor and wall assemblies shall be sealed with firestop material appropriate to achieve the designated fire resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7.

#### 3.5 DEMOLITION

- A. Remove all existing lighting lamps and fixtures exercising caution to prevent damage. All such lamps and fixtures shall be made available to the owner. Any items the owner does not want shall be properly disposed of by the contractor.
- B. Remove all existing duplex receptacles. In receptacle locations not subject to reuse, repair wall and prepare for new finish.
- C. All lighting and duplex receptacle branch circuit wiring will be pulled back to the originating panelboard and removed.
- D. All demolished materials shall be removed from the project site and disposed of properly.

3.6 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. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.7 REFINISHING AND TOUCHUP PAINTING

- A. The following procedure should be used for refinishing and/or touch-up needed:
  - 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.

END OF SECTION 16050





## SECTION 16120 - CONDUCTORS (LOW VOLTAGE, 600 VOLTS)

### PART 1 – GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Furnishing, installing and testing 600 volt conductors for lighting, power, and auxiliary systems.
- B. Furnishing, installing and testing 600 volt conductors for 2 hour fire rating.
- C. **Note: Contractor shall provide a neutral conductor with each single phase circuit, even if shown on the plans as grouped homeruns. There will be no shared neutrals in single phase branch circuits.**

### PART 2 – PRODUCTS

#### 2.1 CONDUCTORS:

- A. 98% conductivity copper; #12 AWG minimum; #8 AWG and smaller solid, #6 and larger stranded.
- B. Conductors furnished with NEC, 600 volt, insulation as follows:
  - Dry locations:
    - #6 AWG and smaller – type THW, THWN or XHHW  
(do not intermix in circuits)
    - #4 AWG and larger - type RHH, RHW, USE,  
(cross linked polyethylene)
  - Wet locations: type RHH, THW, USE
  - 2 Hour Fire Rating - type RHH UL 2196, UL 44 and F417 #25
- C. Wiring for controls and auxiliary systems #14 AWG stranded minimum with NEC type THWN insulation.
- D. Luminaire Wire: Incandescent – Use type SF-2, #14 (minimum) for all interior luminaires, except for luminaires in concrete pour use #12 or larger or as shown. Conductors in channels of, and flex to fluorescent luminaires type THHN or XHHW.
- E. Ungrounded System Wiring: All wiring connected to the secondary side of isolated transformers: Cross-linked polyethylene insulation with dielectric constant of less than 3.5; 30 mills minimum thickness, resistance constant greater than 20,000 at 60 degrees F, shall be suitable for wet and dry locations. Cables – G.E. No. SI-58053 or approved equivalent.
- F. Color Code as follows and/or per local ordinances. Conductors #10 and smaller shall have colored insulation. Conductors #8 and larger not available in colors, color coded with colored pressure sensitive tape. Apply minimum 2" of tape to each individual phase or neutral conductor in half lapped pattern. The equipment ground conductor shall be taped green for its entire exposed length. Color-code as follows:

<u>Phase</u>		<u>120/208 Volts</u>	<u>120/240 Volts</u>	<u>Ungrounded</u>
A		Black	Black	Orange
B		Red	Red	Brown
C		Blue	Orange	Yellow
Neutral		White	White	White
Eq Grnd		Green	Green	Green

- G. Manufacturers of copper conductors: Pirelli, Phelps Dodge, Capital Cable, Rome Southwire, Senator, Essex, American, or approved equal.
- H. Manufacturers of 2 Hour rated conductors "LIFELINE" 2 Hour fire rated RHH.
- I. 2 Hour Rated conductors are to be used for all exit egress lighting circuits, emergency feeders not otherwise protected, and any other Life Safety Circuits. Must be installed in conduit.

### **PART 3 – EXECUTION**

- A. Install wiring complete with connections to equipment.
- B. No wiring installed until after plastering and similar work is complete and dry.
- C. Install wiring so conductors are not in tension in completed system.
- D. Form wiring neatly and group in circuits. Tie grouped conductors with nylon ties, T&B "Tyrup" or approved equal.
- E. Use pulling compound of Ideal "Yellow 77", Minerallac No. 100, or approved equal. Do not use pulling compound for circuits on secondary side of ungrounded isolation transformers.
- F. Join and terminate copper conductors individually.
  - 1. Lugs in connected to copper bus: Solid 98% conductivity long copper barrel, tin plated, compression type connectors, Thomas & Betts color keyed, Burndy "Hydent" or approved equal; applied with appropriate hydraulic tool.
- G. Provide lugs where not furnished as part of equipment – furnish as specified above, to connect all conductors.
- H. Furnish lugs for conductors #2/0 and larger with two bolt tongue or approved equivalent.
- I. Make conductor taps #8 and larger from a second conductor with 98% conductivity bolted insulated connector, T&B "IDT", Ilco "KUP-L-TAP" or approved equivalent. Insulate splices with 600 volt "heat shrink" covers T&B or equal.

- J. Splice conductors #8 and larger with solid copper barrel, type fittings applied with an appropriate hydraulic tool. Splices used only where approved. Splice fittings: Burndy "Hydent". Insulate splices with 600 volt "heat shrink" covers T&B or equal.
- K. Joints #10 and smaller: T&B Sta-Kon wire joints EPT66M, with insulating caps, installed with WT161 Tool or C nest of WT11M Tool; Ideal Super/Nuts; Ideal Wing Nuts; 3M "Scotchlock" or Buchanan Electric Products B Cap or Series 2000 Pressure connectors complete with nylon snap on insulators installed with C24 pressure tool. Where conductors are connected to screw terminals, use nylon insulated, locking fork, T&B Sta-Kon or approved equal. Where joints are made in damp or wet locations insulate splices with 600 volt "heat shrink" covers T&B or equal.
- L. Install 2 Hour fire rated conductors in conduit when shown on drawing: terminations same as other cables.
- M. Provide cable supports: As required by NEC. Supports with malleable screwed conduit fitting and non-conductive wedges drilled for the conductors; O.Z. Manufacturing Company or approved equal. Furnish pullbox, sized per NEC for each cable support.
- N. Bond circuit ground wires where installed to all devices, equipment, outlet and junction boxes, and grounding bushings (where provided) with a full size conductor and screw type connection.
- O. Securely fasten non-ferrous identifying tapes, pressure sensitive labels or engraved nameplates to all cables, feeders and power circuits in vaults, pull boxes, manholes, switchboard rooms, terminations of cables, etc.
- P. Mark all branch circuit conductors at panel terminations including neutrals with pressure sensitive numbers to correspond to circuit numbers connected.
- Q. Connect circuits and feeders as shown on drawings. Drawings are diagrammatic and do not show every detail required in the wiring system. Detail wiring accomplished per NEC.
- R. All conductors making up parallel feeders to be same size, same type, and same insulation, all cut same length. Bond each group of conductors making up a phase or neutral at both ends in an approved manner.
- S. DO NOT COMBINE CIRCUITS unless specifically approved by the Engineer. No more than 3 phase, or current carrying conductors, in a circuit.

**END OF SECTION 16120**



## **SECTION 16121 - GROUNDING**

### **PART 1 – GENERAL**

#### **1.1 SCOPE OF WORK: Grounding Details**

### **PART 2 – PRODUCTS**

#### **2.1 SYSTEM GROUNDING**

- A. Bond and ground main service neutral, cabinets, equipment, conduits, metallic piping systems, etc., per the latest edition of NEC.
- B. Ground conductors – 98% conductivity copper, either bare or with green THW insulation. Other conductor requirements same as described for low voltage, 600 volts, conductors.
- C. Ground Connections (if required):
  - 1. Make with mechanical connectors where accessible and with “Cadweld” or approved equivalent where inaccessible.
  - 2. Use high alloy cast copper and/or silicon bronze mechanical connectors with Hex or Allen head bolts where permitted.
  - 3. Use Burndy “GAR” or approved equivalent.
  - 4. Size as required for piping connections.
  - 5. Thoroughly clean prior to installation of clamps and/or lugs.
  - 6. Use bolted or screwed on mechanical connectors. Do not use clip-on connections.
  - 7. Bond ground conductor to metal raceway at each end of the run and at each junction box or pull box.
  - 8. Seal connections between dissimilar metals (i.e.: bronze to steel), with approved epoxy resin.
  - 9. Coat connections with “No-OXID-A” compound as manufactured by Dearborn Chemical Company.
- D. Provide lighting and power circuits with green covered ground wire sized per NEC, or as shown, except not smaller than #12 AWG. Bond ground wire to all outlet boxes, junction and pull boxes, cabinets, equipment, etc., with self-tapping screw or bolt and appropriate lug. See Section covering “Raceways” for use of grounding bushing.

#### **2.2 DRIVEN GROUND SYSTEM**

- A. Provide driven ground rods and buried ground conductor interconnecting ground rods as shown on drawings and required by code.
- B. Ground rods  $\frac{3}{4}$ " x 8'-0" copperclad steel, Thompson #558 or approved equal. Ground rods installed with tops driven to 1'-6" minimum below grade. Connect ground wire to ground rod with Thompson #493 “U” bolt bronze clamp or Cadweld or equal.

- C. Exterior buried ground conductor #2/0, soft drawn, bare, tinned copper, installed 2'-0" minimum below grade encircling building perimeter and bonded to each structural steel column.
- D. Bond all masses of metal, i.e.: pipes, conduits, fence posts, etc., within 6'-0" of the buried ground conductor to ground conductor with #6 AWG bare, solid, tinned copper wire, attached to object with appropriate clamp, lug, etc., (Cadweld or equal). Obtain complete set of drawings to determine quantity and location of required connections.
- E. All connectors lugs, hardware, etc., for building ground system similar to that for other grounding as described above.

## **PART 3 – EXECUTION**

### **3.1 EQUIPMENT GROUND 'GREEN WIRE CONCEPT'**

- A. Ground electrical equipment enclosures and conductor enclosures including metal raceways, outlet boxes, cabinets, switch boxes, motor frames, transformer cases, metallic piping systems such as water, gas, waste, air and metallic enclosures for all electrical equipment.
- B. Provide separate grounding conductor for all circuits to insure adequate ground fault return path.
- C. Install separate ground conductors in conduit.
- D. Bond green wire to equipment enclosure at source and at apparatus served.
- E. Insulate grounding conductors sized to carry ground fault current safely. Minimum size for green wire grounding lead per N.E.C. or as indicated.
- F. Do not use grounded current return conductors (neutrals) for equipment grounding. Connect common grounding lead to supply side of service disconnect unit only.
- G. Do not ground neutral conductor after it has been grounded at service entrance, transformer or generator.
- H. Maintain electrical continuity of conduit systems by threaded fittings with joints made-up wrench tight. Install insulated bushing and locknuts on terminating conduits. Provide conduits containing ground wires with grounding bushings bonded to ground wire with short full size jumper.
- I. Provide receptacles with approved green covered bonding jumper from the grounding terminal screw connected to outlet box.
- J. Install ground rods in quantity to provide a maximum of 5 ohms ground resistance. Where multiple rods are required, separate a minimum of 6 feet and interconnect with wire of ground size shown.
- K. Test ground systems as specified in Section 16010.
- L. Install tags on ground connections to piping or electrode systems for all telephone equipment grounds.

## **END OF SECTION 16121**

## SECTION 16130 - RACEWAYS AND BOXES

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1. Raceways include the following:
  - a. EMT – Electrical Metallic Tubing
  - b. FMC – Flexible Metal Conduit
  - c. LFMC – Liquid Tight Flexible Metal Conduit
  - d. PVC – PVC coated, Rigid Steel Conduit
  - e. RNC – Rigid Non-metallic Conduit
  - f. RSG – Rigid Steel Galvanized Conduit
2. Boxes, enclosures, and cabinets include the following:
  - a. Device boxes.
  - b. Floor boxes.
  - c. Outlet boxes.
  - d. Pull and junction boxes.
  - e. Cabinets and hinged-cover enclosures.

#### 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.

- B. Referenced standards include:

NFPA 70 – National Electric Code  
ANSI C80.1 – American National Standard, Rigid Steel Galvanized Conduit  
ANSI C80.3 – American National Standard, Electrical Metallic Tubing  
OSHA 1910 - Standards for General Industry  
NEMA FB1 – National Electrical Manufacturers Assoc., fittings  
NEMA TC 3 – PVC fittings

#### 1.3 QUALITY ASSURANCE

- A. Provide raceways and boxes specified in this Section that are listed and labeled as defined in NFPA 70, Article 100.
- B. As defined in OSHA Regulation 1910.7, the Listing and Labeling Agency shall be a "Nationally Recognized Testing Laboratory".
- C. The materials and methods used for all raceway and wiring box installation shall comply with NFPA 70.



#### 1.4 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.
- B. Field verify measurements.
- C. Verify routing and termination locations of conduit prior to rough-in.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable 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. Metal Conduit and Tubing:
    - a. Allied Tube and Conduit
    - b. Triangle
    - c. Wheatland
    - d. Anaconda (flexible conduit)
  - 2. Nonmetallic Conduit and Tubing:
    - a. Carlon
    - b. Robroy
    - c. Anaconda
  - 3. Conduit Bodies and Fittings:
    - a. Crouse-Hinds
    - b. Appleton
    - c. O-Z/Gedney
  - 4. Fire Rated Fittings:
    - a. Crouse-Hinds
    - b. O-Z/Gedney
    - c. Appleton
  - 5. Expansion/Deflection Fittings:
    - a. Crouse-Hinds
    - b. O-Z/Gedney
    - c. Appleton
  - 6. Cable Trough/Wireway
    - a. B-Line
    - b. Wiremold
    - c. Cablofil
  - 7. Boxes, Enclosures, and Cabinets:
    - a. Crouse-Hinds
    - b. Hoffman
    - c. B-Line
    - d. Robroy

## 2.2 METAL CONDUIT AND TUBING

### A. EMT and Fittings

1. All electrical metallic tubing shall comply with the latest revision of ANSI C80.3.
2. Electrical metallic tubing (EMT) shall be galvanized steel and shall be used for all indoor work unless otherwise noted. Connectors and couplings shall be threadless compression type.

### B. FMC

1. Flexible metal conduit shall be used for final connections to motors. Conduit shall be of an interlocked steel construction.

### C. LFMC

1. Liquid tight flexible metal conduit shall be used in wet locations for final connections to motors and other equipment subject to vibration. Preference given to neoprene jacketed "Seal-tite" by Anaconda or equal.

### D. PVC

1. PVC coated rigid steel conduit shall be used for all transitions from below grade to 18 (eighteen) inches above the finished grade or floor, and for all installations in contact with concrete.

### E. RSG

1. All rigid steel galvanized conduit shall comply with the latest revision of ANSI C80.1.
2. Rigid steel galvanized conduit shall be used for all exterior work, unless otherwise noted.

### F. Fittings

1. All fittings shall comply with the requirements of NEMA FB 1, standard for conduit fittings, cast metal boxes, and conduit bodies. All fittings used shall be compatible with the conduit and tubing materials used.

## 2.3 NONMETALLIC CONDUIT

### A. RNC

1. All rigid nonmetallic conduit shall be schedule 40 PVC complying with NEMA TC 3 standards.
2. RNC shall be used for underground cable runs, unless otherwise noted.

### B. Fittings

1. All fittings used with nonmetallic conduit shall be schedule 40 PVC complying with NEMA TC 3 standards. The fittings used shall be compatible with conduit size and type.

## 2.4 OUTLET AND DEVICE BOXES

### A. Metal Boxes

1. Provide galvanized steel metal boxes sized to accommodate devices and conductors as per NEC Art. 370 at each outlet location indicated on the drawings or as required. Boxes shall be a minimum of 1.5" deep, of metal a minimum of 1/16" thick.
2. Boxes used with exposed conduit should be a four inch square utility box.
3. The owner reserves the right to make adjustments to the location of outlet boxes prior to rough-in.
4. Sizes and configuration of boxes shall be as required for the intended service. The boxes shall conform to and be applied, i.e., NEC requirements. Supports, gaskets, extension rings, etc. shall be provided where required.
5. Gang type boxes shall be used where multiple wiring devices are located together.

### B. Floor Boxes

1. Floor boxes shall be located as indicated on the drawings. Coordinate with architect/owner prior to final placement. A multi-function floor box, providing separated power and data cables should be used, as applicable.
2. Nonmetallic boxes suitable for concrete encasement may be used and cut in the field to the appropriate depth.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Minimum Raceway Size: 1/2-inch trade size. Homeruns shall be 3/4" minimum.
- C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors, except in equipment room. Do not run conduit in cavity of exterior wall.
- D. Keep raceways at least 12 inches away from hot-water pipes. Install horizontal raceway runs above water piping.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Complete raceway installation before starting conductor installation.

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- G. All conduits, concealed or exposed, shall be supported and substantially fastened to structural members at intervals of not more than 8 (eight) feet. Attach supporting devices with screws, bolts, expansion sleeves or other workmanlike means appropriate to the surface. Boxes which are not embedded in masonry or concrete shall be fastened to the structure in the same manner as for conduits.
- H. Use temporary closures to prevent foreign matter from entering raceways.
- I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab. Where conduits emerge from the ground or slab, provide a rigid steel adapter, elbow and conduit. Slope conduits to drain away from the building. All metal conduits installed underground shall be PVC coated. PVC coated rigid steel conduit shall be used within five feet from foundation walls.
- J. Make 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.
- K. Use raceway fittings compatible with raceways and suitable for use and location.
- L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
- M. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
  - 1. Run parallel or banked raceways together, on common supports where practical.
  - 2. Make bends in parallel or banked runs from same centerline. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- N. Join raceways with fittings designed and approved for the purpose and make joints tight.
  - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
  - 2. Use insulating bushings to protect conductors.
- O. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box. Provide bushings on ends where auxiliary system conduit raceway is stubbed out into furred space, adjacent to backboard, etc.
- P. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
- Q. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.
- R. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet 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.

- S. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver- operated, threaded flush plugs flush with floor for future equipment connections.
- T. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.
- U. Set floor boxes level and trim after installation to fit flush to finished floor surface.
- V. Provide galvanized sheet metal pull boxes with screw type cover, as required, to avoid excessive runs or bends between outlets.
- W. Grade all raceway away from service entrance equipment to prevent water damage.
- X. Provide expansion fittings in all conduits crossing an expansion joint. Fitting shall be OZ type "EX" for rigid metal conduit or schedule 40 pvc. Fitting shall be OZ type "TX" for EMT. Metallic conduit not containing a grounding conductor shall have OZ type "BJ" bonding jumpers installed across expansion joints. Provide expansion fittings for PVC conduit runs over 150 feet, or outdoors or in areas or runs subject to temperature variations over 75 degrees F, and as recommended by the manufacturer.
- Y. Grouped raceways shall be supported with galvanized steel channel assemblies equal to Kindorf B-909 and single bolt straps equal to Kindorf C-105. Raceway supports shall be spaced within 2 (two) feet of termination and/or connection and 8 (eight) feet on center for rigid steel, and EMT conduit. RNC shall be supported i.a.w. NFPA 70, 347-8. FNMC shall be supported within 12 (twelve) inches of termination/connection and 4.5 (four and one-half) feet on center.
- Z. The drawings indicate approximate locations only. Determine the exact location on site in consideration of all structural and architectural conditions.
- AA. Provide and install "low point drains" in all above grade, outdoor raceway. Provide and install breather drains in the bottom of outdoor control panels. As much as possible, route conduits into the bottom of control panels.
- BB. All phase conductors and, where used, the grounded conductor, and all equipment grounding conductors shall be grouped together in a single raceway. Where multiple phase conductors are run in parallel, separate conduits shall be run to contain one set of all phase conductors, neutral (if used) and the equipment grounding conductor.

### 3.3 PROTECTION

- A. Provide final protection and maintain conditions, in a manner that ensures coatings, finishes, and cabinets are without damage or deterioration at the 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.
  - 3. RMC shall be protected through concrete.

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3.4 CLEANING

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 16130



## SECTION 16140 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Work of this section includes specification of the following:
  - 1. Receptacles
  - 2. Switches
  - 3. Wall Plates

- B. Related Sections include the following:

Section 16010 - General Provisions  
Section 16050 - Basic Materials & Methods  
Section 16130 - Raceways and Boxes

#### 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.
- B. Referenced standards include:
  - NFPA 70 - National Electric Code
  - OSHA - Standards for General Industry

#### 1.3 SUBMITTALS

- A. Submit product data on the switches, receptacles, and wall plates to be used.

#### 1.4 QUALITY ASSURANCE

- A. Provide electrical components, devices, and accessories specified in this section that are listed and labeled as defined in NFPA 70, Article 100.
- B. As defined in OSHA Regulation 1910.7, the Listing and Labeling Agency shall be "Nationally Recognized Testing Laboratory".
- C. The materials and methods used for all electrical components, devices, and accessories specified in this section shall comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable 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. Wiring Devices:
  - a. Arrow
  - b. Hubbell
  - c. Leviton

## 2.2 RECEPTACLES

- A. Receptacles shall be specification grade, duplex type, rated 20 amp, 120 volt service, unless otherwise noted. Receptacles shall be of the straight-blade design, NEMA configuration 5-20R. Hubbell 5351, Arrow-Hart 5351, or Leviton 5351: 125 V single convenience receptacle  
Hubbell 5352, Arrow-Hart 5352, or Leviton 5352: 125 V duplex convenience receptacle
- B. GFCI receptacles may be a feed-through, as needed to protect downstream receptacles on the same circuit. The duplex receptacle configuration shall be NEMA 5-20R. Weatherproof enclosures shall be provided as indicated on the drawings. Receptacle shall have an integral ground fault circuit interrupter.  
  
Hubbell GF5362, Arrow-Hart GF5342, or Leviton 6899: 125 V GFCI duplex receptacle.
- C. All receptacles shall have plaster ears and grounding straps.
- D. Unless otherwise noted by Owner and/or Architect, all receptacles shall be ivory in color with brushed stainless steel cover plate. Each like receptacle on the project shall be of the same manufacturer and catalog number.

## 2.3 SWITCHES

- A. All toggle switches will be specification grade, quiet type snap switches, rated for 20 amp, 120/277 volt service. At a minimum, side screw terminals shall be provided.  
  
Hubbell HBL1221, Arrow-Hart 1991, Leviton 1221: Single pole toggle switch.  
Hubbell HBL1222, Arrow-Hart 1992, Leviton 1222: Double pole toggle switch.  
Hubbell HBL1223, Arrow-Hart 1993, Leviton 1223: Three-way toggle switch.  
Hubbell HBL1224, Arrow-Hart 1994, Leviton 1224: Four-way toggle switch.
- B. Unless otherwise noted by Owner and/or Architect, all switches shall be ivory in color with brushed stainless steel cover plate. Each like switch on the project shall be of the same manufacturer and catalog number.
- C. Fluorescent dimmer switches shall be compatible with dimmer ballast. Dimmer/Ballast combination shall be capable of consistent dimming down to no more than 10% of full brightness.

## 2.4 WALL PLATES

- A. Single, gang, and combination type wall plates will be used as needed with each corresponding wiring device.
- B. Provide brushed stainless steel plate unless otherwise noted by Owner and/or Architect.
- C. Both receptacle and switch plates shall be labeled with panel and circuit information.
- D. Where weatherproof devices are noted, provide "in-use" type.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install all wiring devices and assemblies plumb and secure.
- B. Install all wall plates when painting is complete.
- C. Install all wiring devices by connection to screw terminals only. Connection to pressure terminals is not acceptable.
- D. Use single plates of proper gang where more than one device occurs. Furnish blank plates on outlets for future use.
- E. Unless otherwise noted, install wall devices vertically so that all devices of any given height will exactly align. Plates must be plumb and true with all four edges in continuous contact with the wall surface. Do not install devices until plastering or other wall covering work is complete.
- F. Protect wiring devices and wiring insulation during painting.
- G. Wiring devices and other equipment shall, unless otherwise noted, be mounted with respect to indicated surfaces as follows:
  - Receptacles: 1'6" above finished floor or 6" above working surface
  - Switches: 4'6" above finished floor or as otherwise required for ABA compliance, coordinate with Architect.
  - Telephone outlets: Same as receptacles
  - Computer network outlets: Same as receptacles
  - Thermostats: 5'0" above finished floor or as otherwise required for ABA compliance, coordinate with Architect.
- H. Wiring device grounding terminals shall be connected to the branch-circuit equipment grounding conductor.
- I. GFCI receptacles will be functionally tested according to the manufacturer's instructions. Record of the test shall be provided to the owner.
- J. Install all switches with the "OFF" position down.
- K. Install receptacles with grounding pole on top.
- L. Coordinate exact location of all wiring devices with owner/architect prior to rough-in.

END OF SECTION 16140



## SECTION 16442 - PANELBOARD

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 V and less for the following types:

Lighting and appliance branch - circuit panelboards  
Distribution panelboards

#### 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.

- B. Referenced standards include:

NFPA 70 - National Electric Code  
OSHA 1910 - Standards for General Industry

#### 1.3 SUBMITTALS

- A. Submit product data for each type of panelboard, accessory item, and component specified.
- B. Submit shop drawings for panelboards. Include dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:
1. Enclosure type with details.
  2. Bus configuration and current ratings.
  3. Short-circuit current rating of panelboard.
  4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
  5. Wiring Diagrams: Details of schematic diagram including control wiring and differentiating between manufacturer-installed and field-installed wiring.
- C. Submit panelboard schedules for installed panelboards after load balancing.

#### 1.4 QUALITY ASSURANCE

- A. Provide products specified in this Section that are listed and labeled as defined in NFPA 70, Article 100.
- B. As defined in OSHA Regulation 1910.7, the Listing and Labeling Agency shall be a "Nationally Recognized Testing Laboratory".

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- C. Acceptable manufacturers shall be companies regularly engaged in the design, manufacture, and testing of panelboards for electrical use and shall have been producing such products for at least five (5) years.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable 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. Cutler-Hammer
  - 2. General Electric
  - 3. Square D
  - 4. Siemens

### 2.2 PANELBOARD FABRICATION

- A. Panelboard enclosures shall be flush or surface-mounted cabinets, as indicated on the plans. NEMA PB 1, Type 1, unless otherwise indicated to meet environmental conditions at the installed location. All panelboards will be supplied complete with all interior components and front for a complete installation
- B. Panelboards shall be dead front, secured to box with concealed trim clamps, unless otherwise indicated. Front, for surface mounted panelboards shall be of the same dimensions as box. Fronts for flush mount panelboards shall overlap the box, unless otherwise indicated.
- C. The directory frame shall be metal with a transparent protective cover, mounted inside each panelboard door.
- D. All panelboard bus shall be hard drawn copper of 98 percent conductivity with compression type main and neutral lugs. Panelboard shall have a full-capacity neutral bus.
- E. The equipment ground bus will be adequate for feeder and branch-circuit equipment ground conductors and be bonded to the box.
- F. Only panelboards listed as approved for service entrance equipment use with a main disconnect shall be used as a service entrance panel.
- G. Minimum rating of panelboards shall be 10,000 AIC rms sym. Refer to the drawings for higher rating requirements. Refer to the drawings for panel bus ratings.
- H. Panelboards shall have provisions for at least the number of branch-circuits as indicated on the drawing panel schedules. Circuits will be filled with circuit breakers, at least, as indicated on the panel schedule. All panelboards shall be provided with a main circuit breaker.
- I. The panelboard box shall be fabricated of code gauge, galvanized sheet steel i.a.w. UL standards. The box shall have standard knockouts on the enclosure.

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- J. The front shall be fabricated of sheet steel and finished with a baked on gray enamel over a rust inhibitor. Panelboards shall have a full hinged cover. Doors shall have flush type cylinder locks and catches. Panelboard locks shall be master keyed, with two keys furnished for each panelboard.
- K. Panels shall be provided with arc flash labels.
- L. Provide Panelboard with integrally mounted, Type 1, Surge Protective Devices (SPDs). SPDs shall be designed, tested, manufactured and listed in accordance with UL 1449, 3rd Edition, effective September 29, 2009. The SPDs shall be installed on the load side of the main service disconnect (breaker) and include overcurrent protective devices and disconnects as needed for protection and isolation of the unit. The SPD shall consist of serviceable and replaceable modules. The SPDs will be equipped with the following diagnostics:
  - a. Visual LED diagnostics including a minimum of one green LED indicator per phase and one red service LED.
  - b. Audible alarm with on/off silence function and diagnostic test function
  - c. Form C dry contacts
  - d. Surge counter
- M. TVSS Panelboards shall be supplied with thermal-magnetic main circuit breaker. Branch overcurrent protective devices shall be bolt-on circuit breakers, full module. A 200% capacity neutral bus shall be provided. The TVSS device shall comply with IEEE C62.41, integrally mounted, plug-in-style solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.
  - 1. Protection shall be as follows with the minimum single-impulse current rating noted:
    - a. Line to Neutral: 100,000 A.
    - b. Line to Ground: 100,000 A.
    - c. Neutral to Ground: 50,000 A.
  - 2. Accessories shall include the following:
    - a. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
    - b. Audible alarm activated on failure of any surge diversion module.
    - c. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.
- N. Panel shall have main circuit breaker.

## 2.3 CIRCUIT BREAKERS

- A. Circuit breakers shall be bolt-on type full module, with quick-make and quick-break toggle action mechanism. Trip indication shall be shown by breaker handle taking position between on and off. All multiple pole services shall be common trip with a single handle. Circuit breakers shall be replaceable without disturbing adjacent units. .
- B. Circuit breakers shall be fully rated with an interrupting rating equal to that of the panelboard to which they are installed.

- C. Circuit breakers will be of the same manufacturer as the panelboard installed.
- D. Circuit breakers shall have mechanical compression connections.
- E. Single pole circuit breakers serving fluorescent lighting loads shall have the SWD marking.
- F. Circuit breakers serving air conditioning branch loads shall be UL listed as HACR type.
- G. All circuit breakers shall be of the same manufacturer as the panelboard to which they are installed.
- H. Branch circuit breakers shall have provision for being locked in the "open" position.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Panelboards shall be installed at 74 inches above finished floor to the top of the trim, unless otherwise indicated.
- B. Panelboards shall be mounted plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish.
- C. Type the circuit directory to indicate installed circuit loads after balancing panelboard loads. Install the typed directory in the panelboard.
- D. Install filler plates in unused spaces.
- E. Wiring shall be neatly arranged in panelboard gutters.
- F. For flush mount panelboards, stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

#### 3.2 IDENTIFICATION

- A. Label each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion-resistant screws, i.a.w. the requirements of Section 16050.

#### 3.3 GROUNDING

- A. Make equipment grounding connections for panelboards as indicated, i.a.w, NEC. Provide ground continuity to main electrical ground bus.

#### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 TESTING

- A. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuits.

Panelboard bus insulation tests shall consist of a 1000 volt "megger" test, phase-to-phase and each phase-to-ground, each test shall be held for a minimum of one minute. Minimum acceptable insulation resistance shall be 500 megohms. Test results shall be corrected for temperature deviations from a 20 deg C standard. Provide test results to Owner and Engineer.

- B. Make continuity tests of each circuit.

- C. Measure steady-state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase load within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

END OF SECTION 16442





## SECTION 16476 - DISCONNECT SWITCHES

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. This Section includes individually mounted switches used as an equipment disconnect.

#### 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.
- B. Referenced standards include:
  - NFPA 70 – National Electric Code
  - OSHA 1910 – Standards For General Industry
  - ANSI/UL 198C – High-Intensity Capacity Fuses: Current Limiting Types
  - ANSI/UL 198E – Class R Fuses

#### 1.3 SUBMITTALS

- A. Submit product data and shop drawings for the fused disconnect specified.

#### 1.4 QUALITY ASSURANCE

- A. Provide products specified in this Section that are listed and labeled as defined in NFPA 70 Article 100.
- B. As defined in OSHA Regulation 1910.7, the Listing and Labeling Agency shall be a “Nationally Recognized Testing Laboratory”.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering disconnect switches and circuit breakers that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Molded Case Circuit Breaker:
    - a. General Electric
    - b. Square D
    - c. Cutler-Hammer
    - d. Siemens

- 2. Fusible Switches:
  - a. General Electric
  - b. Square D
  - c. Cutler-Hammer
  - d. Siemens

## 2.2 DISCONNECT SWITCHES

- A. Fusible Switch Assemblies: Switch shall be heavy-duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. The handle shall be lockable and interlocked with the cover in the CLOSED position to prevent opening with the switch in the ON position. Fuse clips shall be designed to accept Class R fuses.
- B. Non-fusible Switch Assemblies: Switch shall be heavy-duty, quick-make, quick-break load interrupter enclosed knife switch with externally operable handle. The handle shall be lockable and interlocked with the cover in the CLOSED position to prevent opening with the switch in the ON position.
- C. Operation of the handle shall disconnect all three poles.
- D. Switch terminations shall be rated for copper.

## 2.3 FUSES

- A. Fuses 600 amps and less shall be ANSI/UL 198E, Class RK1, RK5, size as indicated, dual element, current limiting, time delay.
- B. Interrupting rating shall be 200,000 amps rms symmetrical.
- C. Acceptable manufacturers: Bussman, Gould, Reliance Co.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. The location indicated for each disconnect is approximate. Coordinate with the protected equipment's installer for the exact location. Install i.a.w. manufacturer's written instructions.
- B. Install disconnect switches level and plumb.
- C. Install all wiring between disconnect switches, and equipment so as to make a complete and functional installation.
- D. Provide grounding i.a.w. NEC requirements.
- E. Label the disconnect with the distribution panel name and circuit number feeding the switch. Labeling shall comply with the applicable requirements of Section 16050.

END OF SECTION 16476

## SECTION 16519 - LED INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

#### 1.2 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.

#### 1.3 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.
  - a. 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.

#### 1.4 QUALITY ASSURANCE

- A. Provide luminaires from a single manufacturer for each luminaire type.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Recessed Fixtures: Comply with NEMA LE 4.
- C. CRI of minimum 80 CCT of 3500 K.
- D. Rated L70 life of 50,000 hours for the entire fixture assembly, including driver.
- E. Lamps dimmable from 100 percent to 1 percent of maximum light output.
- F. Internal driver.

2.2 MATERIALS

- A. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
  - 1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  - 2. Glass: Annealed crystal glass unless otherwise indicated.
  - 3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- D. Housings:

- 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.

## 2.3 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## 2.4 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- B. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm)
- C. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- D. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with NECA 1.
- B. 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 a minimum 20 gauge backing plate attached to wall structural members.
2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaire Support:

1. 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.
2. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. 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.

### 3.3 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.

END OF SECTION 16519

## SECTION 16713 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Nonmetallic wireways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.
8. Handholes and boxes for exterior underground cabling.

#### 1.2 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

### PART 2 - PRODUCTS

#### 2.1 METAL CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Allied Tube & Conduit; a part of Atkore International.
  2. Electri-Flex Company.
  3. O-Z/Gedney; a brand of Emerson Industrial Automation.
  4. Republic Conduit.
  5. Robroy Industries.
  6. Southwire Company.
  7. Thomas & Betts Corporation, A Member of the ABB Group.
  8. Wheatland Tube Company.
- B. General Requirements for Metal Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Comply with TIA-569-B.



- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
  - 2. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

## 2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Allied Tube & Conduit; a part of Atkore International.
  - 2. CANTEX INC.
  - 3. Carlon; a brand of Thomas & Betts Corporation.
  - 4. CertainTeed Corporation.
  - 5. Electri-Flex Company.
  - 6. RACO; Hubbell.
  - 7. Thomas & Betts Corporation, A Member of the ABB Group.
- B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- C. RTRC: Comply with UL 1684A and NEMA TC 14.
- D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- E. Solvents and Adhesives: As recommended by conduit manufacturer.

## 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 2. Hoffman; a brand of Pentair Equipment Protection.
  - 3. Square D; by Schneider Electric.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Comply with TIA-569-B.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Carlon; a brand of Thomas & Betts Corporation.
  2. Cooper Technologies Company.
  3. EGS/Appleton Electric.
  4. Hoffman; a brand of Pentair Equipment Protection.
  5. Oldcastle Enclosure Solutions.
  6. O-Z/Gedney; a brand of Emerson Industrial Automation.
  7. Quazite: Hubbell Power Systems, Inc.
  8. RACO; Hubbell.
  9. Robroy Industries.
  10. Stahlin Non-Metallic Enclosures.
  11. Thomas & Betts Corporation, A Member of the ABB Group.
  12. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets:
1. Comply with TIA-569-B.
  2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep). Depth of boxes shall be large enough to allow manufacturers' recommended conductor bend radii.
- H. Gangable boxes are allowed.
- I. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

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.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Physical Damage: GRC. Pathway locations include the following:
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Damp or Wet Locations: GRC.
5. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Pathway Size: 3/4-inch (21-mm) trade size. Minimum size for optical-fiber cables is 1 inch (27 mm).

D. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

### 3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- H. Pathways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
  - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
  - 3. Arrange pathways to keep a minimum of [1 inch (25 mm)] [2 inches (50 mm)] of concrete cover in all directions.
  - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- I. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for pathways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

- N. Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
  - O. Install pull wires in empty pathways. Use polypropylene 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 pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
  - P. Expansion-Joint Fittings:
    - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
    - 2. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
    - 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 time of installation. Install conduit supports to allow for expansion movement.
  - Q. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
  - R. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
  - S. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
  - T. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
  - U. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
  - V. Set metal floor boxes level and flush with finished floor surface.
  - W. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- 3.3 FIRESTOPPING
- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section "Penetration Firestopping."
- 3.4 PROTECTION
- A. Protect coatings, finishes, and cabinets from damage or deterioration.

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1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 16713



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## SECTION 16721 - FIRE ALARM AND MASS NOTIFICATION SYSTEMS

### PART 1 - GENERAL

#### 1.1 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All publications shall be referred to in their latest edition, including any revisions thereof:
- ABA- Architectural Barriers Act and ADAAG
  - OSHA 1910-165 Employee Alarm system
  - IEC 60268-16 ed3.0: Sound system equipment - Part 16: Objective rating of speech intelligibility by speech transmission index
- B. ELECTRONIC INDUSTRIES ASSOCIATION (EIA)
- ANSI/EIA/TIA-222-G 2005 Steel Antenna Tower and Antenna Supporting Structures
  - ANSI/ASA S3.41-1990 (R2008) Audible Emergency Evacuation Signal
- C. FEDERAL STANDARDS (FED-STD)
- FED-STD-595 (Rev. B) Colors
- D. FACTORY MUTUAL ENGINEERING AND RESEARCH CORPORATION (FM)
- FM P7825a 2009 Approval Guide
- E. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC. (IEEE)
- IEEE C62.41.1-2002 Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits
  - IEEE C62.41.2-2002 Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
- F. UNIFIED FACILITIES CRITERIA (UFC)
- UFC 4-021-01 Design and O&M: For Individual Building Mass Notification SystemUFC
  - 03-601-01 Facility Planning and Design Guide
  - UFC 04-010-01 DoD Minimum Antiterrorism Standards for Buildings
- G. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
- NEMA ICS 6 1993 (R2001, R2006) Enclosures for Industrial Control and Systems
- H. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
- NFPA 70 National Electrical Code current edition
  - NFPA 72 National Fire Alarm Code current edition
  - NFPA 1221 Installation Maintenance and Use of Public Fire Service Communication Systems current edition
  - NFPA 90A Installation of Air Conditioning and Ventilating Systems current edition



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- NFPA 78 Lightning Protection Code

## 1.2 RELATED REQUIREMENTS

- A. Section "Electrical General Requirements," applies to this section, with the additions and modifications specified herein.

## 1.3 QUALIFICATIONS OF INSTALLER

- A. Prior to commencing work, the contractor shall submit data which will show that he has successfully installed fire alarm systems, or that he has a firm contractual agreement with a subcontractor having such required experience. The data shall include the names and locations of at least two installations where the contractor, or the subcontractor referred to above, has installed such systems. The contractor shall indicate these systems have performed satisfactorily in the manner intended for a period of not less than 18 months. The installer shall be UL listed under category UUJS of the UL Fire Protection Equipment Directory.

## 1.4 MANUFACTURERS' REPRESENTATIVE

- A. Provide the services of a qualified and authorized manufacturer's representative or technician, experienced in the installation and operation of the type of system being provided to attend final system testing and commissioning perform programming adjustment of the system.

## 1.5 GENERAL REQUIREMENTS

- A. Materials and equipment shall be first grade, standard, current products of the manufacturer and shall be suitable for the performance of their separate functions. Where two or more pieces of equipment performing the same function are required, they shall be exact duplicates produced by one manufacturer. Equipment added to an existing system shall function in the same manner as similar components of the existing system. Installed system shall meet the installation and operational requirements of NFPA Standard 72 except as modified or annotated herein. When manufactured as a standard product, the addressable fire alarm control unit, power supply and radio transceiver may be provided as a single integrated unit in one or more enclosures as required.

## 1.6 MAJOR EQUIPMENT SUBMITTALS

- A. Provide submittals as indicated herein.

### 1.6.1 Manufacturer's Data

- A. Data which describe more than one type of item shall be clearly marked to indicate which type the contractor intends to provide. Partial submittals will not be accepted. Submit data for the following:
  1. Fire alarm & mass notification system (FACP & MNS) control panels in each configuration required by this specification.
  2. Radio transceivers
  3. Power supplies, including batteries
  4. Lightning protection devices
  5. Addressable smoke sensors of each type provided
  6. Addressable heat sensors of each type provided
  7. Addressable manual stations
  8. Addressable control modules
  9. Addressable monitor modules

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10. Audible/visual devices of each type provided
11. Non-addressable devices of each type provided
12. Wire and cables for fire alarm system

#### 1.6.2 Approvals and Certifications

A. Submit the following:

1. Evidence of current UL listing or FM approvals.
2. Evidence of FCC type acceptance.
3. Name(s) and qualifications of personnel who will attend final testing and commissioning of the system, and who will provide instruction to government personnel, along with the manufacturer's certification of the qualifications of the named individual(s).

#### 1.6.3 Shop Drawings

A. Submit shop drawings indicating the following:

1. Layout drawings of the entire system, showing location of all fire alarm equipment and devices.
2. Wiring diagrams showing points of connection and terminals to be used.
3. Interior wiring diagrams of each major system component.

#### 1.6.4 Calculations

A. Substantiate battery capacity, supervisory and alarm power requirements for:

1. Fire alarm/MNS control panels/radio alarm transceivers
2. Supplementary power supplies or devices (if provided)

#### 1.6.5 Operations and Maintenance Manuals

A. Submit six (6) copies of operations and maintenance manuals for system and parts thereof. Maintenance manuals shall include the following:

1. Operation, Function Description and Analysis and Trouble Shooting - Fire Alarm/MNS Control Panels.
2. Operation, Function Description and Analysis and Trouble Shooting -Interface Units, if not integral with FACP/Transceiver.

### PART 2- FIRE ALARM DETECTION SYSTEM

#### 2.1 ADDRESSABLE FIRE ALARM CONTROL PANEL WITH INTEGRATED RADIO TRANSCEIVER

- A. The fire alarm control panel, (hereafter known as the FACP) shall be modular, installed in a surface-mounted corrosion-resistant metal cabinet with hinged door and cylinder lock. Provisions shall be made for conduit (minimum 3/4 inch I.D.) entry and attachment at no less than two places on the housing. All indicators and switches shall be clearly identified. LED indicators shall be provided for AC POWER, BATTERY, FAULT, TRANSMIT, RECEIVE, CARRIER DETECT, TRANSMITTER DISCONNECT, ALARM AND TROUBLE. In addition, a minimum 40 character two (2) line LCD display shall be provided to display system messages in a plain English format. Switches shall be provided for ALARM SILENCE, RESET, TROUBLE SILENCE, DRILL TEST, LAMP TEST and TRANSMITTER RESET. The control unit shall contain an integral keyboard capable of performing all maintenance, history and other control functions of the system. All control panel switches shall be within the locked cabinet. Above indicators and LCD display shall be plainly visible when the cabinet door is

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closed. Each initiating device circuit (IDC) and signaling line circuit (SLC) shall be powered and supervised so that a signal on one IDC, SLC or addressable device point does not prevent the receipt of signals from another IDC or SLC or addressable device point.

- B. The transmission method shall provide for identification by zone of any alarm, supervisory, or trouble condition on an IDC/SLC and by both zone and/or addressable device point alarm, supervisory, or trouble condition for any addressable initiating device point on the system by means of panel programming in the panel's software. The control unit shall be capable of transmitting a minimum of 48 user defined zones and each addressable initiating device point individually. Use of interfacing relays between the FACP and communication transceiver to provide point or zonal alarm and trouble status shall not be permitted. The number of zones/points to be transmitted and their identification shall be coordinated with the base fire department. Loss of power, including any or all batteries, shall not require the reloading of a program from any source. Upon restoration of power, startup will be immediate, automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory, or trouble signals. Panel shall be listed or approved compatible with the existing base-wide Monaco Enterprise's D-21 Incident Management System.
- C. The FACP shall have a minimum capacity of sixteen (16) Style 4 or eight (8) Style 6 or 7 addressable SLC with class of operation selectable by programming function. The unit shall be expandable to the maximum capacity by addition of plug-in circuit cards in existing sockets and shall be provided with all hardware to support a minimum of two (2) Style 6 or 7 signaling line circuits. Aside from programming, no other FACP additions or modifications shall be required for expansion. Each plug-in card shall support up to 99 addressable sensor device points (smoke or heat) and 99 addressable modules (monitor or control). In addition, the control unit shall provide connections for up to four (4) Class B, jumper selectable to two (2) Class A, conventional initiating circuits and four (4) Style Y, jumper selectable to two (2) Style Z, Notification appliance circuits. A minimum of two (2) programmable on-board relays shall be provided.
- D. The fire alarm control panel shall be a Monaco M-2A addressable panel with integrated radio transceiver.

#### 2.1.1 Operational Features

- A. The system shall have the following operational features:
  - 1. Electrical supervision of alarm initiation device circuits, signaling line circuits and notification appliance circuits, and auxiliary output circuits for open, short, or ground fault conditions.
  - 2. Electrical supervision of the primary power (ac) supply, presence of the battery, battery voltage, battery charger voltage, and all fusing devices.
  - 3. Electrical supervision of expansion module connections.
  - 4. Electrical supervision of the transmitter interrupt and disconnect circuitry.
  - 5. A trouble buzzer and trouble LED (light emitting diode) which activate when any supervised circuit is compromised. The trouble condition shall be further identified by a plain English LCD display. A trouble silencing switch shall be provided which will silence the trouble buzzer but not extinguish the trouble LED or remove the trouble condition from the display. After the fault is corrected, the system shall automatically return to normal operating condition.

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6. An evacuation alarm silencing switch which will turn off the alarm indicating devices designated as silenceable. Operation of the alarm silencing switch will not affect the alarm indicating LED or display nor the operation of the transceiver. This switch shall be arranged so that activation of a subsequent alarm on an unalarmed zone or device shall cause the evacuation alarm signaling devices to reactivate.
7. Switches for testing the indicating LEDs and trouble buzzer and for performing drill tests.
8. A transceiver disconnect function to allow testing and maintenance of the system without activating the transmitter.
9. PC/terminal emulation programming capability which allows entry of zone identification, description, and type, device description, device address, device location, operating parameters and all other required programming to provide a complete system as described herein and on the system drawings.
10. Storage of the programmed configuration in nonvolatile memory. Simultaneous or subsequent actuation of any individual messages (from zones or devices not initially in alarm), including those actuated during "off air" periods, shall not result in the loss of any messages.
11. Integrated Radio Transceiver to support communication between the FACP and the base central fire alarm receiving and mass notification control system
12. Monitoring circuitry to detect and shut down a continuously keyed transmitter.
13. Zones for alarm initiating circuits shall be arranged as indicated on the contract drawings.
14. Supervision of intelligent detection sensors, monitor and control modules

#### 2.1.2 Alarm Functions

- A. An alarm condition on an IDC or addressable device shall automatically initiate the following functions:
  1. Transmission of an alarm signal to the base fire alarm receiving system identifying the Building number, name and zone/point description.
  2. Lighting of an alarm indicating LED and activation of a plain English display identifying the activated IDC and/or addressable device.
  3. Continuous activation of the alarm notification appliances throughout the building and activation of all associated control outputs as identified by system programming.

#### 2.2 NOTIFICATION APPLIANCE NETWORK

- A. The notification appliance network shall comply with NFPA 72 and the requirements of UFC 4-021-01 Design and O&M: Mass Notification Systems using separate notification appliances for the fire alarm and mass notification systems.

##### 2.2.1.1 Notification Appliance Location

- A. Speakers shall provide interior coverage throughout the building. Horn/strobes and strobe only devices.
- B. Notification appliances shall be located per the contract drawings, in accordance with NFPA 72 notification appliance placement standards. Notification appliance design shall comply with the relevant sections of NFPA 72.

##### 2.2.1.2 Audible Intensity

- A. The system shall be designed for effective notification within the building in accordance with the requirements of NFPA 72.

##### 2.2.2 Visual Notification Appliances for Fire

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- A. Visual notification appliances shall satisfy all ADAAG Guidelines. Separate strobes shall be provided for Fire and MNS activation.

#### 2.2.2.1 Visual Notification Appliance Location

- A. Visual notification shall be installed in accordance with NFPA 72 visual notification appliance placement standards.
- B. Notification appliances shall be located per the contract drawings, in accordance with NFPA 72 notification appliance placement standards. Notification appliance design shall comply with the relevant sections of NFPA 72. Preference shall be given to ceiling mounted locations.

#### 2.2.2.2 Visual Notification Type appliances shall be suitable for installation in commercial and industrial applications and suitable for the intended climatic and environmental conditions. Strobes shall utilize a xenon flash tube outputting white light and at a flash rate of 1 flash per second.

#### 2.2.2.3 Sync-Rated Strobes

- A. Strobes shall meet strobe visibility and synchronization requirements in accordance with NFPA 72.

#### 2.2.2.4 Strobe Markings and Colors

- A. Separate strobes shall be used for mass notification and fire
  - Mass notification strobes body shall be white with amber-colored lens and marked with the word "ALERT" to alert the hearing impaired.
  - Fire strobe shall be white with white/clear strobes marked with the word "FIRE".

#### 2.2.3 PRIMARY POWER

- A. Operating power shall be 120 Vac 60hz provided from a single dedicated branch circuit via a single pole, 20 amp lockable circuit breaker. The circuit shall be identified by a red nameplate with the words "FIRE ALARM/MNS CIRCUIT CONTROL." Upon loss of ac power or during a brownout condition, the fire alarm control panel shall automatically and instantaneously switch to standby battery power without loss of any alarm signals and without causing transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal to the fire alarm receiving system upon operation of any initiating circuit. Loss of ac power shall also activate a trouble indication and cause an ac failure message to be transmitted if ac power is not restored within one minute. Upon restoration of ac power, transfer back to ac operation shall be automatic. Power supply filtering shall prevent false message transmissions caused by transient or steady-state electrical disturbances.

#### 2.2.4 EMERGENCY POWER

- A. Emergency power shall be through use of rechargeable, sealed-type storage batteries requiring no addition of water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system/transceiver for a period of 48/10 hours. Following this period of battery operation, the batteries shall retain sufficient capacity to operate the system in alarm mode for 15 minutes and transmit an alarm to the central system during this time. Batteries shall be located within the fire alarm enclosure or in a separate battery cabinet. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm control panel. The cabinet shall be painted to match the fire alarm control panel according to 4.12.10 and both units shall be keyed alike.

#### 2.2.5 Battery Charger

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- A. The battery charger shall be integral to the fire alarm control or provided as a separate unit and shall be completely automatic, capable of recharging the batteries from full discharge (18 Volts) to full charge within 48 hours.

#### 2.2.6 CIRCUIT CONNECTIONS

- A. Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each terminal marked for identification. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment and to provide sufficient space for all external wiring entering the cabinet. Where more than one module is required to form a control unit, the interconnection between modules shall be supervised. Where addressable devices contain an LED for alarm indication, the control panel shall support the lighting of up to a total of 160 alarm LEDs at one time or up to 20 device LEDs on a single addressable signaling line circuit.

#### 2.2.7 PROGRAMMING

- A. All required programming of the system shall be capable of being accomplished from programming software operating on a portable PC (laptop). An RS-232 port shall be provided for programming via a PC or terminal. All software, interconnecting cables and instructions required for programming shall be provided to the government without additional cost under this contract. All programming information internal to the control panel shall be stored in non-volatile memory and shall not be lost in the event of a total system power failure. Programming software shall allow "Control by Event" type programming wherein specific inputs may control specific outputs for either fire alarm, MNS or other non-fire/MNS control. The programming interface shall be a graphical user type interface. Remote programming software shall be compatible with Microsoft® Windows® XP operating systems and shall allow programming to be entered and confirmed prior to downloading into the control unit. The software shall also allow the off-loading of current programmed information from the control unit to the remote programming device. Capability shall be provided to create, modify, store and print program data.

#### 2.2.8 Remote Equipment Connections

- A. The control unit shall contain an RS-232 port for connection of a local/remote printer and an RS-422 port for connection to remote graphical, programmable, annunciators. Provisions shall also be provided for connections to standard LED type annunciators where shown on the drawings. Where provided, communication connections to remote graphical type annunciators shall be supervised.

#### 2.2.9 Internal Communications

- A. The control unit firmware shall orchestrate and control all internal communications as well as all communications to the addressable devices via the signaling line circuits. All internal communications shall be in a digital format. Signaling line circuit communications shall be such that all addressable devices, up to the maximum allowed quantity of the system, shall be polled within four (4) seconds. Signaling line circuits shall be capable of being connected in either NFPA Style 4, 6 or 7 and shall be protected such that a short circuit on the signaling line will not damage the equipment or prevent normal operation of any other SLC. All open, short or ground faults on signaling lines shall result in a trouble indication.

#### 2.2.10 Additional Features

- A. In addition to those specified elsewhere, the addressable fire alarm control panel shall provide the following operational features:

#### 2.2.11 Programmable Mass Notification System Actions

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- A. The addressable fire alarm control panel shall provide at least four (4) user programmable actions when the MNS system is activated. These actions shall be initiated by commands from the MNS FSK transceiver. Interface between the FACP and MNS FSK transceiver shall be by supervised a RS-422 serial port connection.

#### 2.2.11.1 Addressable Smoke Sensors

- A. The control panel shall support both ionization and photoelectric type smoke sensors. In addition, the control panel will provide high and low maintenance alerts, pre alarm signals, programmable sensitivity adjustment and alarm verification capability.

#### 2.2.11.2 Lamp Test

- A. A lamp test switch shall be provided on the control unit which will light all panel LEDs for test purposes.

#### 2.2.11.3 Drill Test

- A. A drill test switch shall be provided on the control panel which will activate all circuits and control modules designated as type NAC (Notification Appliance Circuit). Operation of the drill test switch shall not result in an alarm transmission to the central system supervising station or operation of any supplementary circuits such as air handling unit (AHU) shutdown.

#### 2.2.11.4 Transmitter Disconnect Circuit

- A. The connected FSK Transceiver shall provide a transmitter disconnect mechanism providing the following features: A circuit which automatically disconnects the transmitter in the event the transmitter stays in a transmit condition for a period longer than 30 seconds. A transmitter reset button which will reconnect the transmitter when operated. A transmitter disconnected LED to indicate when the transmitter has been automatically disconnected. A failure warning to the central system supervising station if the transmitter has been automatically disconnected.

#### 2.2.11.5 Walk Test

- A. The control panel shall contain provisions for placing the system in a walk test mode. In this mode, activation of any sensor or monitor module included in the walk test program shall activate the visual devices for a period of approximately two (2) seconds. The walk test mode shall not initiate an alarm transmission to the central system supervising station or activate any supplementary devices not specifically included in the walk test program.

#### 2.2.11.6 History Log

- A. The control panel shall contain the capability to store for display or printing up to 500 events including time and date information. History events shall be stored in non-volatile memory. Provisions shall be included to allow the history file to be downloaded to the aforementioned Windows program for storage, printing or analyzation. A means shall also be provided to clear all history entries from the control unit under password control.

### 2.3 ADDRESSABLE SENSORS AND DEVICES

#### 2.3.1 Addressable Smoke Sensors

- A. Addressable smoke sensors shall be located as shown on the drawings. All addressable smoke sensors shall consist of a detector head and separate twist lock base. Detector bases shall accommodate either ionization or photoelectric type detector heads, however, except where indicated, photoelectric heads shall be provided. All wiring shall connect to the detector base via screw type terminals. Each detector assembly shall contain two (2) LED indicators which will flash to indicate a detector poll from the control unit and light steady to indicate an

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alarm. Where required, detector/base combinations shall include remote indicator, relay operation or internal alarm audible (sounder) signaling devices. Detector addressing means shall be rotary or dip type switches which require no special tools to operate. Jumper arrangements or plug in components will not be accepted. Addressing means shall clearly show the address set for the unit without binary interpretation. Ionization sensors shall operate on the dual chamber principle with both a reference and sensing chamber. Photoelectric sensors shall operate on the light scattering principle. All sensors shall be compatible with the control unit and support all required operational features of the control unit. Sensors shall be rated for 30' spacing on smooth ceilings.

#### 2.3.2 Addressable Heat Sensors

- A. Addressable heat sensors shall be located as shown on the drawings. Fixed temperature and combination fixed temperature and rate of rise types shall be rated as shown. Heat detector assemblies shall consist of a detector head utilizing a dual thermistor sensing circuit and twist lock base and shall contain two (2) LED indicators for polling and alarm indications. Detector bases shall provide screw terminals for wiring connections and will accommodate both types of sensors. Addressing means and compatibility shall be as indicated in paragraph 2.12.3.1. Sensors will be rated for 50' spacing on smooth ceilings.

#### 2.3.3 Addressable Manual Pull Stations

- A. Addressable manual stations shall be located as indicated on the drawings. Manual stations shall be surface mounted at a height of 48" AFF. Where existing flush or semi-flush stations are to be replaced, existing mounting locations may be reused if under 54" AFF. Manual stations shall be finished in red with raised letters in a contrasting color indicating operating instructions. Stations shall be single action type with key lock for test/reset. Stations shall be keyed the same as the control panel. The addressable function may be accomplished by connection of a standard manual station to an addressable monitor module provided the connection is supervised. Addressable modules may be located in the pull station back box. See section 2.3.5. Stations requiring the breaking of glass or plastic rods or panels are not acceptable. Addressing means shall be as indicated in paragraph 2.3.1. Gravity or mercury switches are not acceptable.

#### 2.3.4 Addressable Duct Sensors

- A. Addressable duct smoke sensors shall be installed as shown on the drawings. Duct sensors shall be photoelectric type meeting the requirements of paragraph 2.3.1 and shall be mounted in a special housing fitted with duct sampling tubes where duct sizes exceed 2' in width. Sensors and associated circuitry shall be mounted in a housing exterior to the duct. Sampling tubes shall run the full width of the duct. Sensors shall be listed for air velocities between 100 and 4000 fpm. Duct sensors shall be powered from the fire alarm panel. Where AHU shutdown is required, it shall be performed by the fire alarm panel. Addressing means shall be as indicated in paragraph 2.3.1. Duct sensors located above 6' AFF or in difficult to access locations shall be furnished with remote test, alarm indicator and reset controls.

#### 2.3.5 Addressable Monitor Modules

- A. Addressable monitor modules shall be provided for connection of non-addressable devices such as water flow switches, supervisory switches and detection devices not available as addressable devices as shown on the drawings. Monitor modules shall provide supervised initiating device circuits which may be connected in either Class A or Class B configuration. Addressable monitor modules shall be mountable to a standard electrical box and shall contain an LED to indicate polling and alarm conditions. Addressing means shall be as indicated in paragraph 2.3.1. Small profile (mini) Monitor modules used to connect to a single manual pull station can be connected in a Class B configuration and a status LED is not required.



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#### 2.3.6 Addressable Control Modules

- A. Addressable control modules shall be provided and installed where shown on the drawings to provide supplementary fire alarm control. Control modules shall provide dry contact or supervised output capability for both Style Y and Style Z circuits. Control modules shall mount to standard electrical boxes and shall contain an LED to indicate polling and active output. Where connected to powered devices, power will be provided from the fire alarm control system and shall be supervised. Addressing means and compatibility shall be as indicated in paragraph 2.3.1.

#### 2.3.7 Central System Communication Transceiver

- A. The FACP shall share a common FSK radio transceiver with the MNS control panel. Communication interface between the FACP and FSK Fire/MNS transceiver shall be provided by a supervised RS-422 serial data connection. This interface will support communication between the FACP, the local building mass notification system and the base central fire alarm receiving and mass notification control systems. The FSK Fire /MNS transceiver shall be allowed to be in an enclosure separate from the FACP and shall be housed in a common enclosure with the MNS control panel.

### PART 3- MASS NOTIFICATION SYSTEM (MNS) CONTROL PANEL WITH MNS RADIO TRANSCEIVER

#### 3.1 MASS NOTIFICATION SYSTEM CONTROL PANEL WITH INTEGRATED FIRE/MNS TRANSCEIVER

- A. The MNS control panel with MNS transceiver (MNS Control/Transceiver) shall provide local live-voice and prerecorded voice/tone emergency messages, as defined in paragraph 3.10, to occupants in the facility. It shall include an FSK transceiver to provide centralized control of the building MNS and shall monitor the MNS control panel for alarm and trouble status and transmit them to the base wide central fire alarm receiving and mass notification control system. An MNS Control/Transceiver shall be installed in each facility or building as indicated on the contract drawings and shall meet these requirements. The MNS Control/Transceiver shall be a standard manufacturer's product, fully factory assembled, tested and installed in an enclosure meeting the requirements of paragraph 3.4. The MNS Control/Transceiver shall be allowed to be in an enclosure separate from the MNS control panel.
- B. The mass notification system shall utilize a Monaco BT-XM mass notification communicator.

#### 3.2 COMPATIBLE WITH BASE CENTRAL FIRE ALARM AND MNS CENTRAL CONTROL SYSTEM

- A. The MNS Control/Transceiver shall be compatible with the base central mass notification control system at Barksdale Air Force Base factory tuned to operate at the dedicated radio frequency of the system. Consult the manufacturer of the mass notification system central controller to determine compatibility.

#### 3.3 COMPATIBILITY WITH THE FIRE ALARM CONTROL PANEL

- A. The MNS Control/Transceiver, if required, shall be compatible with the building fire alarm control panel meeting the requirements of Section 2 of this specification.

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### 3.4 ENCLOSURE

- A. The MNS Control/Transceiver enclosure shall be fabricated from sheet steel conforming, as a minimum, to the NEMA standard 1 for indoor locations of the NEMA ICS 6 standard. It shall be painted red according to 4.12.10. Provisions shall be made for conduit (minimum 3/4 inch) entry and attachment to no fewer than two places on the housing. Switches and other controls shall not be accessible without the use of a key.

### 3.5 ENVIRONMENTAL OPERATING REQUIREMENTS

- A. The MNS Control/Transceiver shall be designed for reliable operation in an ambient temperature range of 0° C to +49° C (32° F to +120° F), humidity 0-90% relative, non-condensing.

### 3.6 POWER REQUIREMENTS

- A. The MNS Control/Transceiver shall be powered by a combination of locally available 120 or V ac power and spill-proof, sealed gel-type lead acid battery requiring no addition of water or electrolyte. Operating power shall be obtained from a single connection to a dedicated, fused branch circuit of the building's regular 60 or Hz ac service. The primary power supply for the MNS Control Panel and the MNS Transceiver may be integrated or separate. In the event of loss of respective ac power, the MNS Control/Transceiver shall automatically and instantaneously switch to a secondary power source. Power supply filtering shall prevent nuisance message transmissions caused by transient or steady state electrical disturbances. Upon restoration of ac power, transfer back to ac operation shall be automatic. Depending upon backup battery requirements, the battery and converter/battery charger can be installed within the unit housing or can be in a separate locked enclosure.
- B. The MNS Control/Transceiver power supply shall be provided with suitable transient protection that meets the requirements of IEEE C62.41. The battery shall be capable of supplying all power requirements of unit and connected devices. The standby battery capacity shall provide sufficient power to operate the unit in normal standby status for 48/10 hours, shall support an alarm condition for [5] [15] minutes, and shall be capable of initiating a message the end of the period.

#### 3.6.1 Battery Supervision

- A. Each MNS Control/Transceiver shall constantly monitor and supervise its respective battery power supply. Loss of ac power shall also activate an indicator and cause a common trouble message to be transmitted to the central system.

### 3.7 ON-BOARD MICROPHONE LIVE-VOICE

- A. Each MNS Control/Transceiver shall have an on-board push-to-talk (PTT) microphone for live, emergency voice announcements and instructions. The on-board microphone shall override (mute) any voice message or tones in progress.

### 3.8 LOCAL OPERATING CONSOLE

- A. A local operating console shall be provided as indicated on the contract drawings. This console shall include a handheld PTT microphone with pre-amplifier and associated LEDs. The microphone shall override locally stored prerecorded messages. Central-initiated live-voice messages shall not be overridden by the local operating console. The local operating console shall provide activation controls to manually activate pre-recorded messages and tones that are resident on the MNS Control/Transceiver and shall initiate the MNS visual strobes.

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### 3.9 PRERECORDED TONES AND MESSAGES

- A. Each MNS Control/Transceiver shall be capable of storing a minimum of eight pre-recorded messages that are programmed into the unit in replaceable non-volatile memory. These messages can include tones followed by a voice message that shall be automatically repeated until terminated by the central system operator, at the MNS Control/Transceiver, or until a user-defined timeout period is reached.
- B. The message order and textual script shall be as follows: (use Barksdale Standard Message Set)

### 3.10 LIVE-VOICE MESSAGES

- A. Each MNS Control/Transceiver shall be capable of delivering live-voice messages initiated from the central control system, the on-board microphone, or from a local operating console.

### 3.11 CHANNELS AND AMPLIFIER POWER

- A. The MNS Control/Transceiver shall provide adequate channels and amplification power to meet intelligibility requirements as specified on the contract drawings of **Error! Reference source not found.**

### 3.12 MNS STROBE POWER

- A. The MNS Control/Transceiver shall provide on-board strobe NAC power for powering and controlling the strobes of the MNS visual notification appliance network. Where strobe current requirement exceeds the limit of the on-board strobe power source, auxiliary strobe NAC supervised power expansion modules can be added.

### 3.13 SUPERVISION AND DIAGNOSTICS

- A. Each MNS Control/Transceiver shall be fully supervised with on-board diagnostics and trouble reporting for the following:
  - 1. Audio NAC wiring shall be supervised for open and short conditions.
  - 2. Strobe NAC wiring and auxiliary expansion modules shall be supervised for open and short conditions.
  - 3. Self-amplified power output circuit wiring shall be supervised for open and short conditions.
  - 4. Microphone shall be supervised for an open condition.
  - 5. Amplifier shall be supervised for communication.
  - 6. Input voltage/low battery shall be supervised.
  - 7. Remote microphone station shall be supervised.
- B. Any supervision loss shall result in a trouble condition, annunciated locally by built-in audible alert and LED indicators. The transceiver shall transmit the trouble message to the central system.

## PART 4- MNS FSK TRANSCEIVER MODULE

- A. The MNS Alarm transceiver shall be a Factory Mutual (FM) approved or Underwriter's Laboratory (UL) approved transceiver compatible with the base central system. The MNS/fire alarm transceiver shall employ FSK message encoding and communicate via dedicated licensed radio frequency as the primary method of communication. Notwithstanding any other requirements herein, no other equipment will be acceptable.

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- B. All indicators and switches shall be clearly identified. Status LED indicators shall be provided for alarm, trouble, and communication with central, including carrier detect, and transmitting. Power LED indicators shall also be provided to indicate the status of power: primary power in use, battery power in use, float charge and boost charge when the power supply is charging the battery or batteries. Switches shall be provided for battery start, acknowledge trouble or alarm, test, and reset the unit. All switches shall be within the locked cabinet. The transmission method shall provide for identification by zone of any alarm, supervisory, or trouble condition on the addressable FACP system or connected devices. Loss of power, including any or all batteries, shall not require the reloading of a program from any source. Upon restoration of power, startup will be immediate, automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory, or trouble signals.
- C. The MNS/fire alarm transceiver shall provide a minimum of eight on-board relay drivers connected to a relay board installed within the enclosure.

#### 4.1 RADIO FREQUENCY ALLOCATION

- A. The MNS/fire alarm transceivers shall be factory configured to operate on the dedicated licensed frequencies of the respective system. Transceivers shall be single-channel synthesized.

#### 4.2 POWER REQUIREMENTS

- A. Each MNS/fire alarm transceiver shall be powered by a combination of locally available 120 or V ac power and spill-proof, sealed gel-type lead acid battery requiring no addition of water or electrolyte. Operating power shall be obtained from a single connection to a dedicated, fused branch circuit of the building's regular 60 or Hz ac service. Where a local energy fire alarm control panel is fed by the same arrangement, a common feed to both the local panel and the transceiver is permitted. In the event of loss of ac power, the transceiver shall automatically and instantaneously switch to standby battery power without loss of any alarm signals. Loss of ac power shall also activate an indicator and cause an ac failure message to be transmitted if power is not restored within 60 seconds. Power supply filtering shall prevent nuisance message transmissions caused by transient or steady state electrical disturbances. Upon restoration of ac power, transfer back to ac operation shall be automatic. Under presence of ac power, batteries shall be charged through a converter/float charge. The charger shall recharge a fully discharged battery in not more than 48 hours while the transceiver is operating under ac power. The battery and converter/battery charger shall be installed within the fire alarm transceiver housing.
- B. The MNS/fire alarm transceiver power supply shall be provided with suitable transient protection that meets the requirements of IEEE C62.41.

#### 4.3 BATTERY CHARGER

- A. The battery charger shall be integral to the transceiver or provided as a separate unit and shall be completely automatic, capable of recharging the batteries from full discharge (10.8 Volts) to full charge within 48 hours.

#### 4.4 BATTERY POWER

- A. The battery package shall be capable of supplying all power requirements of the fire alarm Transceiver.

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#### 4.5 BATTERY DURATION

- A. MNS/fire alarm transceiver standby battery capacity shall provide sufficient power to operate the unit in a normal standby status for a minimum of 48 hours and be capable of transmitting an alarm signal at the end of the period. Each fire alarm transceiver shall disconnect the standby batteries before the batteries are permanently damaged by excessive discharge.

#### 4.6 BATTERY SUPERVISION

- A. Each MNS/fire alarm transceiver shall constantly monitor and supervise its battery power supply. A Battery Fault message shall be transmitted when battery voltage under load falls below 85% percent of the rated battery voltage, but in any case, prior to the point at which the battery will fail to operate the transceiver and before the low battery disconnect activates. A unique Battery Fault message will also be transmitted upon disconnection or removal of the battery supply and when charging system faults occur.

#### 4.7 GROUNDING

- A. Non current carrying metallic parts associated with new fire alarm equipment shall have maximum resistance to solid "earth" ground not to exceed the following values:
  - Antennas 10 ohms
  - Radio Transceiver 10 ohms

#### 4.8 CIRCUIT CONNECTIONS

- A. Circuit conductors entering or leaving the enclosure shall be connected to screw-type removable terminal blocks that are marked for identification. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the equipment within the enclosure and to provide sufficient space for all external wiring entering the cabinet. All wiring shall be color coded and shall be clearly labeled with permanent self sticking markers.

#### 4.9 PROGRAMMING

- A. All required programming of the system shall be capable of being accomplished using a personal computer that runs a terminal emulation program that displays the transceiver's program menu stored in non-volatile memory. In addition, a RS-232 port shall be provided for programming. All software and programming information shall be stored in non-volatile memory and shall not be lost in the event of a total system power failure. The programming interface shall be menu driven and all entries shall be alpha-numeric based on menu prompts.

#### 4.10 ANTENNAS AND CABLES

- A. Building mounted antennas may be omnidirectional or directional (as appropriate) with a driving point impedance of 50 ohms. All antennas shall be installed external to buildings and shall be located in accordance with manufacturers' recommendations. The antenna and antenna mounts shall be designed to withstand wind velocities of up to 100 miles per hour. Each fire alarm transceiver shall have its own antenna. Antennas shall be of non-corrosive materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead power circuits. Coaxial cables shall be RF type (50 ohm) and shall include PL, BNC and/or N type fittings or connectors as appropriate.

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#### 4.11 LIGHTNING PROTECTION

- A. All antennas shall be provided with coaxial static lightning static surge protection installed in suitable enclosures and grounded in accordance with NFPA 70, Article 810. Surge protectors shall of a type approved by the manufacturer and shall be located as close as practicable to the grounding location. Ground conductors shall be 10 AWG solid copper or 8 AWG solid aluminum minimum. All antenna coax shall be installed in conduit.

#### 4.12 FUNCTIONAL REQUIREMENTS

- A. In addition to those specified elsewhere, the MNS/fire alarm transceiver shall provide the following operational features:
- B. The MNS transceiver shall include a circuit that automatically disconnects the radio transmitter in the event the transmitter stays continuously in a transmit condition for a period of 30 seconds. A transmitter reset button shall also be provided which will reconnect the transmitter when manually operated. A transmitter disconnected LED shall be provided to indicate the transmitter has been automatically disconnected. A transmitter which has been automatically disconnected will be indicated during the next scheduled polling cycle by a communication "no reply" at the Central System.
- C. The MNS alarm transceiver shall be a complete, microprocessor controlled supervised unit with the capacity to communicate with the Central System via methods stated herein. The transceiver shall remain in the alarm mode until the initiating fire alarm control panel is reset and restored to the normal operating mode.
- D. The transceiver shall have the following operational features:
  - 1. Electrically supervised connection to the addressable FACP that reports all regular messages in addition to communications faults. Electrically supervised connection(s) to the MNS control panel that report local MNS activations, and supervisory conditions including open, short, or ground fault conditions.
  - 2. Electrical supervision of the primary power (ac) supply, presence of the battery, battery voltage, battery charger voltage, and all fusing devices.
  - 3. Electrical supervision of expansion module connections.
  - 4. Electrical supervision of the transmitter interrupt and disconnect circuitry.
  - 5. A trouble audible alert and trouble LED (light emitting diode) that activate when any supervised circuit is compromised. A trouble silencing switch shall be provided, which will silence the trouble buzzer but not extinguish the trouble LED. After the fault is corrected, the system shall automatically return to normal operating condition.
  - 6. Switches for testing the indicating LEDs.
  - 7. On-board programming capability accessed using a terminal emulation program that allows entry of operating parameters and all other required programming to provide a complete system as described herein and on the drawings.
  - 8. Storage of the programmed configuration in nonvolatile memory. Simultaneous or subsequent actuation of any individual messages (from zones not initially in alarm), including those actuated during "off air" periods, shall not result in the loss of any messages.
  - 9. The communication method to the central system shall allow an interrogation/reply technique in which the transceiver is interrogated at regular time intervals automatically, as well as manually by the operator from the central system, and replies are returned by the MNS/fire alarm transceiver indicating unit status. MNS/fire alarm transceivers shall be fully compatible with the existing base central system.
  - 10. Monitoring circuitry to detect and shut down a continuously keyed transmitter.

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#### 4.12.1 Alarm and Trouble Functions

A. An alarm or trouble from the connected MNS control panel and the connected addressable FACP shall automatically initiate the following functions:

1. Transmission of an alarm or trouble signal to the central system identifying the identity code, zone position/point ID and status change.

#### 4.12.2 MNS Central System Control Interface

A. Live-voice audio from the central system shall be provided as an output from the transceiver shall be transformer coupled, dc isolated, with an integral supervision resistor and a Form "A" (NO) key relay to trigger and terminate central source live-voice messages. The output level shall be field programmable and provide the following output levels:

- |   |                    |                          |
|---|--------------------|--------------------------|
| ▪ | Output Level Low:  | 0.08 VRMS @ 1kHz nominal |
| ▪ | Output Level Med:  | 0.3 VRMS @ 1kHz nominal  |
| ▪ | Output Level High: | 1.0 VRMS @ 1kHz nominal  |
| ▪ | Output Level High: | 1.0 VPTP @ 1kHz nominal  |

B. A minimum of eight isolated relays shall be provided for connection to the MNS control panel to activate pre-recorded messages from the central system. The relays shall be normally open or Form C with isolated dry contacts. The eight relays shall be provided to trigger the playing and stopping of pre-recorded tones and messages under automatic or manual commands from the central system.

#### 4.12.3 Optional Features

A. In addition to those specified elsewhere, the MNS/fire alarm transceiver shall support the following features through the purchase of optional equipment:

#### 4.12.4 Generation of Signals

A. Each MNS/fire alarm transceiver shall provide for a prioritized transmission of all initiated signals; alarms shall always have reporting priority. The unit shall transmit all alarms, troubles, and status changes at programmed intervals until receipt of the message is acknowledged via return acknowledgement message from the central system.

#### 4.12.5 Power Output

A. The radio frequency (RF) power output of each fire alarm transceiver shall be a minimum of four (4) watts or as required for reliable reception over long distances. Note: UHF frequencies in the range of 450 to 470 MHz may be limited by the area frequency coordinator to two (2) watts maximum power output.

#### 4.12.6 Memory

A. The MNS/fire alarm transceivers shall have adequate memory capability to ensure that simultaneous or subsequent actuation of any individual messages (from zones not initially in alarm), including those actuated during "off air" periods, shall not result in the loss of messages. Such messages shall be stored until they are successfully transmitted.

#### 4.12.7 MNS Transceiver Identity Code

A. The MNS transceiver shall transmit a distinct identity code as part of all signals emanating from the transceiver. The MNS/fire alarm transceiver identity code and any other parameters required for proper operation of the transceiver shall be programmed into the MNS alarm transceiver using a terminal emulation program. The identity code shall allow entry of at least four digits.

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#### 4.12.8 Message Designations

- A. The MNS alarm transceiver shall allow as a minimum, or as required, no less than ten distinct and individually identifiable message designations indicating the status of the addressable FACP unit and its zone inputs:
1. **Alarm Messages** Alarm messages shall be transmitted upon automatic or manual actuation of the addressable FACP device inputs. The transceiver identity code and addressable FACP zone causing the actuation shall be individually identified with the transmission; each MNS/fire alarm transceiver shall be capable of transmitting a minimum of four unique alarm messages associated with the connected MNS control panel and which are identifiable at the central system as fire type zones with a description of the zone. The transceiver shall also be capable of transmitting a trouble signal for each zone. In addition, restoration of the zone input to normal shall result in a specific restoration signal being transmitted to indicate the return of the zone to normal supervisory condition.
  2. **Test Message** Each fire alarm transceiver shall be capable of responding to automatic continuous or scheduled polls as well as manually activated system or individual transceiver polls. If the schedule method of interrogation is selected, automatic testing shall occur at least once each 24 hours—at intervals of from one to 24 hours, selectable in one-hour increments—and the time(s) of occurrence shall be specified by the user. The central system console CPU module clock shall regulate scheduled tests. Fire alarm transceiver response to test messages shall include their current status including identification of all off-normal conditions.
  3. **Tamper Message Designations** Each exterior or publicly accessible fire alarm transceiver shall provide for connection of an optional enclosure tamper and/or tilt switch and shall transmit a message automatically when the switch is activated if programmed to do so. The message shall be identified as tamper and shall include the MNS/fire alarm transceiver identity. The MNS/fire alarm transceiver shall transmit a restoration to normal message when the tamper switch is returned to the normal position.
  4. **Trouble Message Designation** Each MNS/fire alarm transceiver shall provide for automatic transmission of the following separate identifiable trouble messages:
    - **Trouble Reported** if a supervised circuit or device on the addressable FACP senses an open, short or ground fault condition. This message shall identify the transceiver identity code and zone/point position of the trouble. When the trouble is corrected, the MNS/fire alarm transceiver shall transmit a message indicating the unit and zone/point and the restoration to normal condition.
    - **AC Fail Reported** when the ac power source has failed for 60 seconds. This message shall be identified by the MNS/fire alarm transceiver identity code. When ac power is restored, the MNS/fire alarm transceiver shall transmit a message indicating the unit and zone position and the restoration to normal condition.
    - **Battery Fault Reported** if the battery supply voltage under load (1) falls below 85% of its rated voltage, (2) the battery supply is disconnected from the transceiver or (3) the battery charger voltage is high or low. This message shall be identified by the transceiver identity code. When the battery is recharged, replaced, or reconnected, the transceiver shall transmit a message indicating the unit and zone position and the restoration to normal condition.

#### 4.12.9 Environmental Operating Requirements

- A. MNS/fire alarm transceivers shall be designed for reliable operation in an ambient temperature range of 0° C to +49° C (32° F to +120° F).



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#### 4.12.10 Painting

- A. MNS/fire alarm transceiver enclosures shall be factory painted with polyester powder-coat paint. The finish color shall be "Fire Engine Red". Painted surfaces damaged during installation shall be repainted to match the existing paint.

#### 4.12.11 Access

- A. Switches and any other controls shall not be accessible without the use of a key. Access to controls shall be by unlocking and opening a panel or door.

#### 4.12.12 Inputs/Outputs

- A. MNS transceiver shall provide a minimum of eight relays for the purpose of connecting to the MNS control panel.

#### 4.12.13 Installation Wiring

#### 4.12.14 Primary and Secondary Communication with Central System

- A. The MNS/fire alarm transceiver shall communicate with the central system using FSK radio operating on a dedicated, licensed frequencies, as the primary communication method.

### PART 5- INSTALLATION

- A. The contractor shall provide all equipment, labor, materials, transportation and documentation required herein and on the drawings to install a complete and operable system to include all required testing and test documents. The installation shall be provided by skilled craftsman trained in the installation of these types of systems.
- B. The installing contractor shall be UL listed as a fire alarm installer under category UUJS of the UL Fire Protection Equipment Directory. The installation shall be under the direct supervision of a factory trained representative of the equipment manufacturer with a minimum of four (4) years experience in the installation of similar systems. Qualifications of the installers and supervisor shall be provided to the Contracting Officer upon request.

#### 5.1 CONDUIT AND WIRING

- A. Conduit, raceway, and wiring shall be in accordance with the requirements of NFPA 70, NFPA 72. Wire for primary AC volt circuits shall be No. 12 AWG, type THHN, minimum. All wiring shall be color coded and shall be clearly labeled with permanently affixed markers. AC power and low voltage (NAC, IDC, SLC etc) wiring shall be installed in separate conduit.
- B. All system wiring shall be approved for fire alarm use and shall be installed in metallic conduit or raceway. All conduit penetrations through walls shall be sealed with appropriate fire resistant material. Conduit runs shall follow the building contours and shall be installed parallel or perpendicular to walls and ceilings. All conduit field bends shall be made by benders specifically designed for the purpose. All junction boxes shall be sized to accommodate the number of conductors installed in accordance with the NEC. Conduit wire fill shall not exceed 40% percent. Conductors for lighting, power or class 1 circuits shall not be installed with fire alarm conductors in any conduit, raceway or cable.

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#### 5.1.1 Fault Tolerance and Supervision

- A. Fire alarm system wiring shall be installed Style 6 or Style 7 for addressable signaling line circuits (SLC), Class A for initiating device circuits (IDC) and Style Z for notification appliance circuits (NAC). SLCs, NACs and IDCs shall have supply and return conductors installed in separate conduits in accordance with NFPA 72.

#### 5.2 WORK HOURS

- A. All work shall be accomplished between the hours of 7:00 AM and 5:00 PM excluding weekends and designated holidays. The facility is expected to be occupied during installation operations and care shall be exercised to protect occupants, equipment and furnishings from injury or damage during installation. All damage to existing facilities shall be promptly repaired to original condition at no expense to the government. Work outside of regular work hours shall require approval by the contracting officer. Work shall be scheduled to minimize interference with normal facility operations.

#### 5.3 AS-BUILT DRAWINGS

- A. The contractor shall maintain a set of drawings on site to record as-built construction. The drawings shall be updated on a daily basis and shall be available for review at all times. These drawings shall not be used for construction prints. As-built drawings shall show details of installation including conduit/cable locations, device locations, wire counts, equipment locations and such other details of construction required for a complete record of the construction. Upon completion of the construction the on site as-built drawings shall be formally produced in a computer aided drawing (CAD) format for turnover to the government as part of the required documentation package.

#### 5.4 TESTING

- A. Upon completion of system installation the contractor shall test the entire system for proper operation including tests of every device and control function. All defects shall be corrected and retested. Upon completion of contractor testing, the contractor shall request a final inspection and test by the government. All equipment, devices and materials required for final inspection and test of the system shall be provided by the contractor. Any system failure during final testing shall be corrected and retested during the inspection if this can be accomplished within a reasonable time. Otherwise, the test shall be rescheduled. Completion forms will be provided after the final test.

#### 5.5 DRAWINGS, MANUALS, TOOLS AND SPARE PARTS

- A. Upon completion of the installation and prior to final inspection, the contractor shall furnish "as-built" drawings as indicated in section 5.3 above. In addition, the contractor shall furnish three (3) copies of a manual, including wiring diagrams, giving complete instructions for the operation, inspection, testing and maintenance of the system. Also, prior to final acceptance, the contractor shall provide a factory-trained qualified instructor to conduct a minimum of 16 hours of classes instructing base personnel as designated by the contracting officer, in the maintenance, troubleshooting, operation and programming of furnished equipment. Any special tools necessary for the maintenance of the equipment shall be furnished, as well as, one spare set of fuses of each type and size required. As soon as practicable after approval of the list of equipment, the contractor shall furnish copies of spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies with current unit prices.

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#### 5.6 SPARE EQUIPMENT

A. In addition to the above, the contractor shall provide the following materials and supplies:

1. Two (2) spare Addressable devices of each type of device installed.
2. One (1) spare antenna of each type utilized.
3. One (1) spare coaxial lightning arrester for each type installed.
4. Four (4) keys for locks of control panels or cabinets.

END OF SECTION 16721