

# PROJECT MANUAL



## NOVANT HEALTH OCEANSIDE FAMILY MEDICAL EXPANSION UPFIT

501 OLDE WATERFORD WAY  
LELAND, NORTH CAROLINA 28451

**PERMIT SET**

DECEMBER 13, 2024

VOLUME 1 OF 1

### ARCHITECT








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**LS3P COMMISSION NUMBER: 7403-240347**



DOCUMENT 000107 – PROJECT DIRECTORY AND SEALS PAGES

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## SECTION 011000 - SUMMARY

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under Owner's separate contracts.
4. Contractor's use of site and premises.
5. Coordination with occupants.
6. Work restrictions.

## 1.2 PROJECT INFORMATION

## A. Project Identification: Novant Health Oceanside Family Medical Expansion

1. Project Location: 501 Olde Waterford Way Leland, NC 28451.

## B. Owner: Novant Health.

1. Owner's Representative: Mary Anna Phillips 336.277.8612  
([mary.phillips@novanthealth.org](mailto:mary.phillips@novanthealth.org)) Construction Manager to be determined.

## C. Architect: LS3P Associates, Ltd.

1. Architect's Representative: Matthew Kauzlauric, AIA 910.790.9901

## D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents.

1. Mechanical & Plumbing Engineer: CBHF Engineers, PLLC, 910.791.4000
  - a. Representative: Troy O. Grady, PE.
2. Electrical Engineer: CBHF Engineers, PLLC, 910.791.4000
  - a. Representative: Jason P. Famiglietti, PE.
3. Fire Protection Engineer: CBHF Engineers, PLLC, 910.791.4000
  - a. Representative: David F. Stacy, PE.

## 1.3 WORK COVERED BY CONTRACT DOCUMENTS

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

1. The project is the upfit of the shelled space in this project: Work indicated in the Contract Documents. Finishes to match existing project, 9403-200080 Novant Health

Leland Family clinic. The exterior work is limited to infilling a roll up garage door, and adding 2 windows.

B. Type of Contract:

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

1.4 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.
- B. 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.
1. Low voltage systems not included in the Contract Documents
  2. Installation of exterior and interior building signage
  3. Installation of medical equipment and furniture.

1.5 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.6 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000



## SECTION 012100 - ALLOWANCES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
  - 1. Unit-cost allowances.
  - 2. Quantity allowances.
- C. Related Requirements:
  - 1. Section 012200 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.
  - 2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
  - 3. Section 014000 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

## 1.3 DEFINITIONS

- A. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

## 1.4 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

## 1.5 ACTION SUBMITTALS

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

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## 1.6 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

## 1.7 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
  - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

## 1.8 UNIT-COST ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
  - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

## 1.9 QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.



1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

#### 1.10 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, required maintenance materials, and similar margins.
  1. Include installation costs in purchase amount only where indicated as part of the allowance.
  2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
  3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
  4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

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

#### PART 3 - EXECUTION

##### 3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

##### 3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

##### 3.3 SCHEDULE OF UNIT COST ALLOWANCES

- A. No. 1, ---: Include the sum of \$--.00 per -- for --, as specified in Section ----- and as shown on Drawings.

##### 3.4 SCHEDULE OF QUANTITY ALLOWANCES

- A. No. 1 ----: Include ---, of, as specified in Section ----.
  1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."

##### 3.5 SCHEDULE OF LUMP SUM ALLOWANCES

- A. No. 1 "Door Hardware". Include a lump sum of ---- for Door Hardware.

END OF SECTION 012100



## SECTION 012300 - ALTERNATES

## PART 1 - GENERAL

## 1.1 SUMMARY

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

## 1.2 DEFINITIONS

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

## 1.3 PROCEDURES

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

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

## 3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1

1. Base Bid: --.
2. Alternate: --.

END OF SECTION 012300

## SECTION 017329 - CUTTING AND PATCHING

## 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 administrative and procedural requirements for cutting and patching.
- B. Related Requirements:
  - 1. Division 02 Section "Selective Demolition" for demolition of selected portions of the building.

## 1.3 DEFINITIONS

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

## 1.4 ACTION SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
  - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
  - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
  - 3. Products: List products to be used and firms or entities that will perform the Work.
  - 4. Dates: Indicate dates when cutting and patching activities will be performed.
  - 5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

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

## 1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
  1. Primary operational systems and equipment.
  2. Air or smoke barriers.
  3. Fire-suppression systems.
  4. Mechanical systems piping and ducts.
  5. Control systems.
  6. Communication systems.
  7. Electrical wiring systems.
  8. Operating systems of special construction in Division 13 Sections.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
  1. Water, moisture, or vapor barriers.
  2. Membranes and flashings.
  3. Exterior curtainwall construction.
  4. Equipment supports.
  5. Piping, ductwork, vessels, and equipment.
  6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

## 1.6 WARRANTY

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

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place, adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials and as approved by Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
  - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption of free passage to adjoining areas.

### 3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer, comply with original Installers written recommendation.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.



4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Exposure: Patch components in a manner that restores enclosures to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329



## SECTION 024119 - SELECTIVE DEMOLITION

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.

## 1.2 MATERIALS OWNERSHIP

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

## 1.3 INFORMATIONAL SUBMITTALS

- A. Engineering Survey: Submit engineering survey of condition of building.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.
- C. Schedule of selective demolition activities with starting and ending dates for each activity.
- D. Predemolition photographs or video.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

## 1.4 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. Hazardous materials will be removed by Owner before start of the Work.
  2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- D. Storage or sale of removed items or materials on-site is not permitted.

- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

## 1.5 WARRANTY

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

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with 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. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
- C. Inventory and record the condition of items to be removed and salvaged.

### 3.2 PREPARATION

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

### 3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
  - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
  - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - d. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - e. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

### 3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- C. Remove temporary barricades and protections where hazards no longer exist.

### 3.5 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  4. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
  5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  6. Dispose of demolished items and materials promptly

- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

### 3.6 CLEANING

- A. Remove demolition waste 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.
- B. Burning: Do not burn demolished materials.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

## SECTION 040120.63 - BRICK MASONRY REPAIR

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes repairing brick masonry.

## 1.2 DEFINITIONS

- A. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.

## 1.3 ACTION SUBMITTALS

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

## PART 2 - PRODUCTS

## 2.1 MASONRY MATERIALS

- A. Face Brick and Mortar: As required to complete brick masonry repair work.
  - 1. Brick and Mortar Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork.
  - 2. Brick Type 1: Running bond or stack bond at jambs brick course by Boral Bricks, Inc. (770) 648-4500 Color: "Burgundy" and mortar color to be "Holnam" #3605 by Mortarmix (888) 289-6606 (Exclusive color match system for Boral Bricks)
  - 3. Brick Type 2: Utility Brick. Color: "Tan" (10-852) with Mortar "Holnam" #10-852 to match.

## PART 3 - EXECUTION

## 3.1 PROTECTION

## 3.2 BRICK REMOVAL AND REPLACEMENT

- A. At locations indicated, remove bricks without damaging surrounding masonry.

- B. Support and protect remaining masonry that surrounds removal area.
- C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
- D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- E. Remove in an undamaged condition as many whole bricks as possible.
  - 1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
  - 2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
- F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.
- G. Replace removed damaged brick with other removed brick in good condition, where possible, matching existing brick. Do not use broken units unless they can be cut to usable size.
- H. Install replacement brick into bonding and coursing pattern of existing brick unless shown otherwise on the drawings. For cutting, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
  - 1. Maintain joint width for replacement units to match existing joints.
  - 2. Use setting buttons or shims to set units accurately spaced with uniform joints.
- I. Lay replacement brick with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
  - 1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
  - 2. Rake out mortar used for laying brick before mortar sets according to Section 040120.64 "Brick Masonry Repointing." Point at same time as repointing of surrounding area.
  - 3. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.
- J. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
  - 1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.



## 3.3 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low pressure spray.
1. Do not use metal scrapers or brushes.
  2. Do not use acidic or alkaline cleaners.

END

OF

SECTION

040120.63



## SECTION 042613 - MASONRY VENEER

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Brick.
  - 2. Concrete masonry units.
  - 3. Mortar materials.
  - 4. Ties and anchors.
  - 5. Embedded flashing.
  - 6. Accessories.
  - 7. Mortar mixes.
  - 8. Anti-graffiti protection.
  
- B. Products Installed but not Furnished under This Section:
  - 1. Steel lintels in masonry veneer.
  - 2. Steel shelf angles for supporting masonry veneer.

## 1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

## 1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).

## 1.4 PREINSTALLATION MEETINGS

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

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
  - 1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
  - 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
  - 1. Clay face brick, in the form of straps of five or more bricks.
  - 2. Glazed brick.
  - 3. Decorative CMUs, in the form of small-scale units.
  - 4. Concrete face brick, in the form of small-scale units.
  - 5. Colored mortar.
  - 6. Weep/cavity vents.
- D. Samples for Verification: For each type and color of the following:

1. Clay face brick, in the form of straps of five or more bricks.
2. Glazed brick.
3. Special brick shapes.
4. Decorative CMUs.
5. Weep/cavity vents.
6. Cavity drainage material.
7. Accessories embedded in masonry.

## 1.6 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Material Certificates: For each type and size of the following:
1. Masonry units.
    - a. Include data on material properties.
    - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
    - c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
    - d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing in accordance with ASTM C67/C67M.
  2. Integral water repellent used in decorative CMUs.
  3. Cementitious materials. Include name of manufacturer, brand name, and type.
  4. Mortar admixtures.
  5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  6. Anchors, ties, and metal accessories.
- C. Qualification Statements: For testing agency.
- D. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.7 QUALITY ASSURANCE

- A. Qualifications:
1. Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.
  2. Testing Agency: Qualified in accordance with ASTM C1093 for testing indicated.

## 1.8 MOCKUPS

- A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 36 inches high by full thickness.
  2. Build sample panels facing south.
  3. Where masonry is to match existing, build panels adjacent and parallel to existing surface.
  4. Clean[ **one-half of**] exposed faces of panels with masonry cleaner indicated.
  5. Protect approved sample panels from the elements with weather-resistant membrane.
  6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
    - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

## 1.9 DELIVERY, STORAGE, AND HANDLING

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

## 1.10 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of veneer, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
1. Extend cover a minimum of 24 inches down face of veneer, and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  2. Protect sills, ledges, and projections from mortar droppings.
  3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.
  - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

## PART 2 - PRODUCTS

### 2.1 SOURCE LIMITATIONS

- A. Obtain exposed masonry units and mortar aggregate from single source.

### 2.2 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work and will be within 20 ft. vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
  - 1. Where fire-resistance-rated construction is indicated, use the equivalent thickness method for masonry units in accordance with ACI 216.1.

### 2.3 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
  - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
  - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including corners, movement joints, bond beams, sashes, and lintels.
- B. Clay Face Brick: Facing brick complying with ASTM C216, Grade SW, Type FBX.
  - 1. Provide products from one of the following manufacturers pending conformance with requirements.
    - a. Palmetto Flashed Wirecut Modular, 3-5/8" x 2 1/4" x 7 5/8". (Basis of Design).
    - b. Advanced Building Products.
    - c. Old Carolina Brick Company.
    - d. W. R. Meadows.
    - e. WIRE-BOND.
  - 2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M.
  - 3. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."

4. Surface Coating: Brick with colors or textures produced by application of coatings withstand 50 cycles of freezing and thawing in accordance with ASTM C67/C67M with no observable difference in the applied finish when viewed from 10 ft..
5. Size (Actual Dimensions): 3-5/8 inches wide by 2 - 1/4" high by 7 - 5/8" long.
6. Application: Use where brick is exposed unless otherwise indicated.
7. Color and Texture: As selected by Architect.

## 2.4 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
  1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, will show no visible water or leaks on the back of test specimen.

## 2.5 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
  1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Aggregate for Mortar: ASTM C144.
  1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
  3. White-Mortar Aggregates: Natural white sand or crushed white stone.
  4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- E. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- F. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
- G. Water: Potable.

## 2.6 TIES AND ANCHORS

- A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Mill-Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A641/A641M, Class 1 coating.
  2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
  3. Stainless Steel Wire: ASTM A580/A580M, Type 304.
  4. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

## 2.7 EMBEDDED FLASHING

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
  2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft.. Provide splice plates at joints of formed, smooth metal flashing.
  3. Fabricate through-wall metal flashing embedded in masonry from **[stainless steel] [copper]**, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
  4. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
  5. Fabricate metal drip edges and sealant stops for sawtooth metal flashing from plain metal flashing of same metal as sawtooth flashing and extending at least 3 inches into wall with hemmed inner edge to receive sawtooth flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
  6. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
  7. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
  8. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
  9. Solder metal items at corners.
- B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- C. Termination Bars for Flexible Flashing: Stainless steel steel bars 0.075 inch by 1 inch.

## 2.8 ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from **[neoprene] [urethane] [or] [PVC]**.
- B. Weep/Vent Products: Use one of the following unless otherwise indicated:
1. Wicking Material: Absorbent rope, made from cotton, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity. Use only for weeps.
  2. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long.
  3. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches long.



4. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
  5. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
  6. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.
- C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Mortar Deflector: Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches that prevent clogging with mortar droppings.
  2. Rainscreen Drainage Mat: Sheets or strips not less than full depth of cavity thick and installed to full height of cavity, with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity to prevent weep holes from clogging with mortar.
- D. Offset Angle Supports: Steel plate brackets anchored to structure, allowing continuous insulation behind shelf angle supporting veneer. Component and anchor size and spacing engineered by manufacturer.
- E. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

## 2.9 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
  2. Use portland cement-lime mortar unless otherwise indicated.
  3. For exterior masonry, use portland cement-lime mortar.
  4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
1. Mix to match Architect's sample.
  2. Application: Use colored-aggregate mortar for exposed mortar joints.
- D. ANTI GRAFFITI PROTECTION
1. High performance anti-graffiti impregnation for interior and exterior concrete and masonry.
  2. Provide products from one of the following manufacturers pending conformance with requirements.
    - a. Cementaid GraffeX. (Basis of Design).
    - b. Prosoco.
    - c. Rain Guard Pro.

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**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION, GENERAL**

- A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- D. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

**3.3 TOLERANCES**

- A. Dimensions and Locations of Elements:
  - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
  - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
  - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
  - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
  - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
  - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
  - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.

5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

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

### 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
  1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

### 3.6 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached and seismic anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
  2. Embed tie sections in masonry joints.
  3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
  4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
  5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each [2.67 sq. ft.] [3.5 sq. ft.] of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
  6. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.
- B. Provide not less than 2 inches of airspace between back of masonry veneer and face of sheathing.
1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

### 3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

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

### 3.8 EXPANSION JOINTS

- A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form expansion joints as follows:
1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
  2. Build flanges of factory-fabricated, expansion-joint units into masonry.
  3. Build in compressible joint fillers where indicated.
  4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."
- C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

### 3.9 LINTELS

- A. Install steel lintels where indicated.

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

### 3.10 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
  - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
  - 2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
  - 3. At lintels and shelf angles, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.
  - 4. Interlock end joints of sawtooth sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
  - 5. Install metal drip edges and sealant stops with sawtooth sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
  - 6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
  - 7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
  - 8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are indicated to be built into masonry.
- D. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
  - 1. Use specified weep/cavity vent products to form weep holes.
  - 2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
  - 3. Space weep holes 24 inches o.c. unless otherwise indicated.
  - 4. Space weep holes formed from plastic tubing or wicking material 16 inches o.c.
  - 5. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
  - 6. Trim wicking material flush with outside face of wall after mortar has set.
- E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.
- F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

### 3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level 2 in TMS 402.
  1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
- C. Testing Prior to Construction: One set of tests.
- D. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.
- E. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

### 3.12 REPAIRING, POINTING, AND CLEANING

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

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3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
  - 1. Crush masonry waste to less than 4 inches in each dimension.
  - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
  - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042613





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**SECTION 054000 - COLD-FORMED METAL FRAMING****PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.

**1.2 ACTION SUBMITTALS****A. Product Data:** For each type of product.**B. Shop Drawings:**

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

**1.3 INFORMATIONAL SUBMITTALS****A. Welding certificates.****B. Product certificates.****C. Product test reports.****D. Evaluation Reports:** For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.**1.4 QUALITY ASSURANCE****A. Testing Agency Qualifications:** Qualified according to ASTM E329 for testing indicated.**B. Product Tests:** Mill certificates or data from a qualified independent testing agency.**C. Welding Qualifications:** Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

- D. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
1. Wall Studs: AISI S211.
  2. Headers: AISI S212.
  3. Lateral Design: AISI S213.
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

### 2.2 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
1. Grade: As required by structural performance.
  2. Coating: G60.
- B. Steel Sheet for Vertical DeflectionClips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance].
  2. Coating: G60.

### 2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING (INFILL IN EXISTING WALL)

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0677 inch.
  2. Flange Width: 2 inches.
  3. Section Properties:  $I_x = 8.138 \text{ in}^3$   $S_x = 2.035 \text{ in}^4$
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.
- C. Vertical Deflection Clips: Manufacturer's standard bypass head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

#### 2.4 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0677 inch
  - 2. Flange Width: 2 inches.
  - 3. Section Properties:  $I_x = 8.318 \text{ in}^4$   $S_x = 2.035 \text{ in}^3$  (to match existing conditions)
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.
- C. Vertical Deflection Clips: Manufacturer's standard bypass head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

#### 2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

## 2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
- B. Anchor Bolts: ASTM F1554, Grade 36], threaded carbon-steel, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on **ICC-ES AC01** as appropriate for the substrate.
  - 1. Uses: Securing cold-formed steel framing to structure.
  - 2. Type: **Torque-controlled expansion anchor**
  - 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

## 2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M
- B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

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**PART 3 - EXECUTION****3.1 PREPARATION**

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

**3.2 INSTALLATION, GENERAL**

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
- D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- E. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- G. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

### 3.3 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
  - 1. Anchor Spacing: As shown on Shop Drawings.
- B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
  - 1. Stud Spacing: Infill as indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
  - 1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
  - 2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
  - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically 48 inches. Fasten at each stud intersection.
  - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
  - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.

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3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
  - J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
  - K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- 3.4 INTERIOR NON-LOAD-BEARING WALL INSTALLATION
- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
  - B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
    1. Stud Spacing: 16 inches]
  - C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
  - D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
    1. Install single deep-leg deflection tracks and anchor to building structure.
    2. Install double deep-leg deflection tracks and anchor outer track to building structure.
    3. Connect vertical deflection clips to studs and anchor to building structure.
    4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
  - E. Install horizontal bridging in wall studs, spaced vertically in rows indicated[ but not more than 48 inches apart. Fasten at each stud intersection.
    1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
    2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
    3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
  - F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches] of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
    1. Install solid blocking at centers indicated on Shop Drawings.

- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.5 ERECTION TOLERANCES

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

### 3.6 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

END OF SECTION 054000



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**SECTION 055000 - METAL FABRICATIONS****PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Miscellaneous steel framing and supports.
2. Miscellaneous steel trim.

**B. Products furnished, but not installed, under this Section include the following:**

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete.

**1.2 ACTION SUBMITTALS****A. Product Data: For the following:**

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.

**B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.****PART 2 - PRODUCTS****2.1 METALS**

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.**
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.**
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.**

**2.2 FASTENERS**

- A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.**

1. Provide stainless steel fasteners for fastening.
- B. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- C. Post-Installed Anchors: Torque-controlled expansion anchors.

## 2.3 MISCELLANEOUS MATERIALS

- A. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

## 2.5 MISCELLANEOUS FRAMING AND SUPPORTS

- A. 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.

## 2.6 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 with zinc-rich primer.

## 2.7 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Galvanize and prime loose steel lintels located in exterior walls.

## 2.8 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.

## 2.9 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

- B. Shop prime steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 3. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.





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**SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY****PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Framing with dimension lumber.
2. Rooftop equipment bases and support curbs.
3. Wood blocking, cants, and nailers.
4. .
5. Plywood backing panels.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of process and factory-fabricated product.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.

**PART 2 - PRODUCTS****2.1 WOOD PRODUCTS, GENERAL**

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

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

**2.2 WOOD-PRESERVATIVE-TREATED MATERIALS**

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
  1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

### 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
  2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- D. Application: Treat items indicated on Drawings, and the following:
  1. Concealed blocking.
  2. Roof framing and blocking.
  3. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
  4. Plywood backing panels.

### 2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  1. Blocking.



2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: 15 percent maximum moisture content of the following species and grades:

1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
2. Eastern softwoods, No. 2 Common grade; NELMA.
3. Northern species, No. 2 Common grade; NLGA.

## 2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, [fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

## 2.6 FASTENERS

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

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M of Type 304 stainless steel.

B. Screws for Fastening to Metal Framing: ASTM C1002, length as recommended by screw manufacturer for material being fastened.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

- D. Do not splice structural members between supports unless otherwise indicated.
- E. Comply with AWWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
  - 3. ICC-ES evaluation report for fastener.

### 3.2 PROTECTION

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

END OF SECTION 061053

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**SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY****A. Section Includes:**

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

**B. Related Requirements:**

1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
2. Section 123623.13 "Plastic-Laminate-Clad Countertops."

**1.3 COORDINATION**

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

**1.4 ACTION SUBMITTALS****A. Product Data:** For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

**B. Shop Drawings:**

1. Include plans, elevations, sections, and attachment details.
2. Show large-scaledetails.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

5. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.
- D. Samples for Initial Selection: For each type of exposed finish.
- E. Samples for Verification: For the following:
  1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.
    - a. Provide one sample applied to core material with specified edge material applied to one edge.
  2. Thermoset Decorative Panels: 8 by 10 inches, for each color, pattern, and surface finish.
    - a. Provide edge banding on one edge.
  3. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Product Certificates: For each type of product.
  1. Composite wood products.
  2. Thermoset decorative panels.
  3. High-pressure decorative laminate.
  4. Adhesives.
- C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.
- D. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
  1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

- B. Installer Qualifications: Manufacturer of products.

## 1.8 DELIVERY, STORAGE, AND HANDLING

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

## 1.9 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.
- C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## PART 2 - PRODUCTS

### 2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
  - 1. Provide certificates from [AWI certification program indicating that woodwork[ and installation] complies with requirements of grades specified.
- B. Architectural Woodwork Standards Grade: Custom.

- C. Type of Construction: Frameless.
- D. Door and Drawer-Front Style: Flush overlay.
  - 1. Reveal Dimension: 1/2 inch
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
  - 1. Basis of Design: Wilsonart “5<sup>th</sup> Avenue Elm” 7966K Soft Grain Finish
- F. Laminate Cladding for Exposed Surfaces:
  - 1. Horizontal Surfaces: Grade HGS.
  - 2. Postformed Surfaces: Grade HGP.
  - 3. Vertical Surfaces: Grade VGS.
  - 4. Edges: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
  - 5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- G. Materials for Semiexposed Surfaces:
  - 1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
    - a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
    - b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
    - c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
  - 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
  - 3. Drawer Bottoms: Thermoset decorative panels.
- H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or [glued dovetail joints].

## 2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 to 13percent.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade MD.
  2. Particleboard (Medium Density): ANSI A208.1, Grade M-2-Exterior Glue.
  3. Softwood Plywood: DOC PS 1, medium-density overlay.
  4. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

### 2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."
- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 135 degrees of opening, self-closing.
- C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- E. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141
- F. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081 ANSI/BHMA A156.9, B04102; with shelf brackets, B04112.
- G. Shelf Rests: ANSI/BHMA A156.9, B04013; two-pin plastic with shelf hold-down clip.
- H. Drawer Slides: ANSI/BHMA A156.9.
  1. Grade 1 and Grade 2: Side mounted[ and extending under bottom edge of drawer].
    - a. Type: [Full] [Partial] extension.
    - b. Material: [Zinc-plated] [Epoxy-coated] steel with polymer rollers.
  2. Grade 1HD-100 and Grade 1HD-200: Side mounted; [full] [full-overtravel]-extension type; zinc-plated-steel ball-bearing slides.
  3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 2.
  4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.
  5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.
  6. For computer keyboard shelves, provide Grade 1.
  7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-100.

- I. Door Locks: ANSI/BHMA A156.11, E07121.
- J. Drawer Locks: ANSI/BHMA A156.11, E07041.
- K. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- L. Grommets for Cable Passage: 2 inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
  - 1. Color: Black.
- M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
  - 1. Satin Stainless Steel: ANSI/BHMA 630.
- N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

## 2.4 MISCELLANEOUS MATERIALS

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

## 2.5 FABRICATION

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



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**PART 3 - EXECUTION****3.1 PREPARATION**

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

**3.2 INSTALLATION**

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
  - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
  - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

**3.3 ADJUSTING AND CLEANING**

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

END

OF

SECTION

064116



## SECTION 066400 - SOLID POLYMER FABRICATIONS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section includes solid polymer fabrications for interior applications.
  - 1. Solid polymer resin sheets.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details for solid polymer resin sheets. Include the following:
  - 1. Size and location of penetrations.
  - 2. Type of decorative fabrications.
  - 3. Paneling methods.
  - 4. Mounting methods.
  - 5. Attachments to other work.
  - 6. Full-size details of edge profiles.
- C. Samples for Verification: For the following products, in manufacturer's standard sizes:
  - 1. Solid polymer resin sheets.
  - 2. Hardware for mounting.
- D. Product Schedule: For solid polymer resin sheets. Use same designations indicated on Drawings.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Product Test Reports: For solid polymer resin sheets, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Sample Warranty: For manufacturer's warranty.

## 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid polymer resin sheets to include in maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of solid polymer resin sheet through one source from a single manufacturer to provide products of consistent quality in appearance and physical properties.
- B. Fire-Test-Response Characteristics: Provide solid polymer resin sheets identical to those tested for the following fire-test-response characteristics:
1. Flame Spread: Less than 75 per ASTM E84.
  2. Smoke Developed: Less than 450 per ASTM E84.
  3. Rate of Burning: Class CC1 for a nominal thickness of 1.5 mm (0.060 in.) per ASTM D635.
  4. Self-Ignition Temperature: Greater than 650°F per ASTM D1929.
  5. Density of Smoke: Less than 75% per ASTM D2843.
- C. Impact Resistance: Provide Solid Polymer Fabrications that comply with the following requirements:
1. Impact Strength, Un-notched (23°), ASTM D4812: No breakage
  2. Impact Strength, Notched (23°), ASTM D526: 88J/m (1/16).
- D. Allowable Tolerances:
1. Maximum Deflection: 1/16 inch over 12 inches.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's written instructions for shipping, storing, and handling solid polymer resin sheets and for removing protective coverings after installation.
- B. Maintain protective coverings on sheets to avoid exposures to abrasive substances, excessive heat, and other sources of possible deterioration.
- C. Move solid polymer resin sheet material into spaces where they are to be installed and allow it to reach room temperature prior to installation.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with installing paneling sealants when ambient and substrate temperature conditions are outside limits permitted by paneling sealant manufacturers or below 40 deg F.
- B. Field Measurements: Verify dimensions to fit by field measurements before fabrication and indicate measurements on Shop Drawings

#### 1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace solid polymer resin sheets that develop defects from normal use within specified warranty period.
1. Warranty Period: One year from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Solid Polymer Resin Sheets:
  - 1. Lumicor.
    - a. Color and Pattern: As indicated on Finish Schedule.
- B. Thickness: As indicated on Drawings.
- C. Finish: Honed.

## 2.2 SOLID POLYMER RESIN SHEET

- A. General: Fabricate solid polymer resin sheet for decorative paneling in designs, sizes and thicknesses indicated and to comply with indicated standards.
- B. Fabricate decorative paneling and provide other paneling products in sizes required for openings and surfaces indicated on Drawings, with edge and face clearances, edge and surface conditions complying with manufacturer's written recommendations.
- C. Machining: Acceptable means of machining are indicated below. Ensure that material is not chipped or warped by machining operations.
  - 1. Sawing: Select equipment and blades suitable for type of cut required.
  - 2. Drilling: Drills specifically designed for use with solid polymer resin sheet products.
  - 3. Milling: Clean cut where possible.
  - 4. Routing.
  - 5. Tapping.
- D. Forming: Form products to shapes indicated using appropriate methods indicated below. Comply with manufacturer's written instructions.
  - 1. Cold-bending.
  - 2. Hot-bending.
  - 3. Thermoforming; only on uncoated material.
  - 4. Drape forming.
  - 5. Matched mold forming.
  - 6. Mechanical forming.

## 2.3 ACCESSORIES

- A. Cleaners: Comply with manufacturer's written recommendations.
- B. Bonding Cement: Suitable for use with product and application and complying with manufacturer's written recommendations.
- C. Hardware: Use hardware as recommended by manufacturer.

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**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. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. Comply with combined written instructions of manufacturers of solid polymer resin sheet materials, sealants, gaskets, and related materials, unless more stringent requirements are indicated.
- B. Install solid polymer resin sheets according to manufacturer's written instructions and approved Shop Drawings.
- C. Protect solid polymer resin sheet surfaces from abrasion and other damage during handling and installation, according to the following requirements.
  - 1. Retain solid polymer resin sheet manufacturer's protective covering or protect by other methods according to solid polymer resin sheet manufacturer's written instructions.
  - 2. Remove covering at border of each piece before installing; remove remainder of covering immediately after installation where solid polymer resin sheets will be exposed to sunlight or where other conditions make later removal difficult.
  - 3. Remove damaged solid polymer resin sheets from Project site and legally dispose of off-site. Damaged solid polymer resin sheets are those containing imperfections that, when installed, result in weakened paneling and impaired performance and appearance.
- D. Set solid polymer resin sheets true in line with uniform orientation, pattern, draw, bow, and similar characteristics.

**3.3 PROTECTION AND CLEANING**

- A. Protect solid polymer resin sheet fabrications from contact with contaminating substances from construction operations. If contaminating substances come into contact with solid polymer resin sheets, remove immediately and wash by method recommended in writing by solid polymer resin sheet manufacturer.
- B. Remove and replace solid polymer resin sheets that are broken, chipped, cracked, abraded, or damaged in other ways during construction period.
- C. Wash solid polymer resin sheets on both faces before date scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Wash solid polymer resin sheets by method recommended in writing by solid polymer resin sheet manufacturer.

END OF SECTION 066400

## SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Modified bituminous sheet waterproofing.
  - 2. HPDE Sheet Waterproofing.

## 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation 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 sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

## 1.3 ACTION SUBMITTALS

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

## 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample Warranties: For special warranties.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
  - 1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatment, corner treatment, and protection.
    - a. Size: 100 sq. ft. in area.
  - 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 Final Acceptance.

#### 1.6 FIELD CONDITIONS

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

#### 1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's labor and material water tightness warranty in which manufacturer agrees to provide labor and material for remedial waterproofing material and labor for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
  1. Warranty Period: Ten (10) years from date of Substantial Completion.
- B. Installers Special Warrantee: Specified form, signed by Installer, covering Work of this Section, for Warrantee period of two (2) years.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer. Provide auxiliary materials as recommended by waterproofing manufacturer.

#### 2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil-thick, polyethylene-film reinforcement, and with release liner on adhesive side.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Mapethane HT-60
    - b. Mapeproof AL Pro Polyglaa.
    - c. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861
    - d. CETCO, a Minerals Technologies company; Envirosheet
    - e. GCP Applied Technologies.; Bituthene 3000
    - f. Henry Company; Blueskin WP 200
    - g. W. R. Meadows, Inc; Mel-Rol
  2. Physical Properties:
    - a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
    - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
    - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
    - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
    - e. Puncture Resistance: 50 lbf minimum; ASTM E 154.
    - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.



- g. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
- h. Hydrostatic-Head Resistance: 150 feet minimum; ASTM D 5385.

### 2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
  - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.
- G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
  - 1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.
  - 2. Detail Strips: 62.5-mil thick, felt-reinforced self-adhesive strip, 9 inches wide, with release film on adhesive side.
- H. Metal Termination Bars: Stainless steel bars, approximately 1 by 1/8 inch thick, predrilled at 6-inch centers. Provide stainless-steel fasteners.
- I. Protection Board: Unfaced, extruded-polystyrene board insulation, nominal thickness 2 inches with compressive strength of not less than 25 psi per ASTM D 1621.
- J. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side with a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft.
  - 1. Product: Subject to compliance with requirements, provide one of the following:
    - a. American Wick Drain; Amerdrain
    - b. Carlisle Coatings & Waterproofing; Miradrain 6200
    - c. Hydraway Drainage Systems; Hydraway 2000

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

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

### 3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

F. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
  - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

### 3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Application: Apply sheets from low to high points to ensure that laps shed water.
- E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- F. Seal edges of sheet-waterproofing terminations with mastic.
- G. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- I. Immediately install protection course with butted joints over waterproofing membrane.
- J. Molded-Sheet Drainage Panel: Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
  1. For vertical applications, install protection course before installing drainage panels.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.

### 3.5 PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Protect installed protection board from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction. Insert Installer's Special Warranty Form here if required.

END OF SECTION 071326



## SECTION 072100 - THERMAL INSULATION

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Molded polystyrene foam-plastic board.
  - 2. Glass-fiber blanket.

## 1.2 ACTION SUBMITTALS

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

## 1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research reports.

## PART 2 - PRODUCTS

## 2.1 MOLDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Molded Polystyrene Board, Type I: ASTM C578, Type I, 10-psi minimum compressive strength.
  - 1. ACH Foam Technologies, Inc.
  - 2. Insulfoam, Carlisle Construction Materials Compnay

## 2.2 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced (for interior walls (acoustic) ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics).
  - 1. Certain Teed
  - 2. Johns Manville
  - 3. Owens Corning

- B. Glass-Fiber Blanket, Polypropylene-Scrim-Kraft Faced (to patch existing wall insulation: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).
  - 1. Certain Teed
  - 2. Johns Manville
  - 3. Owens Corning

### 2.3 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
  - 1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
- B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.
- C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

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

### 3.2 INSTALLATION OF SLAB INSULATION

- A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
  - 1. Replace existing horizontal slab insulation around perimeter of existing building where the existing insulation has been removed to install new underground piping..

## 3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
  5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

END

OF

SECTION

072100





## SECTION 076200 - SHEET METAL FLASHING AND TRIM

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Formed roof-drainage and low-slope sheet metal fabrications.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: For sheet metal flashing and trim. Include the following:
  - 1. For roof edge assemblies, detail of prototypical assembly tested in accordance with ANSI/SPRI ES-1.
  - 2. Identification of material, thickness, weight, and finish for each item and location in Project.
  - 3. Details for forming, including profiles, shapes, seams, and dimensions.
  - 4. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
  - 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
- C. Samples for Verification: For each type of exposed finish.
  - 1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
  - 2. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Sample Warranty: For special warranty.

## 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.
  - B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
    1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
    2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
  - C. Preinstallation Conference: Conduct conference at Project site.
    1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
    2. Review methods and procedures related to sheet metal flashing and trim.
    3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
    4. Review special roof details, roof drainage, roof penetrations, and condition of other construction that will affect sheet metal flashing.
    5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
- 1.6 COORDINATION
- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
  - B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
  - B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.
- 1.8 WARRANTY
- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
    1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
    2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE CRITERIA

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. FM Approvals Listing: Manufacture and install copings and roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.
- D. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashing tested per SPRI ES-1 and capable of resisting design pressure as indicated on Drawings.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

## 2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
  - 1. Exposed Coil-Coated Finish: Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 2. Color: As selected by Architect from manufacturer's full range.
  - 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

## 2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Atlas Roofing Corporation; WeatherMaster PolySeal.
    - b. Carlisle Coatings & Waterproofing Inc.; WIP 300HT.
    - c. GAF Materials Corporation; Roof Pro.
    - d. GCP Applied Technologies; Grace Ice and Water Shield HT.

- e. Henry Company; Blueskin PE200 HT.
  - f. Kirsch Building Products, LLC; SharkSkin Ultra SA.
  - g. Polyguard Products, Inc.; Deck Guard HT.
2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
  3. Low-Temperature Flexibility: ASTM D1970; passes after testing at minus 20 degrees F.
- B. Synthetic Underlayment: UV-resistant, bitumen free; laminated or reinforced, polypropylene, polyolefin, or polyethylene polymer fabric with slip resistant surface coatings or treatments; evaluated and documented to be suitable for use as roof underlayment under applicable codes by testing and inspecting agency acceptable to authorities having jurisdiction.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Atlas Roofing Corporation; Summit Synthetic Underlayment.
    - b. GAF Materials Corporation; Tiger Paw Roof Deck Protection.
    - c. GCP Applied Technologies; Tri-Flex.
    - d. Tamko Building Products, Inc.; Tam-Shield Synthetic Underlayment.
    - e. VaproShield LLC; SlopeShield Water-Resistive Roof Underlayment.
  2. Permeability: 0.06 perms minimum per ASTM E96 (Procedure A).
  3. Water Transmission: Passes per ASTM D4869.
  4. Surface Burning: Class A Fire per ASTM E108.
  5. Minimum Thickness: 12 to 25 mils.

#### 2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
  2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- C. Solder For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
  - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- B. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true in line and levels indicated, with exposed edges folded back to form hems.
  - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- D. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
  - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual".

## 2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
  - 1. Fabricate from 0.032 inch thick aluminum.
- B. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes.
  - 1. Fabricate from 0.032 inch thick aluminum.

## 2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch-long pre-formed roof perimeter and edge, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, solder or weld watertight.
  - 1. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.
  - 2. Fabricate from 0.050 inch thick aluminum.

- B. Base Flashing: Fabricate from 0.032 inch thick aluminum.
- C. Counterflashing: Fabricate from 0.032 inch thick aluminum.
- D. Flashing Receivers: Fabricate from 0.032 inch thick aluminum.
- E. Roof Drain Flashing: Fabricate from 0.016 inch thick stainless steel.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
  - 1. Verify compliance with requirements for installation tolerances of substrates.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

#### 3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to provide a complete sheet metal flashing and trim system.
  - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
  - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  - 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
  - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
  - 5. Torch cutting of sheet metal flashing and trim is not permitted.
  - 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
  - 1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
  - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Aluminum: Use aluminum or stainless-steel fasteners.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
  1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
  2. Prepare joints and apply sealants to comply with requirements in Section 079200 – Joint Sealants.
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

### 3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
  1. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
  2. Loosely lock front edge of scupper with conductor head.
  3. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
- C. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch below scupper discharge.

### 3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at intervals required by referenced standards to meet performance requirements.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
  1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at intervals required by reference standards to meet performance requirements.
  2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at intervals required by reference standards to meet performance requirements.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

### 3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200



## SECTION 079200 - JOINT SEALANTS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Silicone joint sealants.
  - 2. Nonstaining silicone joint sealants.
  - 3. Mildew-resistant joint sealants.
  - 4. Butyl joint sealants.
  - 5. Latex joint sealants.

## 1.2 PREINSTALLATION MEETINGS

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

## 1.3 ACTION SUBMITTALS

- A. Product Data:
  - 1. Joint-sealants.
  - 2. Joint sealant backing materials.
- B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Test and Evaluation Reports:
  - 1. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested from sealant manufacturer, indicating the following:
    - a. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
    - b. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
- B. Field Quality-Control Submittals:
  - 1. Field-Adhesion-Test Reports: For each sealant application tested.
- C. Sample warranties.

## 1.5 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
1. Manufacturers' special warranties.
  2. Installer's special warranties.

## 1.6 QUALITY ASSURANCE

- A. Qualifications:
1. Installers: Authorized representative who is trained and approved by manufacturer.
  2. Testing Agency: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

## 1.7 MOCKUPS

- A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

## 1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
  2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
  3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with masonry substrates.
  4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
  5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
  7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

## 1.9 FIELD CONDITIONS

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

## 1.10 WARRANTY

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

## PART 2 - PRODUCTS

### 2.1 SOURCE LIMITATIONS

- A. Obtain joint sealants from single manufacturer for each sealant type.

### 2.2 JOINT SEALANTS, GENERAL

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

### 2.3 SILICONE JOINT SEALANTS

- A. Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. GE Silicones
    - b. Dow Corning Corporation; 890-SL
    - c. Pecora Corporation; 300 SL
    - d. Sika Corporation; 728 SL
    - e. Tremco Incorporated; Spectrem 900 SL
  - 2. Exterior Joint Locations:
    - a. Other exterior horizontal traffic joints.
  - 3. Interior Joint Locations:
    - a. Control and expansion joints in tile flooring.

## 2.4 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; 790
    - b. GE Momentive SilPruf LM SCS2700
    - c. Pecora Corporation; 890
    - d. Sika Corporation; 290
    - e. Tremco Incorporated; Spectrem 1
  - 2. Exterior Joint Locations:
    - a. Metal panels,
    - b. Exterior perimeter joints between materials listed above and frames of doors, windows, and louvers.
    - c. Control and expansion joints in ceilings and other overhead surfaces.
    - d. Other vertical or horizontal non-traffic joints.
  - 3. Interior Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Interior perimeter joints of exterior openings.

## 2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; 786
    - b. Pecora Corporation; 898
    - c. Sika Corporation; SikaSil N
    - d. Tremco; Tremsil 600 White
  - 2. Interior Joint Locations:
    - a. Tile control and expansion joints.
    - b. Joints between plumbing fixtures and adjoining walls, floors, and counters.

## 2.6 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Bostik; Chem-Calk 300
    - b. Pecora; BC-158
    - c. Tremco; General Purpose Butyl Sealant
  - 2. Exterior Joint Locations: Under door thresholds.

## 2.7 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. BASF Building Systems; Sonolac
    - b. Bostik, Inc.; Chem-Calk 600
    - c. Pecora Corporation; AC-20+
    - d. Tremco Incorporated; Tremflex 834
  2. Interior Joint Locations:
    - a. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
      - 1) Color: Paintable white.
    - b. Other non-dynamic interior joints including between interior wall surfaces and casework.
      - 1) Color: Clear.
- B. Preformed Elastomeric Seal:
1. Preformed Silicone Elastomer Extrusion: Highly flexible low modulus pre-cured silicone flashing and transition material in size to fit joint widths indicated.
  2. Compatibility: Shall be compatible with substrates, silicone and accessories under condition of service and application, as demonstrated by sealant manufacturer project specific testing.
  3. Product Quality Standards: ASTM C1518, Movement Class 220, Tear Class PT or when tested in accordance with ASTM C1523, modified to include project specific materials
  4. Acceptable Products:
    - a. Dowsil;
      - 1) 123 Silicone Seal
      - 2) Silicone transition system (STS): Weather barriers to other substrates, using Dow 758 only.
  5. GE Silicones:
    - a. UltraSpan US1100: UST Transitions.
  6. Pecora: Sil-Span.

## 2.8 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape:
1. Description: Self adhering PTFE (Teflon), polyethelene or polyurethane foam tape, recommended by sealant manufacturer.
    - a. Available Manufacturers and Products.
      - 1) 3M, Industrial Adhesives and tapes division: Polyethylene Tape 483.
      - 2) Norton: Tbond II V2200 Foam Spacer.
      - 3) Saint-Gobain: Thermalbond V2100 Foam Saucer.

- 4) Tremco Commercial Sealants 7 waterproofing: SGT-900 Series.

D. Foam Backer Rods:

1. Preformed joint filler, non-staining. Diameter approximately 25 percent larger than joint width, unless otherwise directed by manufacturer.
2. Bi-cellular Structure with Surface Skin:
  - a. Product Quality Standard: ASTM C 1330, Type B.
  - b. Description: Non-gassing, extruded polyolefin; acceptable to joint sealant manufacturer.
  - c. Available Manufacturers and products:
    - 1) Nomaco inc: SOF-Rod (Dual Rod) Backer Rod.
    - 2) Industrial Thermo Polymers LTD: ITP Std. Insulating Backer Rod.
3. Closed Cell Structure:
  - a. Product Quality Standard: ASTM C 1330, Type C.
  - b. Description: Non-gassing, extruded polyethylene; acceptable to joint sealant manufacturer.
  - c. Available Manufacturers and products:
    - 1) Nomaco inc: Green Rod or HBR Backer Rod.
    - 2) Industrial Thermo Polymers LTD: ITP Std. Insulating Backer Rod.
    - 3) Backer Rod Manufacturing, Inc.: Mile high Foam Backer Rod.
4. Open Cell Structure:
  - a. Open cell backer rod is only acceptable under the following conditions:
    - 1) With ultra-low modulus sealants used against a non-porous substrate.
    - 2) When a double line of sealant (joints installed simultaneously) is required to allow for curing of sealant at the interior seal. Exterior seal shall be by-cellular or closed cell.
      - a) Exception: When interior seal is allowed a minimum of 7 days cure time before installing the exterior seal.
      - b) Drain cavity between seals through weep holes.
  - b. Product Quality Standard: ASTM C 1330, Type O.
  - c. Description: Extruded polyurethane; acceptable to joint sealant manufacturer.
  - d. Available Manufacturers and products:
    - 1) Nomaco inc: Foam-Pak II Backer Rod.
    - 2) Industrial Thermo Polymers LTD: Tundra open cell Foam Backer Rod.
    - 3) Backer Rod Manufacturing, Inc.: Denver Foam Backer Rod.

## 2.9 MISCELLANEOUS MATERIALS

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

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**PART 3 - EXECUTION****3.1 EXAMINATION**

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

**3.2 PREPARATION**

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

**3.3 INSTALLATION OF JOINT SEALANTS**

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
    - a. Extent of Testing: Test completed and cured sealant joints as follows:
      - 1) Perform 10 tests for the first 1000 ft. of joint length for each kind of sealant and joint substrate.
      - 2) Perform one test for each 1000 ft. of joint length thereafter or one test per each floor per elevation.
    - b. Test Method: Test joint sealants in accordance with Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
      - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
    - c. Inspect tested joints and report on the following:
      - 1) Whether sealants filled joint cavities and are free of voids.
      - 2) Whether sealant dimensions and configurations comply with specified requirements.
      - 3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
    - d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
    - e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.



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

- C. Prepare test and inspection reports.

### 3.5 CLEANING

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

### 3.6 PROTECTION

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

END OF SECTION 079200



## SECTION 081216 - ALUMINUM FRAMES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Interior aluminum frames for glazing installed in gypsum board partitions.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For aluminum frames:
  - 1. Include elevations, sections, and installation details for each wall-opening condition.
- C. Samples: For each exposed product and for each color and texture specified.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Subject to compliance, the following manufacturers are acceptable:
  - 1. Efco Corporation
  - 2. Kawneer North America; an Alcola company
  - 3. Oldcastle Building Envelope
  - 4. YKK AP America Inc.

## 2.2 COMPONENTS

- A. Aluminum Framing: ASTM B221, with alloy and temper required to suit structural and finish requirements, and not less than 0.062 inch thick.
- B. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.
- C. Glazing Frames: Extruded aluminum, for indicated glass thickness.
- D. Door Tracks: Extruded aluminum where exposed, sized to enclose sliding-door hardware, and in finish matching frame and trim finish.
- E. Trim: Extruded aluminum, not less than 0.062 inch thick; removable, snap-in casing trim glazing stops and door stops, without exposed fasteners.
- F. Doors: As specified in Section 081416 "Flush Wood Doors."

## 2.3 ACCESSORIES

- A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.
- B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals in black color.
- C. Glazing Gaskets: Manufacturer's standard extruded or molded rubber or plastic, to accommodate glazing thickness indicated; in black.
- D. Glass: As specified in Section 088000 "Glazing."
- E. Door Hardware: As specified in Section 087111 "Door Hardware (Descriptive Specification)."

## 2.4 FABRICATION

- A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted and mitered connections.
- B. Factory prepare aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Section 087111 "Door Hardware (Descriptive Specification)."
  - 1. Locate hardware cutouts and reinforcements as required by fire-rated label for assembly.
- C. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.
  - 1. Locate removable stops on the inside of spaces accessed by keyed doors.
- D. Fabricate components to allow secure installation without exposed fasteners.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install aluminum frames plumb, rigid, properly aligned, and securely fastened in place; according to manufacturer's written instructions.
- B. Install frame components in the longest possible lengths with no piece less than 72 inches or shorter shall be one piece.
- C. Glass: Install glass according to Section 088000 "Glazing" aluminum-frame manufacturer's written instructions.
- D. Doors: Install doors aligned with frames and fitted with required hardware.

- E. Door Hardware: Install according to Section 087111 "Door Hardware (Descriptive Specification)" aluminum-frame manufacturer's written instructions.

### 3.2 ADJUSTING

- A. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended in writing by frame manufacturer and according to AAMA 609 and 610.
- B. Touch Up: Repair marred frame surfaces to blend inconspicuously with adjacent unrepaired surface so touchup is not visible from a distance of 48 inches as viewed by Architect. Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END

OF

SECTION 081216



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**SECTION 081416 - FLUSH WOOD DOORS****PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Factory finishing flush wood doors.
3. Factory machining for hardware.

**1.2 ACTION SUBMITTALS****A. Product Data:** For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Factory-machining criteria.
6. Factory finishing specifications.

**B. Shop Drawings:** Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Apply AWI Quality Certification Program label to Shop Drawings.

**1.3 CLOSEOUT SUBMITTALS****A. Quality Standard Compliance Certificates:** AWI Quality Certification Program certificates.**B. Record Documents:** For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

## PART 2 - PRODUCTS

## 2.1 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.
- B.

## 2.2 SOLID-CORE, FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

## A. Interior Doors:

1. Basis of Design: Marshfield-Algoma by Masonite Architectural Signature Series Wood Veneer Doors
2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty]
3. Performance Grade:
  - a. ANSI/WDMA I.S. 1A Heavy Duty unless otherwise indicated on Drawings.
4. ANSI/WDMA I.S. 1A Grade: Premium.
5. Faces: Single-ply wood veneer not less than 1/50 inch thick.
  - a. Species: Select white birch
  - b. Cut: Rotary cut.
  - c. Match between Veneer Leaves: Book match.
  - d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
  - e. Stain: Espresso
    - 1) Exposed Vertical Edges: Applied wood-veneer edges of same species as faces and covering edges of faces. Screw-Holding Capability: 475 lbf in accordance with WDMA T.M. 10.
6. Core for Non-Fire-Rated Doors:
  - a. ANSI A208.1, Grade LD-1 particleboard.
    - 1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
    - 2) Provide doors with WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087111 "Door Hardware (Descriptive Specification."
  - b. WDMA I.S. 10 structural composite lumber.
    - 1) Screw Withdrawal, Face: 475 lb.
    - 2) Screw Withdrawal, Edge: 475 lb.
  - c. WDMA I.S. 10 structural composite lumber.



7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

B. Interior Doors with Radiation Shielded Core:

1. Basis of Design: Marshfield-Algoma by Masonite Architectural Signature Series Wood Veneer Doors- Dura Shield
2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty]
3. ANSI/WDMA I.S. 1A Grade: Premium.
4. Faces: Single-ply wood veneer not less than 1/50 inch thick.
  - a. Species: Select white birch
  - b. Cut: Rotary cut.
  - c. Match between Veneer Leaves: Book match.
  - d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
  - e. Stain: Espresso
    - 1) Screw-Holding Capability: 475 lbf in accordance with WDMA T.M. 10.
5. Core for Non-Fire-Rated Doors:
  - a. ANSI A208.1, Grade LD-1 particleboard or WDMA I.S.10 structural composite lumber with laminated lead lined sheets of thickness called out in door schedule (outer face, room side).
    - 1) Screw Withdrawal, Face: 475 lb.
    - 2) Screw Withdrawal, Edge: 475 lb.
  - b. WDMA I.S. 10 structural composite lumber.
6. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

## 2.3 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
1. Wood Species: Same species as door faces
  2. Profile: Flush rectangular beads.

## 2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  2. Comply with NFPA 80 requirements for fire-rated doors.

- B. Factory machine doors for hardware that is not surface applied.
  - 1. Locate hardware to comply with DHI-WDHS-3.
  - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
  - 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
  - 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
- C. Openings: Factory cut and trim openings through doors.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

## 2.5 FACTORY PRIMING

## 2.6 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
  - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  - 2. Finish faces, all four edges, edges of cutouts, and mortises.
  - 3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
  - 1. ANSI/WDMA I.S. 1A Grade: Premium.
  - 2. Finish: ANSI/WDMA I.S. 1A TR-6 Catalyzed Polyurethane.
  - 3. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Hardware: For installation, see Section 087111 "Door Hardware (Descriptive Specification)."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.
  - a. Secure with countersunk, concealed fasteners and blind nailing.
  - b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
    - 1) For factory-finished items, use filler matching finish of items being installed.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
  - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:
  - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
  - b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
  - c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.2 ADJUSTING

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

END

OF

SECTION

081416



## SECTION 083113 - ACCESS DOORS AND FRAMES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of access door and frame and for each finish specified.
- C. Product Schedule: For access doors and frames

## PART 2 - PRODUCTS

## 2.1 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges:
  - 1.
  - 2. Description: 2' x2' Face of door flush with frame, with exposed flange and concealed hinge.
  - 3. Locations: Wall and ceiling .
  - 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage , factory primed.
  - 5. Frame Material: Same material, thickness, and finish as door.
  - 6. Latch and Lock: Cam latch, screwdriver operated

## 2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

## 2.3 FABRICATION

- A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- C. Latch and Lock Hardware:
  - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
  - 2. Keys: Furnish two keys per lock and key all locks alike.

## 2.4 FINISHES

- A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

## SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

## 1.2 PREINSTALLATION MEETINGS

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

## 1.3 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

## B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
  - a. Joinery, including concealed welds.
  - b. Anchorage.
  - c. Expansion provisions.
  - d. Glazing.
  - e. Flashing and drainage.
3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
4. Include point-to-point wiring diagrams showing the following:
  - a. Power requirements for each electrically operated door hardware.
  - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

## C. Samples: For units with factory-applied color finishes.

## D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

## E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door

hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

- F. Delegated Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
  - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by qualified testing agency.
- C. Field quality-control reports.
- D. Qualification Statements: For Installer.
- E. Delegated design engineer qualifications.
- F. Sample warranties.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For aluminum-framed entrances and storefronts.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

#### 1.6 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installers: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.
  - 2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.



## 1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
1. Build mockup of typical wall area as shown on Drawings.
  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 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures, including, but not limited to, excessive deflection.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Deterioration of metals and other materials beyond normal weathering.
    - d. Water penetration through fixed glazing and framing areas.
    - e. Failure of operating components.
  2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  2. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening of fasteners, attachments, and other components.
    - e. Failure of operating units.
- C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
  2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
  2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
    - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
  2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
  3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
  2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- H. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
    - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
    - b. Entrance Doors: U-factor of not more than 0.68 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
    - c. Venting Windows: Whole window U-factor of not more than 0.37 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

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2. Solar Heat-Gain Coefficient (SHGC):
    - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.26 as determined in accordance with NFRC 200.
    - b. Entrance Doors: SHGC of not more than 0.22 as determined in accordance with NFRC 200.
    - c. Venting Windows: Whole window SHGC of not more than 0.22 as determined in accordance with NFRC 200.
  3. Air Leakage:
    - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.
    - b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
    - c. Venting Windows: Whole window air leakage of not more than 0.3 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
  4. Condensation Resistance Factor (CRF):
    - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 35 as determined in accordance with AAMA 1503.
    - b. Entrance Doors: CRF of not less than 57 as determined in accordance with AAMA 1503.
    - c. Venting Windows: Whole window CRF of not less than 45 as determined in accordance with AAMA 1503.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- 2.3 STOREFRONT SYSTEMS
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. EFCO Corporation.
    2. Kawneer North America.
    3. Oldcastle BuildingEnvelope.
    4. Wausau Window and Wall Systems.
    5. YKK AP America.
  - B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
    1. Exterior Framing Construction: Thermally broken.
    2. Interior Vestibule Framing Construction: Nonthermal.
    3. Glazing System: Retained mechanically with gaskets on four sides.
    4. Glazing Plane: As indicated on Drawings.
    5. Finish: High-performance organic finish.
    6. Fabrication Method: Field-fabricated stick system.
    7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
    8. Steel Reinforcement: As required by manufacturer.
  - C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
  - D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

## E. Insulated Spandrel Panels:

1. Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
  - a. Overall Panel Thickness: As indicated.
  - b. Exterior Skin: Aluminum.
    - 1) Thickness: Manufacturer's standard for finish and texture indicated.
    - 2) Finish: Match framing system.
    - 3) Texture: Smooth.
    - 4) Backing Sheet: 1/8-inch- thick tempered hardboard.
  - c. Interior Skin: Aluminum.
    - 1) Thickness: Manufacturer's standard for finish and texture indicated.
    - 2) Finish: Matching storefront framing.
    - 3) Texture: Smooth.
    - 4) Backing Sheet: 1/8-inch- thick tempered hardboard.
  - d. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board.
  - e. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - 1) Flame-Spread Index: 25 or less.
    - 2) Smoke-Developed Index: 450 or less.

## F. Venting Windows:

1. Manufacturer's standard units, complying with AAMA/WDMA/CSA 101/I.S.2/A440, with self-flashing mounting fins, and as follows:
  - a. Window Type: As indicated on Drawings.
  - b. Minimum Performance Class: CW.
  - c. Minimum Performance Grade: As indicated on Drawings.
  - d. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:
    - 1) Cam handle locking system.
    - 2) Multi-point locking system.
    - 3) Pole-operated, cam handle locking system, where rail is more than 72 inches above floor.
    - 4) Rotary operator.
    - 5) Steel or bronze operating arms.
    - 6) Limit Devices: Concealed friction adjustor and adjustable stay bar limit devices designed to restrict sash opening.
      - a) Limit clear opening to 4 inches for ventilation; with custodial key release.
  - e. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
  - f. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, complying with SMA 1004 or SMA 1201, and as follows:
    - 1) Aluminum Wire Fabric: 18-by-18, 0.0445-inch-by-0.0445-inch; 18-by-16, 0.0445-inch-by-0.0515-inch; or 18-by-14, 0.0445-inch-by-0.0624-inch mesh of 0.013-inch-diameter, coated aluminum wire.
    - 2) Glass-Fiber Mesh Fabric: 18-by-16 0.0445-inch-by-0.0515-inch or 18-by-14 0.0445-inch-by-0.0624-inch mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D3656/D3656M.
    - 3) Fabric: Manufacturer's standard aluminum wire fabric or glass-fiber mesh fabric.

- g. Glazing: Same as adjacent aluminum-framed entrances and storefront glazing.
- h. Finish: Match adjacent aluminum-framed entrances and storefront finish.

## 2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
  - 1. Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
    - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
  - 2. Door Design: As indicated.
  - 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
    - a. Provide nonremovable glazing stops on outside of door.
  - 4. Finish: Match adjacent storefront framing finish.

## 2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. Weather Stripping: Manufacturer's standard replaceable components.
  - 1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
  - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

## 2.6 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Comply with Section 088000 "Glazing."
- C. Glazing Sealants: Comply with Section 088000 "Glazing."

## 2.7 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
  - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
  - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
  - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface

preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

## 2.8 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
  - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 2. Reinforce members as required to receive fastener threads.
  - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
  - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Sill Pan: Provide high performance flashing by manufacturer. Extruded aluminum, factory fabricated to provide sealed end dams, finished to match storefront; designed to direct water away from building when installed horizontally at sill. If manufacturer offers a similar sill pan as part of aluminum-framed entrance and storefront system, submit details and product data including finishes, for consideration and approval by Architect. PVC is not acceptable.
- D. Sill Extension: Extruded aluminum. Profile as indicated on Drawings.
- E. Perimeter Filler: Provide perimeter filler / backer plate to close back of frame and facilitate placement of backer rod and sealant.
  - 1. Back Plates: Furnish jamb and head framing members with manufacturer's standard continuous back plates, unless continuous plates are integral to the design of the framing system.
- F. Concealed Flashing: Dead-soft, 0.018-inch- thick stainless steel, complying with ASTM A240/A240M, of type recommended by manufacturer.
- G. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.
- H. Rigid PVC filler.

## 2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
  6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using shear-block system or screw-spline system.
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
  2. At exterior doors, provide weather sweeps applied to door bottoms.
- I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- J. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

## 2.10 ALUMINUM FINISHES

- A. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  2. Color and Gloss: Custom color as selected by Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.

- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
  - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
  - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Installation at Sill: Install sill pan system in accordance with manufacturer's written instructions.
  - 1. Set sill pan in a continuous bed of sealant or apply a nominal 6-inch-wide strip of 60 mil self-adhering waterproofing membrane to the bottom of the pan and where a penetration might be required to comply with specified performance requirements.
  - 2. Do not apply sealant between flashing pan and bottom of frame, except as required by manufacturer to comply with specified performance requirements. Set sill members in watertight sill flashing pan. Do not penetrate bottom of flashing pan and/or attach sill members to vertical leg of angle unless required by manufacturer to comply with specified performance requirements.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

### 3.3 INSTALLATION OF OPERABLE UNITS

- A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

### 3.4 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

### 3.5 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

- A. Install entrance doors to produce smooth operation and tight fit at contact points.
  - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
  - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

### 3.6 ERECTION TOLERANCES

- A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
  - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
  - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
  - 3. Alignment:



- a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
  - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
  - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

### 3.7 FIELD QUALITY CONTROL

- A. Contractor/Installer Testing: Contractor/Installer shall be prepared to provide the following minimum testing as part of the Work.
1. Testing shall be in compliance with AAMA 501.2. Testing shall be performed at approximately 10 percent and 50 percent completion. A minimum of 2 test areas to be tested at each phase. Additional testing may be required if installation crew changes or if construction is suspended and resumed after an extended period of time. Coordinate with Architect's representative for areas to be tested, testing times, and representative's availability to monitor tests.
- B. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.
- C. Tests and Inspections: Owner's testing agency may perform the following tests on representative areas of aluminum-framed entrances and storefronts.
1. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
  2. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.
  3. Egress Door Inspections: Inspect each aluminum-framed entrance door equipped with panic hardware, each aluminum-framed entrance door located in an exit enclosure, each electrically controlled aluminum-framed egress door, and each aluminum-framed entrance door equipped with special locking arrangements, in accordance with NFPA 101, Section 7.2.1.15.
- D. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.8 MAINTENANCE

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

END OF SECTION 084113



## SECTION 084229.23 - SLIDING AUTOMATIC ENTRANCES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes exterior and interior, sliding, power-operated automatic entrances.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For sliding automatic entrances.
  - 1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
  - 2. Include diagrams for power, signal, and control wiring.
  - 3. Indicate locations of activation and safety devices.
  - 4. Include hardware schedule and indicate hardware types, functions, quantities, and locations.
- C. Samples: For each type of exposed finish required.
- D. Delegated-Design Submittal: For automatic entrances.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Product test reports.
- C. Field quality-control reports.
- D. Sample warranties.

## 1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.

- B. Certified Inspector Qualifications: Certified by AAADM.

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 AUTOMATIC ENTRANCE ASSEMBLIES

- 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. Power-Operated Door Standard: BHMA A156.10.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design automatic entrances.
- B. Structural Performance: Automatic entrances shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Seismic Loads: See existing building structural drawings (Volume 2).
  - 2. Wind Loads: See existing building structural drawings Volume 2.
- C. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 3 for basic protection.
  - 1. Large-Missile Test: For glazing located within 30 feet of grade.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- E. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. of fixed entrance-system area when tested according to ASTM E283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft.[6.24 lbf/sq. ft..

### 2.3 SLIDING AUTOMATIC ENTRANCES

- A. General: Provide manufacturer's standard automatic entrances, including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, controls, and accessories required for a complete installation.
- B. Sliding Automatic Entrance( DFGS):
1. Bi-parting-Sliding Units: Basis of Design: Assa Abloy Besam SL500 OC6-12
  2. Configuration: Bi-parting-sliding doors with two sliding leaves, sidelites on each side.
    - a. Traffic Pattern: Two way.
    - b. Emergency Breakaway Capability: Sliding leaves and sidelites.
    - c. Mounting: Between jambs.
  3. Operator Features:
    - a. Power opening and closing.
    - b. Drive System: Manufacturer's standard .
    - c. Adjustable opening and closing speeds.
    - d. Adjustable hold-open time between zero and 30 seconds.
    - e. Obstruction recycle.
    - f. On-off/hold-open switch to control electric power to operator.
  4. Sliding-Door Carrier Assemblies and Overhead Roller Tracks: Carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.
    - a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.
  5. Sliding-Door Threshold: Threshold members and bottom-guide-track system with stainless-steel, ball-bearing-center roller wheels.
    - a. Configuration: Saddle-type threshold across door opening and surface-mounted guide-track system at sidelites.
  6. Controls: Activation and safety devices according to BHMA standards.
    - a. Activation Device: Motion sensor mounted on each side of door header to detect pedestrians in activating zone and to open door.
    - b. Safety Device: Presence sensor mounted to underside of door header and two photoelectric beams mounted in sidelite jambs on one side of the door to detect pedestrians in presence zone and to prevent door from closing.
    - c. Sidelite Safety Device: Presence sensor, mounted above each sidelite on side of door opening through which doors travel, to detect obstructions and to prevent door from opening.

7. Finish: Finish framing, door(s), and header with Class I, clear anodic finish.

C. Sliding Automatic Entrance (SFGS):

1. Single Sliding Units: Basis of Design: Assa Abloy SL500 OC3-9

2. Configuration: Single-sliding door with one sliding leaf, and sidelite.

- a. Traffic Pattern: Two way.
- b. Emergency Breakaway Capability: Sliding leaf only
- c. Mounting: Between jambs.

3. Operator Features:

- a. Power opening and closing.
- b. Drive System: Manufacturer's standard.
- c. Adjustable opening and closing speeds.
- d. Adjustable hold-open time between zero and 30 seconds.
- e. Obstruction recycle.
- f. On-off/hold-open switch to control electric power to operator.

4. Sliding-Door Carrier Assemblies and Overhead Roller Tracks: Carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.

- a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.

5. Sliding-Door Threshold: Threshold members and bottom-guide-track system with stainless-steel, ball-bearing-center roller wheels.

- a. Configuration: No threshold across door opening and surface-mounted guide-track system at sidelites.

6. Controls: Activation and safety devices according to BHMA standards.

- a. Activation Device: Motion sensor mounted on each side of door header to detect pedestrians in activating zone and to open door.
- b. Safety Device: Presence sensor mounted to underside of door header and two photoelectric beams mounted in sidelite jambs on one side of the door to detect pedestrians in presence zone and to prevent door from closing.

7. Finish: Finish framing, door(s), and header with Class I, clear anodic finish.

## 2.4 ENTRANCE COMPONENTS

A. Framing Members: Extruded aluminum, minimum 0.125 inch thick and reinforced as required to support imposed loads.

1. Nominal Size: 1-3/4 by 4-1/2 inches.
  2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch wall thickness.
- B. Stile and Rail Doors: 1-3/4-inch- thick, glazed doors with minimum 0.125-inch- thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.
1. Glazing Stops and Gaskets: Snap-on, extruded-aluminum stops and preformed gaskets.
  2. Stile Design: Wide stile, more than 4-inch nominal width.
  3. Rail Design: 5-inch nominal height
  4. Muntin Bars: Horizontal tubular rail member for each door; match stile design and finish.
- C. Sidelite(s)]: 1-3/4-inch- deep sidelite with minimum 0.125-inch- thick, extruded-aluminum tubular stile and rail members matching door design.
1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
  2. Glazing Stops and Gaskets: Snap-on, extruded-aluminum stops and preformed gaskets.
  3. Muntin Bars: Horizontal tubular rail members for each sidelite; match stile design.
- D. Headers: Fabricated from minimum 0.125-inch- thick extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
1. Mounting: Surface mounted.
- E. Signage: As required by cited BHMA standard.
1. Application Process: Door manufacturer's standard process.

## 2.5 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Extrusions: ASTM B221.
  2. Sheet: ASTM B209.
- B. Steel Reinforcement: Reinforcement with corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
- C. Glazing: As specified in Section 088000 "Glazing." Insulated glazing on exterior door only
- D. Sealants and Joint Fillers: As specified in Section 079200 "Joint Sealants."
- E. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C1107/C1107M; of consistency suitable for application.

- F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- G. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

## 2.6 DOOR OPERATORS AND CONTROLS

- A. General: Provide operators and controls, which include activation and safety devices, according to BHMA standards, for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
- B. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement.
  - 1. Door Operator Performance: Door operators shall open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
  - 2. Electromechanical Operators: Concealed, self-contained, overhead units powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; complying with UL 325; and with manual operation with power off.
- C. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed by their plastic housings; adjustable to provide detection-field sizes and functions required by BHMA A156.10.
  - 1. Provide capability for switching between bi- and unidirectional detection.
  - 2. For one-way traffic, sensor on egress side shall not be active when doors are fully closed.
- D. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection-field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.
- E. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.
- F. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

## 2.7 HARDWARE

- A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish.
- B. Breakaway Device for Power-Operated Doors: Device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Interrupt powered operation of door operator while in breakaway mode.
- C. Deadlocks: Deadbolt operated by exterior cylinder and interior thumb turn, with minimum 1-inch- long throw bolt; BHMA A156.5, Grade 1.



1. Cylinders: BHMA A156.5, Grade 1, six-pin mortise type.
    - a. Keying: Integrate into building master key system.
    - b. Keys: Two for each cylinder.
  2. Deadbolts: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
  3. Lock/Unlock Indicator: Lock position indicators integrated with locking system. Stile is mounted on secure side of door. Visual display of lock position as follows: "OPEN" in black letters when unlocked, and "LOCKED" in red letters when locked.
  4. Include locking devices for sidelites to prevent manual breakout.
- D. Uninterrupted Power Supply: UL 1778, fully integrated unit mounted within header.
- E. Weather Stripping: Replaceable components.
1. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

## 2.8 ACCESSORIES

## 2.9 FABRICATION

- A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
- B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
1. Provide components with concealed fasteners and anchor and connection devices.
  2. Fabricate components with accurately fitted joints, with ends coped or mitered to produce hairline joints free of burrs and distortion.
  3. Fabricate exterior components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
  4. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
  5. Allow for thermal expansion of exterior units.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
- E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."
- F. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.

1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors .

G. Controls:

1. General: Factory install activation and safety devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.

2.10 ALUMINUM FINISHES

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

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install automatic entrances according to manufacturer's written instructions and cited BHMA A156.10 for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.
1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
  2. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
  3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
  2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
  3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
  4. Level recesses for recessed thresholds using nonshrink grout.
- C. Door Operators: Connect door operators to electrical power distribution system.
- D. Glazing: Install glazing as specified in Section 088000 "Glazing." [
- E. Sealants: Comply with requirements specified in Section 079200 "Joint Sealants" to provide weathertight installation.
1. Set thresholds, bottom-guide-track system, framing members and flashings in full sealant bed.
  2. Seal perimeter of framing members with sealant.

- F. Signage: Apply signage on both sides of each door and breakaway sidelite, as required by cited BHMA standard for direction of pedestrian travel.
- G. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Test and inspect each automatic entrance, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.
- B. Automatic entrances will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.3 ADJUSTING

- A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
- B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

### 3.4 DEMONSTRATION

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

END

OF

SECTION

084229.23



## SECTION 088000 - GLAZING

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Glass for doors interior borrowed lites storefront framing [.
2. Glazing sealants and accessories.
3. Insulated Spandrel Glass Panels.

## 1.2 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Preconstruction adhesion and compatibility test report.

## 1.5 QUALITY ASSURANCE

- A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

## 1.6 PRECONSTRUCTION TESTING

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

## 1.7 WARRANTY

- A. **Manufacturer's Special Warranty for Insulating Glass:** Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. **Warranty Period:** 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. **Delegated Design:** Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- B. **Structural Performance:** Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E1300.
1. **Design Wind Pressures:** As indicated on Drawings.
- C. **Windborne-Debris Impact Resistance:** Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 3 for basic protection.
1. **Large-Missile Test:** For glazing located within 30 feet (9.1 m) of grade.

### 2.2 GLASS PRODUCTS, GENERAL

- A. **Glazing Publications:** Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. **IGMA Publication for Insulating Glass:** SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. **Thickness:** Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
- C. **Strength:** Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article.

## 2.3 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- C. Insulated Spandrel Glass Panels. Refer to Drawings.

## 2.4 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.
  - 1. Sealing System: Dual seals.
  - 2. Perimeter Spacer: Manufacturer's standard spacer material and construction.

## 2.5 GLAZING SEALANTS

- A. General:
  - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  - 3. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations.
- B. Glazing Sealant:
  - 1. Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

## 2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
  - 1. AAMA 804.3 tape, where indicated.

## 2.7 MISCELLANEOUS GLAZING MATERIALS

- A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

- B. Setting Blocks:
  - 1. EPDM with a Shore A durometer hardness of 85, plus or minus 5.
  - 2. Type recommended by sealant or glass manufacturer.
- C. Spacers:
  - 1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
  - 2. Type recommended by sealant or glass manufacturer.
- D. Edge Blocks:
  - 1. EPDM with a Shore A durometer hardness per manufacturer's written instructions.
  - 2. Type recommended by sealant or glass manufacturer.
- E. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

### PART 3 - EXECUTION

#### 3.1 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.



### 3.2 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Apply heel bead of elastomeric sealant.
- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

### 3.3 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.4 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

## 3.5 MONOLITHIC GLASS SCHEDULE

- A. Glass Type GL-1: Clear annealed float glass.
  - 1. Minimum Thickness: 6 mm.
- B. Glass Type GL-2: Clear fully tempered float glass.
  - 1. Minimum Thickness: 6 mm.

## 3.6 INSULATING-LAMINATED-GLASS SCHEDULE

- A. Glass Type GL-3: Clear insulating laminated glass.
  - 1. Overall Unit Thickness: 1 inch.
  - 2. Minimum Thickness of Outdoor Lite: 6 mm.
  - 3. Outdoor Lite: Fully tempered float glass.
  - 4. Interspace Content: Argon.
  - 5. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.
    - a. Minimum Thickness of Each Glass Ply: 3 mm.
    - b. Interlayer Thickness: 0.030 inch.
- B. Insulated Spandrel Glass Panels. Refer to Drawings.

END OF SECTION 088000

## SECTION 092216 - NON-STRUCTURAL METAL FRAMING

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.

## B. Related Requirements:

1. Section 05400 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load bearing wall studs

## 1.2 ACTION SUBMITTALS

## A. Product Data: For each type of product. Indicate yield strength of steel, section properties, limiting heights and spans.

## B. Shop Drawings:

1. For partitions requiring seismic bracing, submit coordinated set of partition anchorage drawings prior to installation including the following:
  - a. Description, layout and location of items to be anchored or braced with anchorage and brace points noted and dimensioned.
  - b. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts and welds clearly identified.
  - c. Numeric value of design seismic brace loads.

## 1.3 INFORMATIONAL SUBMITTALS

## A. Product Certificates: For each type of code-compliance certification for studs and tracks.

## B. Evaluation reports for embossed, high-strength steel studs and tracks.

## 1.4 QUALITY ASSURANCE

## A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

## 2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
    - a. Steel having a yield strength greater than 33 ksi is permitted.
  2. Protective Coating: ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.
  3. Structural Properties: Manufacturer's published data on structural properties shall be calculated based on allowable stress design conforming to AISI "Specification of the Design of Cold-Formed Steel Structural Members".
- B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.
1. Conventional Steel Studs and Tracks:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Phillips Manufacturing Co.
      - 2) Steel Network, Inc. (The)
      - 3) Telling Industries
    - b. Minimum Base-Steel Thickness: 0.0179 inch
      - 1) Yield of strength of steel
      - 2) Deflection Limits:
        - a) Gypsum Wallboard: L/240
      - 3) Limiting heights.
      - 4) Spans: As indicated on the drawings or as recommended by manufacturer.
      - 5) Applied loads composite or non-composite construction as appropriate:
        - a) Gypsum wallboard: 5 psf
        - b) Lead Lined gypsum wall board: 10 psf
      - 6) Depth: As indicated on Drawings
  2. Embossed High Strength Steel and Tracks:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) ClarkDietrich Building Systems
      - 2) Marino/WARE
      - 3) Phillips Manufacturing Co.
      - 4) Steel Network, Inc. (The)
      - 5) Telling Industries

- b. Minimum Base Metal Thickness: Of equivalent thickness to conventional studs and tracks based on criteria above, and validated by independent third party testing.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Track System: ASTM C645 top track with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
  2. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
  3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) Dietrich Metal Framing: SLP-TRK Slotted Deflection Track
      - 2) MBA Building Supplies, Slotted Deflecto Track
      - 3) Steel Network Inc. (The) VertiClip SLD Series
      - 4) Superior Metal Trim; Superior Flex Track System (SFT)
      - 5) Telling Industries; Vertical Slip Track
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  1. Minimum Base-Steel Thickness: 0.0329 inch.
- E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.
  1. Depth: As indicated on Drawings.
  2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C645.
  1. Minimum Base-Steel Thickness: 0.0329 inch.
  2. Depth: As indicated on Drawings

### 2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
  1. Depth: 1-1/2 inches.
- D. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements provide USG Corporation or a comparable product by one of the following:
  - a. Armstrong World Industries, Inc. Drywall Grid Systems
  - b. Chicago Metallic Corporation; Drywall Grid Systems
  - c. USG Corporation; Drywall Suspension System

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:
  1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
  1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support millwork, fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.

- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### 3.3 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  4. Do not attach hangers to steel roof deck.
  5. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216



## SECTION 092900 - GYPSUM BOARD

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Interior gypsum board.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each texture finish indicated on same backing indicated for Work.

## PART 2 - PRODUCTS

## 2.1 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

## 2.2 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
  - 1. Acceptable Manufacturers: Certain Teed, USG Corporation, National Gypsum and other manufacturers who meet the criteria of this specification.
  - 2. Thickness: 5/8 inch.
  - 3. Long Edges: Tapered.
- B. Gypsum Ceiling Board: ASTM C1396/C1396M.
  - 1. Acceptable Manufacturers: Certain Teed, USG Corporation, National Gypsum and other manufacturers who meet the criteria of this specification.
  - 2. Thickness: 1/2 inch.
  - 3. Long Edges: Tapered.
- C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
  - 1. Acceptable Manufacturers: Certain Teed, USG Corporation, National Gypsum and other manufacturers who meet the criteria of this specification.
  - 2. Locations: Patching of existing exterior gypsum board wall, inside face.

3. Core: 5/8 inch, Type X.
4. Long Edges: Tapered.

### 2.3 TRIM ACCESSORIES

#### A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet
2. Shapes:
  - a. Cornerbead.
  - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
  - c. L-Bead: L-shaped; exposed long flange receives joint compound.
  - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
  - e. Expansion (control) joint.

### 2.4 JOINT TREATMENT MATERIALS

#### A. General: Comply with ASTM C475/C475M.

#### B. Joint Tape:

1. Interior Gypsum Board: Paper.

#### C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
  - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use -setting-type, sandable topping- compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

### 2.5 AUXILIARY MATERIALS

#### A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

#### B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

#### C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
- E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.
- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- G. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

### PART 3 - EXECUTION

#### 3.1 APPLYING AND FINISHING PANELS

- A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- B. Comply with ASTM C840.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- E. Prefill open joints and damaged surface areas.
- F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

## 3.2 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

## 1.2 ACTION SUBMITTALS

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

## 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.
- B. Product test reports.
- C. Research reports.
- D. Field quality-control reports.

## 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for ceiling systems.
- B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Class A according to ASTM E1264.
  - 2. Smoke-Developed Index: 50 or less.

## 2.2 ACOUSTICAL PANELS

- A. Acoustical Panel Standard: Armstrong Ultima 1911 Beveled Tegular
- B. Color: White
- C. Light Reflectance (LR): <88% >.
- D. Ceiling Attenuation Class (CAC): 35
- E. Noise Reduction Coefficient (NRC): <0.75 >.
- F. Edge/Joint Detail: As indicated by manufacturer's designation
- G. Thickness: 3/4 inch
- H. Modular Size: 24 by 24 inches.

## 2.3 METAL SUSPENSION SYSTEM

- A. Product: Armstrong Prelude ML 15/16" Exposed Tee System
- B. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M.
- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
  - 1. Structural Classification: Intermediate-duty system.
  - 2. End Condition of Cross Runners: butt-edge type.
  - 3. Face Design: Flat, flush.
  - 4. Cap Material: aluminum.
  - 5. Cap Finish: Painted white.

## 2.4 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

## 2.5 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements for Seismic Category C; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.
- B. Layout openings for penetrations centered on the penetrating items.

## 3.2 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.
- B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
    - a. As indicated on reflected ceiling plans.

END

OF

SECTION

095113





## SECTION 096513 - RESILIENT BASE AND ACCESSORIES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
1. Thermoset-rubber base.
  2. Thermoplastic-rubber base.
  3. Rubber molding accessories.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- 1.
- B. Samples: For each exposed product and for each color and texture specified.

## PART 2 - PRODUCTS

## 2.1 THERMOPLASTIC-RUBBER BASE (RB-1)

- A. Basis of Design Product: Johnsonite "Traditional" Tab Welsh Castle CB
- B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
1. Group: I (solid, homogeneous).
  2. Style and Location: As indicated on Room Finish Legend on Drawings.
- C. Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Colors: As indicated on Room Finish Legend on Drawings.

## 2.2 RUBBER MOLDING ACCESSORY

- A. Manufacturer: Provide from same manufacturer as resilient base

- B. Description: Rubber nosing for resilient floor covering reducer strip for resilient floor covering joiner for tile and carpet transition strips.
- C. Locations: Provide as required at flooring material transitions.
- D. Colors: Selected from Manufacturer's standard color line..

### 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 resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for 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. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 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 practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
  - a. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches] <Insert dimension> in length.
  - a. Miter or cope corners to minimize open joints.

### 3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END

OF

SECTION

096513



## SECTION 096519 - RESILIENT TILE FLOORING

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Solid vinyl floor tile.
2. Walk off mat
3. Vinyl composition floor tile.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1.
- B. Samples: For each exposed product and for each color and pattern specified.

## 1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Warranty: Limited 20 year Commercial Warranty

## 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
  1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

## 2.2 SOLID VINYL FLOOR TILE LVT-1 and LVT-2

- A. LVT-1: Mannington Commercial

1. Type/Pattern: The Drift
  2. Color/Finish/ Size: Stone/Modus Patina D202 12" x 24"
- B. LVT-2 Mannington Commercial
1. Type/Pattern: The Drift
  2. Color/Finish/Size: Pax/Lucent D211 12" x24"
- C. Tile Standard: ASTM F1700.
1. Class: Class III, Printed Film Vinyl Tile.
  2. Type: B, Embossed Surface.
- D. Thickness: 0.100 inch.

### 2.3 WALK OFF MAT

- A. Basis of Design Product: Mannington Commercial Frixtion Force/Vector 14362

### 2.4 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.

## PART 3 - EXECUTION

### 3.1 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 F710.
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 9 pH.
  4. Moisture Testing: Perform tests so that each test area does not 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

- a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of -3 lb of water/1000 sq. ft. in 24 hours.
  - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

### 3.2 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] in pattern of colors and sizes indicated.
- 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 installation 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 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.

END OF SECTION 096519



## SECTION 096813 - TILE CARPETING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:

- 1. Modular carpet tile.

- B. Related Requirements:

- 1. Section 024119 "Selective Demolition" for removing existing floor coverings.
- 2. Section 096513 "Resilient Base and Accessories" Section 096519 "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet tile.

## 1.3 ACTION SUBMITTALS

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

- 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
- 2. Include manufacturer's written installation recommendations for each type of substrate.

- B. Shop Drawings: For carpet tile installation, plans showing the following:

- 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
- 2. Pattern of installation.
- 3. Type, color, and location of edge, transition, and other accessory strips.
- 4. Transition details to other flooring materials.

- C. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

- 1. Carpet Tile: Full-size Sample.
- 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

#### 1.4 INFORMATIONAL SUBMITTALS

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

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
  - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated.

#### 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- B. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

#### 1.8 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
  - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2. Failures include, but are not limited to, the following:
    - a. More than 10 percent edge raveling, snags, and runs.
    - b. Dimensional instability.
    - c. Excess static discharge.
    - d. Loss of tuft-bind strength.

- e. Loss of face fiber.
  - f. Delamination.
3. Warranty Period: 10years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CARPET TILE (CPT-1)

- A. Shaw Contract
- B. Style/Color: Places-Sea 5T172/Village 72760.
- C. Tile Size: 24"x 24"

### 2.2 CARPET TILE (WOM-1)

- A. Mannington Commercial
- B. Style/Color: Force/Vector 14362.
- C. Tile Size: 18"x 36"

### 2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.

- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
  - 1. Moisture Testing: Perform tests in no fewer than 3 separate locations to receive carpet.
    - a. Anhydrous Calcium Chloride Test: ASTM F1869. 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 additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

### 3.3 INSTALLATION

- A. General: Comply with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns .
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

#### 3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
  - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  - 2. Remove yarns that protrude from carpet tile surface.
  - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END

OF

SECTION

096813



## SECTION 096816 - SHEET CARPETING

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Tufted carpet.
2. Woven carpet.
3. Carpet cushion.

## 1.2 ACTION SUBMITTALS

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

## 1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranties.

## 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Certified by the International Certified Floorcovering Installers Association at the [**Commercial II**] [**Master II**] <**Insert description**> certification level.

## 1.6 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 Period: **10** years from date of Substantial Completion.
- B. Special Warranty for Carpet Cushion: Manufacturer agrees to repair or replace components of carpet cushion installation that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **10** years from date of Substantial Completion.

## PART 2 - PRODUCTS

- 2.1 TUFTED CARPET <Insert designation>
  - A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  - B. Color: [As indicated by manufacturer's designations] [Match Architect's samples] [As selected by Architect from manufacturer's full range] <Insert color>.
  - C. Pattern: [Match Architect's samples] <Insert pattern>.
  - D. Fiber Content: [100 percent nylon 6, 6] [100 percent nylon 6] [100 percent polypropylene] <Insert fiber and content by percentage>.
  - E. Fiber Type: <Insert proprietary fiber type>.
  - F. Pile Characteristic: [Level-loop] [Cut] [Cut-and-loop] [Multilevel-loop] [Level tip shear] [Random shear] [Frieze] [Sculptured] <Insert characteristic> pile.
  - G. Yarn Twist: <Insert twist in TPI>.
  - H. Yarn Count: <Insert yarn count>.
  - I. Density: <Insert oz./cu. yd.>.
  - J. Pile Thickness: <Insert inches> for finished carpet[ according to ASTM D6859].
  - K. Stitches: <Insert stitches per inch>.
  - L. Gage: <Insert gage in ends per inch>.
  - M. Face Weight: <Insert oz./sq. yd.>.
  - N. Total Weight: <Insert oz./sq. yd.> for finished carpet.
  - O. Primary Backing: [Manufacturer's standard material] [Woven polypropylene] [Nonwoven, polypropylene or polyester] <Insert specific primary backing material>.
  - P. Secondary Backing: [Manufacturer's standard material] [Woven polypropylene] [Nonwoven, polypropylene or polyester] [Woven jute] [Fiberglass] <Insert specific secondary backing material>.
  - Q. Backcoating: [Manufacturer's standard material] [SBR latex] [PVC] [Thermoplastic copolymer] <Insert backcoating; consult manufacturers>.
  - R. Backing System: <Insert proprietary name>.
  - S. Roll Width: [12 feet] [6 feet] [13.5 feet] [15 feet] <Insert dimension>.



## T. Applied Treatments:

1. Applied Soil-Resistance Treatment: [**Manufacturer's standard material**] <Insert treatment>.
2. Antimicrobial Treatment: [**Manufacturer's standard material**] <Insert treatment>.
  - a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

## U. Performance Characteristics:

1. Appearance Retention Rating: [**Moderate traffic, 2.5**] [**Heavy traffic, 3.0**] [**Severe traffic, 3.5**] <Insert number> minimum according to ASTM D7330.
2. Critical Radiant Flux Classification: Not less than [**0.45 W/sq. cm**] [**0.22 W/sq. cm**] according to NFPA 253.
3. Dry Breaking Strength: Not less than 100 lbf according to ASTM D2646.
4. Tuft Bind: Not less than [**3 lbf**] [**5 lbf**] [**6.2 lbf**] [**8 lbf**] [**10 lbf**] <Insert value> according to ASTM D1335.
5. Delamination: Not less than [**2.5 lbf/in.**] [**3.5 lbf/in.**] [**4 lbf/in.**] <Insert value> according to ASTM D3936.
6. Noise Reduction Coefficient (NRC): <Insert NRC> according to ASTM C423.
7. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
8. Colorfastness to Light: Not less than 4 after [**40**] [**60**] <Insert number> AFU (AATCC fading units) according to AATCC 16, Option E.
9. Electrostatic Propensity: Less than [**3.5**] [**2**] <Insert number> kV according to AATCC 134.

## 2.2 WOVEN CARPET &lt;Insert designation&gt;

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] <Insert color>.
- C. Pattern: [**Match Architect's samples**] <Insert pattern>.
- D. Fiber Content: [**100 percent wool**] [**80 percent wool; 20 percent nylon 6, 6**] [**80 percent wool; 20 percent nylon 6**] <Insert fiber and content by percentage>.
- E. Face Construction: [**Axminster**] [**Wilton**] [**Velvet**] <Insert construction>.
- F. Pile Characteristic: [**Level-loop**] [**Cut**] [**Cut-and-loop**] pile.
- G. Yarn Twist: <Insert twist in TPI>.
- H. Yarn Count: <Insert yarn count>.
- I. Density: <Insert oz./cu. yd.>.

- J. Pile Thickness: <Insert inches> for finished carpet[ **according to ASTM D6859**].
- K. Rows: <Insert number of lengthwise tufts per inch>.
- L. Pitch: <Insert number of rows in 27 inches>.
- M. Face Weight: <Insert oz./sq. yd.>.
- N. Total Weight: <Insert oz./sq. yd.> for finished carpet.
- O. Backing: [Manufacturer's standard.] [As follows:]
1. Chain Warp: <Insert material>.
  2. Stuffer Warp: <Insert material>.
  3. Shot or Fill Weft: <Insert material>.
  4. Backcoating: <Insert backcoating>.
- P. Applied Treatments:
1. Applied Soil-Resistance Treatment: [Manufacturer's standard material] <Insert treatment>.
  2. Antimicrobial Treatment: [Manufacturer's standard material] <Insert treatment>.
    - a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
- Q. Sustainable Design Requirements:
1. Sustainable Product Certification: [Silver] [Gold] [Platinum] level certification according to ANSI/NSF 140.
  2. <Double click to insert sustainable design text for carpet and cushion.>
- R. Performance Characteristics:
1. Appearance Retention Rating: [Moderate traffic, 2.5] [Heavy traffic, 3.0] [Severe traffic, 3.5] <Insert number> minimum according to ASTM D7330.
  2. Critical Radiant Flux Classification: Not less than [0.45 W/sq. cm] [0.22 W/sq. cm] according to NFPA 253.
  3. Dry Breaking Strength: Not less than 100 lbf according to ASTM D2646.
  4. Noise Reduction Coefficient (NRC): <Insert NRC> according to ASTM C423.
  5. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
  6. Colorfastness to Light: Not less than 4 after [40] [60] <Insert number> AFU (AATCC fading units) according to AATCC 16, Option E.
  7. Electrostatic Propensity: Less than [3.5] [2] <Insert number> kV according to AATCC 134.

### 2.3 CARPET CUSHION <Insert designation>

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- B. Traffic Classification: CCC [**Class I, moderate**] [**Class II, heavy**] [**Class III, extra-heavy**] traffic.
- C. Fiber Cushion: [**Rubberized hair, mothproofed and sterilized**] [**Rubberized jute, mothproofed and sterilized**] [**Synthetic**] [**Resinated, recycled textile**].
1. Weight: <Insert oz./sq. yd.>.
  2. Thickness: <Insert inches> plus 5 percent maximum.
  3. Density: <Insert lb/cu. ft.>.
- D. Rubber Cushion: [**Flat**] [**Rippled waffle**] [**Textured flat**] [**Reinforced**].
1. Weight: <Insert oz./sq. yd.>.
  2. Thickness: <Insert inches> plus 5 percent maximum.
  3. Compression Resistance: <Insert lb/sq. in.> at [25] [65] percent according to ASTM D3676.
  4. Density: <Insert lb/cu. ft.>.
- E. Polyurethane-Foam Cushion: [**Grafted prime**] [**Densified**] [**Bonded**] [**Mechanically frothed**].
1. Compression Force Deflection at 65 Percent: <Insert lb/sq. in. of polymer density> according to ASTM D3574.
  2. Thickness: <Insert inches>.
  3. Density: <Insert lb/cu. ft.>.
- F. Performance Characteristics:
1. Critical Radiant Flux Classification: Not less than [0.45 W/sq. cm] [0.22 W/sq. cm] according to NFPA 253.
  2. Noise Reduction Coefficient (NRC): <Insert NRC> according to ASTM C423.
  3. <Double click to insert sustainable design text for carpet and cushion.>

## 2.4 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by [**carpet**] [**carpet cushion**] manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by [**carpet manufacturer**] [**carpet and carpet cushion manufacturers**].
1. <Double click to insert sustainable design text for VOC content of adhesive.>
  2. <Double click to insert sustainable design text for adhesives.>
- C. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with the Carpet and Rug Institute's CRI 104.

- D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

##### A. Concrete Slabs:

1. Moisture Testing: Perform tests so that each test area does not exceed [**200 sq. ft.**] [**1000 sq. ft.**] <Insert area>, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
  - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of [**3 lb of water/1000 sq. ft.**] <Insert emission> in 24 hours.
  - b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum [**75**] <Insert number> percent relative humidity level measurement.
  - c. Perform additional moisture tests recommended in writing by [**adhesive and carpet**] [**adhesive, carpet cushion, and carpet**] manufacturers. Proceed with installation only after substrates pass testing.

- B. Wood Subfloors: Verify that underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

#### 3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by [**adhesive and carpet**] [**adhesive, carpet, and carpet cushion**] manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

## 3.3 INSTALLATION

- A. Comply with the Carpet and Rug Institute's CRI 104 and [**carpet manufacturer's**] [**carpet and carpet cushion manufacturers'**] written installation instructions for the following:
1. Direct-glue-down installation.
  2. Double-glue-down installation.
  3. Carpet with attached-cushion installation.
  4. Preapplied adhesive installation.
  5. Hook-and-loop installation.
  6. Stretch-in installation.
  7. Stair installation.
- B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
1. Stretch-in Carpet Installation: Install carpet cushion seams at 90-degree angle with carpet seams.
- C. Install [**pattern parallel to walls and borders**] [**as indicated on Drawings**] <Insert requirements>.
- D. Install borders with mitered corner seams.
- E. Do not bridge building expansion joints with carpet.
- F. 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.
- G. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.
- I. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer [**and carpet cushion manufacturer**] [**and carpet adhesive manufacturer**] [**and carpet cushion and adhesive manufacturers**].

END

OF

SECTION

096816



## SECTION 099123 - INTERIOR PAINTING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Steel and iron.
  - 2. Galvanized metal.
  - 3. Gypsum board.

## 1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples: For each type of paint system and in each color and gloss of topcoat.

#### 1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
    - b. Other Items: Architect will designate items or areas required.
  2. Final approval of color selections will be based on mockups.
    - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

#### 2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at the Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D ( EPA Method 24)
- D. Colors: As indicated in a color schedule.



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**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

**3.2 PREPARATION**

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

**3.3 APPLICATION**

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

**3.4 INTERIOR PAINTING SCHEDULE**

- A. Steel Substrates:
  - 1. Institutional Low-Odor VOC Latex System:
    - a. Prime Coat: Primer, rust inhibitive, water based.
      - 1) Sherwin Williams; Pro Cryl Universal Primer.

- b. Intermediate Coat: Latex, interior, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC semi-gloss (Level 5).
  - 1) Sherwin Williams: Pro-Industrial Acrylic Semi-Gloss Coating B66W00651.

B. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System:

- a. Prime Coat: Primer sealer, institutional low odor VOC.
  - 1) Sherwin Williams: ProMar 200 Zero Interior Latex Primer B28W02600/B28WQ2600.
- b. Intermediate Coat: Latex, interior, matching topcoat.
- c. Topcoat: Latex, interior institutional low odor/VOC (MPI Gloss Level 3-eggshell).
  - 1) Sherwin Williams: ProMar 200 Zero VOC interior Latex Egg Shell B20W0265/B20WQ2651.

END OF SECTION 099123

## SECTION 102600 - WALL AND DOOR PROTECTION

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Corner guards.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and attachment details
- C. Samples: For each exposed product and for each color and texture specified, 12 inches long.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Material certificates.
- C. Sample warranty.

## 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

## 1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of corner guard - protection units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Fiveyears from date of Substantial Completion.

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**PART 2 - PRODUCTS****2.1 PERFORMANCE REQUIREMENTS**

- A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
  2. Smoke-Developed Index: 450 or less.

**2.2 CORNER GUARDS**

- A. Surface-Mounted, Plastic-Cover Corner Guards
1. CG-1 and CG-2 Basis of Design: Inpro: 150 3" Surface Mount corner guard
    - a. Color/Finish: CG-1: 0238 Feather-and CG-2: 0256 Castle (Branding Wall only)
    - b. Height: 8 feet unless noted otherwise on the drawings
  2. Half Wall Full Corner Guards: Basis of Design: Inpro 150D
    - a. Color Finish: 0238 Feather
    - b. Height: Full height of half wall, 4" above floor.

**2.3 MATERIALS**

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Height: Install above resilient base
- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
1. Provide anchoring devices and suitable locations to withstand imposed loads.

END OF SECTION 102600

## SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Public-use washroom accessories.
2. Healthcare accessories.
3. Childcare accessories.
4. Under-lavatory guards.
5. Custodial accessories.

## B. Owner Furnished- Contractor Installed Products:

1. Soap Dispensers
2. Hand Sanitizers

## C. Related Sections:

1. Division 06 Section "Miscellaneous Rough Carpentry" for blocking and other work related to this section

## 1.2 ACTION SUBMITTALS

## A. Product Data: For each type of product indicated, include the following:

1. Construction details and dimensions
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish description
4. Manufacturer's warranty

## B. Product Schedule:

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

## 1.3 INFORMATIONAL SUBMITTALS

## A. Sample warranty.

## 1.4 CLOSEOUT SUBMITTALS

## A. Maintenance data.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

## 1.6 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning and servicing of accessories.

## 1.7 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
1. Warranty Period: -15 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide Basis of Design products as scheduled, or comparable products approved by the Architect from one of the following:
1. A&J Washroom Accessories, Inc.
  2. American Specialties, Inc.
  3. Bobrick Washroom Equipment, Inc (Basis of Design)
  4. Bradley Corporation.

### 2.2 WASHROOM ACCESSORIES

- A. Toilet Tissue (Roll) Dispenser (TT):

1. Basis of Design: Bobrick B4388
2. Description: Double-roll dispenser.
3. Mounting: Recessed
4. Operation: Non-control delivery with standard spindle.
5. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)

- B. Paper Towel (Folded) Dispenser (PTD):

1. Basis of Design: Bobrick B4262
2. Mounting: Surface mounted.
3. Minimum Capacity: 400 C-fold towels.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

- 
5. Lockset: Tumbler type.
  6. Refill Indicator: Pierced slots at sides or front.
- C. Grab Bars (GB-18, GB-36, GB-42):
1. Basis of Design: Bobrick B-5806.99x18, B-5806.99 x36, B-5806.99x42
  2. Mounting: Flanges with concealed fasteners.
  3. Material: Stainless steel, 0.05 inch thick.
    - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
  4. Outside Diameter: 1-1/4 inches .
  5. Configuration and Length: As indicated on Drawings.
- D. Sanitary-Napkin Disposal Unit (SND):
1. Basis of Design: Bobrick B-254
  2. Mounting: Surface mounted.
  3. Door or Cover: Self-closing, disposal-opening cover.
  4. Receptacle: Removable.
  5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)
- E. Seat-Cover Dispenser (SCD):
1. Basis of Design: Bobrick B-301
  2. Mounting: Surface mounted.
  3. Minimum Capacity: 250 seat covers.
  4. Exposed Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
  5. Lockset: Tumbler type.
- F. Mirror Unit (MIR):
1. Basis of Design: Bobrick B-165
  2. Frame: Stainless steel angle, 0.05 inch thick.
    - a. Corners: Manufacturer's standard.
  3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
    - a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
  4. Size: As indicated on Drawings.
- G. Multiple Coat Hook (MRH)
1. Basis of Design: Bobrick B232 x 24
  2. Description: Multiple hook unit
  3. Material and Finish: Stainless steel ASTM A480/A480M No. 4 finish (satin)
- H. Coat Hook (BH) :
1. Basis of Design: Bobrick B-682

2. Description: Double-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)

## 2.3 HEALTHCARE ACCESSORIES

### A. Specimen Pass-Through Cabinet (PTC):

1. Basis of Design: Bobrick:
2. Description: With self-closing doors on both sides, lock that prevents doors from both being opened at same time, and removable stainless steel tray.
3. Nominal Wall Opening: 12 by 11-1/4 inches , width by height.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

## 2.4 CHILDCARE ACCESSORIES

### A. Diaper-Changing Station: (DCS)

1. Basis of Design: Koala Care Products, a division of Bobrick: KB100-05ST
2. Description: Horizontal recessed unit that opens by folding down from stored position and with child-protection strap.
  - a. Engineered to support minimum of 250-lb static load when opened.
3. Mounting: Recessed
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: HDPE with stainless steel trim. Color: "White Granite"
6. Liner Dispenser: Built in.

## 2.5 UNDERLAVATORY GUARDS

### A. Under-lavatory Guard ULG:

1. Acceptable manufacturers: Buckaroos, Inc, Plumberex Specialty Products, Truebro by IPS Corporation
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

## 2.6 CUSTODIAL ACCESSORIES

### A. Mop and Broom Holder MBH:

1. Basis of Design: Bobrick B-223x24
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 24 inches.
4. Hooks: Three.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.



6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
  - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.

## 2.7 FABRICATION

- A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

END

OF

SECTION 102800



## SECTION 104413 - FIRE PROTECTION CABINETS

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Fire-protection cabinets for portable fire extinguishers.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fire-protection cabinets.
- C. Samples: For each type of exposed finish required.

## 1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

## 1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

## PART 2 - PRODUCTS

## 2.1 FIRE-PROTECTION CABINET &lt; FEC-1&gt;

## A. Cabinet Type: Suitable for fire extinguisher.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Amerex Corporation
  - b. Ansul Incorporated
  - c. J.L.Industries
  - d. Larsens Manufacturing Company
  - e. Nystrom Building Products
  - f. Potter Roemer
  - g. Pyro-Chem

- 
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Recessed Cabinet:
1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
- E. Cabinet Trim Material: Steel sheet
- F. Door Material: Steel sheet.
- G. Door Style: Vertical duo panel with frame
- H. Door Glazing: Tempered float glass (clear)
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide projecting lever handle with cam-action latch
  2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- J. Accessories:
1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
  3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
    - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
      - 1) Location: Applied to cabinet door.
      - 2) Application Process: Decals.
      - 3) Lettering Color: White.
      - 4) Orientation: Vertical.
- K. Materials:
1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
    - a. Finish: Factory primed for field painting
  2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear)

## 2.2 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.
- B. Install fire-protection cabinets in locations and at mounting heights indicated.
- C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
- D. Identification: Apply decals at locations indicated.
- E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END

OF

SECTION

104413



## SECTION 104416 - FIRE EXTINGUISHERS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

## 1.2 ACTION SUBMITTALS

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

## 1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

## 1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

## 1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Six years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

## 2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and [mounting bracket indicated].
  - 1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B
- B. Multipurpose Dry-Chemical Type ( FEC-1 and FEC-2): UL-rated 10lb. (4.5)kg > nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

## 2.3 MOUNTING BRACKETS ( FEC-2)

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
  - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
  - 1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416



## SECTION 105123 - PLASTIC-LAMINATE-CLAD LOCKERS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes plastic-laminate-clad wood lockers.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1.
- B. Shop Drawings: For plastic-laminate-clad wood lockers.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Show locker identification system and numbering sequence.
- C. Samples: For each exposed product and for each color and texture specified.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

## 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

## 1.5 FIELD CONDITIONS

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

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of lockers that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Threeyears from date of Substantial Completion

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in ICC A117.1.

## 2.2 PLASTIC-LAMINATE-CLAD WOOD LOCKERS

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. Construction Style: **Manufacturer's standard** [**Flush overlay**] [**Reveal overlay**] [**Flush inset**] [**Flush inset with face frame**] [**As indicated**].
1. Reveal Dimension: [**1/2 inch**] [**As indicated**] **<Insert dimension>**.
- C. Locker Body: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay.
1. Side, Top, and Bottom Panels: Manufacturer's standard 3/4 or 5/8 inch thick.
  2. Back Panel: Manufacturer's standard 1/2 or 3/8 inch thick.
  3. Exposed Panel Edges: [**Thermoset decorative overlay to match panel**] [**1-mm-thick PVC**] [**3-mm-thick PVC**] [**Vinyl T-molding**] [**High-pressure decorative laminate, Grade HGS, to match panels**] [**High-pressure decorative laminate, Grade VGS, to match panels**].
- D. Plastic-Laminate-Clad Wood Doors: High-pressure decorative laminate, Grade VGS, over both sides of [**particleboard**] [**medium-density-fiberboard**] core.
1. Thickness: 3/4 thick.
  2. Panel Edges: [**1-mm-thick PVC**] [**3-mm-thick PVC**] [**Vinyl T-molding**] [**High-pressure decorative laminate, Grade VGS, to match panels**] [**1/4-inch- thick, solid wood**] [**High-pressure decorative laminate, Grade HGP, postformed with 3/8-inch radius**].
- E. End Panels: Match style, material, construction, and finish of plastic-laminate-clad wood doors.
- F. Shelves: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay; [**fixed**] [**fixed unless otherwise indicated**] [**adjustable**] [**fixed and adjustable, as indicated**].
1. Thickness: 3/4 inch.
  2. Exposed Edges: [**Thermoset decorative overlay to match panels**] [**1-mm-thick PVC**] [**3-mm-thick PVC**] [**High-pressure decorative laminate, Grade VGS, to match panels**].
- G. Corners and Filler Panels: 3/4-inch- thick panels. Match style, material, construction, and finish of plastic-laminate-clad wood doors.

- H. Continuous Finish Base: Plastic-laminate-clad, 3/4-inch- thick panel that matches door faces; fabricated in lengths as long as practical to enclose base and base ends of lockers.
- I. Continuously Sloping Tops: Plastic-laminate-clad, 3/4-inch- thick panel that matches door faces for installation over lockers with separate flat tops. Fabricate tops in lengths as long as practical, without visible fasteners at splice locations. Provide fasteners, supports, and closures, as follows:
  - 1. Closures: [**Vertical**] [**Hipped**]-end type.
- J. Plastic-Laminate Colors, Patterns, and Finishes:
  - 1. As indicated by manufacturer's designations.
  - 2. Match Architect's samples.
  - 3. As selected by Architect from plastic-laminate manufacturer's full range of [**solid colors**] [**solid colors with core same color as surface**] [**wood grains**] [**patterns**].
  - 4. <Insert color, pattern, and finish>.

## 2.3 MATERIALS

- A. Composite Wood: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  - 1. <Double click to insert sustainable design text for recycled content.>
  - 2. <Double click to insert sustainable design text for composite wood products.>
  - 3. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
  - 4. Medium-Density Fiberboard: ANSI A208.2, [**Grade 130**] <Insert grade>.
  - 5. Particleboard: ANSI A208.1, [**Grade M-2**] [**Grade M-2-Exterior Glue**].
  - 6. Softwood Plywood: DOC PS 1[, **medium-density overlay**].
- B. High-Pressure Decorative Laminate: NEMA LD 3, grades as follows:
  - 1. Horizontal Surfaces: [**Grade HGS**] [**Grade HGL**].
  - 2. Postformed Surfaces: Grade HGP.
  - 3. Vertical Surfaces: [**Grade HGS**] [**Grade VGS**].
- C. <Double click to insert sustainable design text for adhesives.>
- D. Anchors: Material, type, size, and finish as required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- E. Wood Support Base: [**2-by-4-inch nominal-size**] [**2-by-6-inch, nominal-size**] lumber treated with manufacturer's standard preservative-treatment, [**nonpressure**] [**pressure**] process.

## 2.4 HARDWARE

- A. Cam Padlock Hasp: Surface mounted, steel; finished to match other locker hardware.
- B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges; back mounted.
  - 1. Provide two hinges for doors **[36 inches] [42 inches]** high and less.
- C. Semiconcealed Hinges: Single-pivot, spring-loaded steel hinges; back mounted.
  - 1. Provide two hinges for doors **[36 inches] [42 inches]** high and less.
- D. Frameless Hinges (European Type): Fully concealed[, **self-closing**], nickel-plated steel, with not less than 125 degrees of opening.
  - 1. Provide two hinges for doors **[36 inches] [42 inches]** high and less.
- E. Wire Pulls: Back mounted; **[4 inches long, 5/16 inch in diameter] 2-1/2 inches deep, and 5/16 inch in diameter**].
- F. Accessible Handle: Metal, fixed, graspable lever handle and rose trim; surface mounted.
- G. Hooks: Manufacturer's standard, ball-pointed aluminum or steel; **[finished to match other locker hardware]**. Attach hooks with at least two fasteners.
  - 1. Provide **two single-prong wall hooks** for each compartment of **triple-tier** lockers.
- H. Exposed Hardware Finish: Satin chrome unless otherwise indicated.

## 2.5 ACCESSORIES

- A. Door Trays: Fabricated from solid wood.
- B. Mirrors: ASTM C1036, Type I, Class 1, Quality q2.
  - 1. Frame: Solid wood.
- C. Number Identification Plates: 1-1/2-inch- diameter, etched, embossed, or stamped, plates with black numbers and letters at least 1/2 inch high. Identify lockers in sequence indicated on Drawings. Finish plates to match other locker hardware.

## 2.6 FABRICATION

- A. Fabricate lockers square, rigid, without warp, and with finished faces flat and free of dents, scratches, and chips. Accurately factory machine components for attachments. Make joints tight and true.
- B. Accessible Lockers: Fabricate as follows:
  - 1. Locate bottom shelf no lower than 15 inches above the floor.

2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.
- C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

#### 3.2 INSTALLATION

- A. Install wood support base[ **with 1/2-inch- thick, plywood top**].
- B. Install lockers level, plumb, and true; use concealed shims.
- C. Connect groups of lockers together with manufacturer's standard[ **brass-finished**] fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit lockers accurately together to form flush, tight, hairline joints.
- D. Install lockers without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.
  1. Installation Tolerance: No more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line. Shim as required with concealed shims.
- E. Locker Anchorage: Fasten lockers through wood locker base, at ends, and not more than 36 inches o.c. with No. 8 flush-head wood screws sized for 1-inch penetration into wood base.
- F. Locker Anchorage: Fasten lockers through back, near top and bottom, at ends with No. 8 flush-head wood screws sized for 1-inch penetration into wood framing, blocking, or furring and spaced not more than 16 inches o.c.
- G. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.
- H. Attach sloping-top units to lockers, with end panels covering exposed ends.
- I. Install [**number identification plates**] [**and**] [**name identification plates and holders**] after lockers are in place.

- J. Provide protective mat at each shoe shelf.
- K. Fixed Locker Benches: Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.
- L. Movable Locker Benches: Place benches in locations indicated on Drawings.

END OF SECTION 105123

## SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Solid surface material countertops.
- B. Related Requirements:

## 1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
  - 1.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
  - 1. Show locations and details of joints.
  - 2. Show direction of directional pattern, if any.
- C. Samples for Initial Selection: For each type of material exposed to view.
- D. Samples for Verification: For the following products:
  - 1. Countertop material, 6 inches square.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

## 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

## 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.
  - 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

## 1.8 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

## PART 2 - PRODUCTS

### 2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
  - 1. Basis of Design: Corian "Linen"
  - 2. Type: Provide Standard type unless Special Purpose type is indicated.
- B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
- C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

### 2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
  - 1. Grade: Custom.
- B. Configuration:
  - 1. Front: Straight, slightly eased on all exposed surfaces, 1-inch (25mm) .
  - 2. .
- C. Countertops: 1/2-inch- with 1" front edge built up with same material.



- D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
- E. Joints: Fabricate countertops without joints.
- F. Joints: Fabricate countertops in sections for joining in field.
  - 1. Joint Locations: Not where a countertop section less than 36 inches long would result, unless unavoidable.

## 2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into corner blocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- F. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

## SECTION 134900 - RADIATION PROTECTION

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Lead sheet, strip, and plate.
2. Lead-lined gypsum board.
3. Lead glass.
4. Lead-lined, hollow-metal door frames.
5. Lead-lined flush wood doors.
6. Lead-lined, observation-window frames.
7. Informational signs.

## 1.2 DEFINITIONS

## A. Lead Equivalence: The thickness of lead that provides the same attenuation (reduction of radiation passing through) as the material in question under the specified conditions.

1. Lead equivalence specified for materials used in diagnostic x-ray rooms is as measured at 100 kV unless otherwise indicated.

## 1.3 ACTION SUBMITTALS

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

## B. Shop Drawings: Show layout of radiation-protected areas. Indicate lead thickness or lead equivalence of components. Show components and installation conditions not fully dimensioned or detailed in product data.

1. Show ducts, pipes, conduit, and other objects that penetrate radiation protection; include details of penetrations.

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

## 1.4 INFORMATIONAL SUBMITTALS

## A. Field quality-control reports.

## B. Sample Warranty: For warranty.

## 1.5 WARRANTY

- A. Warranty for Lead-Lined Flush Wood Doors: Comply with requirements in Section 081416 "Flush Wood Doors."

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Provide materials and workmanship, including joints and fasteners, that maintain continuity of radiation protection at all points and in all directions equivalent to materials specified in thicknesses and locations indicated.
  - 1. Materials, thicknesses, and configurations indicated are based on radiation protection design prepared by Owner's radiation health physicist. This design is available to Contractor on request.
- B. Lead-Lined Assemblies: Unless otherwise indicated, provide lead thickness in doors, door frames, window frames, penetration shielding, joint strips, film transfer cabinets, and other items located in lead-lined assemblies not less than that indicated for assemblies in which they are installed.
- C. Lead Glazing: Unless otherwise indicated, provide lead equivalence not less than that indicated for assembly in which glazing is installed.
- D. Door and Frame Assemblies: Comply with Section 081113 "Hollow Metal Doors and Frames" and Section 081416 "Flush Wood Doors"

### 2.2 MANUFACTURERS

- A. Source Limitations: Obtain each type of radiation protection product from single source from single manufacturer

### 2.3 MATERIALS

- A. Lead Sheet, Strip, and Plate: ASTM B749, Alloy UNS No. L51121 (chemical-copper lead).
- B. Lead-Lined Gypsum Board: 5/8-inch- thick gypsum board complying with Section 092900 "Gypsum Board," of width and length required for support spacing and to prevent cracking during handling, and with a single sheet of lead laminated to the back of the board.
  - 1. Lead Sheet Lining: Full width of board and length necessary to extend from floor to 84 inches above floor
  - 2. Furnish 2-inch- wide lead strips for backing joints.
  - 3. Furnish 5/8-inch lead disks for covering screw heads.
  - 4. Furnish finishing materials, accessories, and trim for lead-lined gypsum board complying with Section 092900 "Gypsum Board."

- C. Lead Glass: 1.58mm Lead-barium, polished glass containing not less than 60 percent heavy metal oxides, including not less than 48 percent lead oxide by weight.
- D. Glazing Compounds, Gaskets, and Accessories: Comply with requirements in Section 088000 "Glazing."
- E. Accessories and Fasteners: Manufacturer's standard fasteners and accessories as required for installation, maintaining same lead equivalence as rest of system.
- F. Asphalt Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- G. Asphalt Felt: ASTM D226/D226M.

#### 2.4 LEAD-LINED, HOLLOW-METAL DOOR FRAMES

- A. General: Steel door frames complying with NAAMM-HMMA 861, , lined with lead sheet of thickness not less than that required for doors and walls where frames are used.
  - 1. Furnish with additional reinforcements and internal supports to adequately carry the weight of lead-lined doors. Install reinforcements and supports before installing lead lining.
  - 2. Form lead sheet to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective lap with lead of adjacent shielding.
  - 3. Finish: Apply manufacturer's [standard primer immediately after cleaning and pretreating.
    - a. Color and Gloss: To match other hollow metal frames. See finish schedule..

#### 2.5 LEAD-LINED FLUSH WOOD DOORS

- A. Lead-Lined Flush Wood Doors: Solid-core wood doors with lead lining, thickness not less than 1/32"
  - 1. Door Construction: Veneer face, to match other doors.core.
  - 2. Lead Lining: One or more continuous sheets of lead extending from top to bottom and edge to edge, constructed either in the core or between the core and faces, at manufacturer's option.
  - 3. Lead Lining: One continuous sheet of lead extending from top to bottom and edge to edge, constructed in the core. Assemble lead lining and core with poured lead fasteners or steel bolts. Space fasteners not more than 1-1/2 inches from door edge and about 8 inches o.c. Countersink bolt heads and cover with lead.
  - 4. Comply with Section 081416 "Flush Wood Doors" for grade, faces, veneer matching, performance grade, fabrication, finishing, and other requirements unless otherwise indicated.
- B. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards"
  - 1. Grade: Premium.
  - 2. Face Veneer Species and Cut: Match wood doors that are not lead lined.

3. Faces: Any closed-grain hardwood of mill option, for opaque finish.
- C. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
  - D. Shield cutouts for locksets with lead sheet of same thickness used in door. Lap lining of cutouts with door lining.
  - E. Factory fit doors to suit frame openings indicated with [1/16-inch] clearance at heads and jambs and minimum clearance at bottom. Factory machine doors for hardware not surface applied.

## 2.6 LEAD-LINED, OBSERVATION-WINDOW FRAMES

- A. General: Fabricate from 0.043-inch- thick, formed-steel sheet or 0.064-inch- thick aluminum extrusions with mitered corners, welded or bolted with concealed fasteners.
  1. Line with lead sheet formed to match frame contour, continuous in each jamb and across head and sill, lapping the stops, and fabricated wide enough to maintain an effective lap with lead of adjoining assemblies.
  2. Construct so lead lining overlaps glazing material perimeter by at least 3/8 inch and furnish removable stops.
  3. Form sill with an opening for sound transmission. Offset sound passage to make opening lightproof and to maintain required lead equivalence at all points and in all directions.

## 2.7 INFORMATIONAL SIGNS

- A. Informational Signs: Comply with Section 101423 "Panel Signage."
  1. Color: As selected by Architect from manufacturer's full range of colors.
  2. Provide copy indicated or as directed.
  3. Indicate lead equivalence in millimeters and heights of radiation protection in inches.
- B. Informational Signs: High-pressure-laminate engraving stock with contrasting face and core, machine engraved from master templates for accurately formed letters, numbers, and symbols.
  1. Color: As selected by Architect from manufacturer's full range of colors.
  2. Provide copy indicated or as directed.
  3. Indicate lead equivalence in millimeters and heights of radiation protection in inches.
- C. Rooms Where the Level of Protection Is Not Uniform Throughout: Provide one sign for each room with different lead equivalences in different locations. Indicate, in tabular form, lead equivalence of each wall, partition, ceiling, floor, door, and window. Indicate height of radiation protection above floor or indicate that partitions are radiation protected to full height. Indicate where lead equivalence changes or is not continuous.

## 2.8 DOOR AND DOOR FRAME FABRICATION

- A. Hardware Preparation: Factory prepare doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door

Hardware Schedule and templates furnished as specified in Section 087111 "Door Hardware (Descriptive Specification)."

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

#### 3.2 INSTALLATION OF LEAD-LINED GYPSUM BOARD

- A. Install with long edge parallel to supports and lead lining facing supports. Provide blocking at end joints.[ Install using construction adhesive and supplementary fasteners.]
- B. Fastening to Metal Supports: Use steel drill screws spaced as recommended in writing by gypsum board manufacturer.
  - 1. Install lead strips covering face of framing and wrap around flange to cover points of screws. Where possible, install lead-lined gypsum board before installing gypsum board on other side of partition, and do not fold lead strips back over inside of flange until after lead-lined gypsum board is applied. Apply lead disks recessed flush with surface of board over heads of screws securing trim.
  - 2. Install lead strips, 2 inches wide and same thickness as lead lining, to face of supports and blocking where joints occur. Secure lead strips with construction adhesive. Provide shims at face of supports and blocking where joints do not occur.
- C. Fastening to Metal Supports: Use steel drill screws spaced as recommended in writing by gypsum board manufacturer.
  - 1. Install lead strips, 2 inches wide and same thickness as lead lining, to face of supports and blocking where joints occur. Secure lead strips with construction adhesive. Provide shims at face of supports and blocking where joints do not occur.
  - 2. Apply lead disks recessed flush with surface of board over heads of screws securing gypsum board and trim.
  - 3. Locate fasteners above ceiling or behind wall base[ and cover fasteners with lead disks recessed flush with surface of board].
- D. Openings: Extend lead-lined gypsum board into frames of openings, lapping lead lining with lead frames or frame linings at least 1 inch. Arrange board around openings so neither horizontal nor vertical joints occur at corners of openings.
- E. Install control and expansion joints where indicated, with appropriate trim accessories. Install lead strip on face of framing, extending across joint, and lap with lead lining of gypsum board.
- F. Finish lead-lined gypsum board to comply with Section 092900 "Gypsum Board."

### 3.3 INSTALLATION OF LEAD-LINED DOORS AND DOOR FRAMES

- A. Install lead-lined steel door frames according to Section 081113 "Hollow Metal Doors and Frames."
  - 1. Apply a coat of asphalt mastic or paint to lead lining in door frames where lead comes in contact with masonry or grout.
- B. Install lead-lined wood doors according to Section 081416 "Flush Wood Doors."
- C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with door manufacturer's written instructions.
- D. Lap lead lining of frames over lining in walls at least 1 inch.
- E. Hardware: Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. See Section 087100 "Door Hardware" for other installation requirements.

### 3.4 INSTALLATION OF LEAD-LINED OBSERVATION WINDOWS

- A. Install observation windows according to manufacturer's written installation instructions.
  - 1. Apply a coat of asphalt mastic or paint to lead lining in frames where lead comes in contact with masonry or grout.
- B. Install windows level, plumb, square, true to line, and anchored securely in place to structural support.
- C. Install leaded side of frame on radiation side of wall. Lap lead lining of frames over lining in walls at least 1 inch.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with manufacturer's written instructions.

### 3.5 INSTALLATION OF PENETRATING ITEMS

- A. At penetrations of lead linings, provide lead shields to maintain continuity of protection.
- B. Provide lead linings, sleeves, shields, and other protection in thickness not less than that required in assembly being penetrated.
- C. Secure shields at penetrations using adhesive or wire ties but not penetrating fasteners unless indicated on Drawings.
- D. Outlet Boxes and Conduit: Cover or line with lead sheet lapped over adjacent lead lining at least 1 inch. Wrap conduit with lead sheet for a distance of not less than 10 inches from box.



- E. Duct Openings: Unless otherwise indicated, line or wrap ducts with lead sheet for distance from partition/ceiling equal to three times the largest opening dimension. Lap lead sheet with adjacent lead lining at least 1 inch.
- F. Piping: Unless otherwise indicated, wrap piping with lead sheet for a distance of not less than 10 inches from point of penetration.

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections after radiology equipment has been installed and placed in operating condition.
- B. Correct deficiencies in or remove and replace radiation protection that inspection reports indicate does not comply with specified requirements.
- C. Prepare test and inspection reports.

END

OF

SECTION

134900



## SECTION 210517 – SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

### 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. Sleeves.
  - 2. Stack-sleeve fittings.
  - 3. Sleeve-seal systems.
  - 4. Sleeve-seal fittings.
  - 5. Grout.
  - 6. Silicone sealants.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.
- B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, anticorrosion coated, with plain ends and integral welded waterstop collar.
- C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- D. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

## 2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers: Jay R. Smith, Mfg., Zurn Products, or approved equal.
- B. Description: Manufactured, Dura-coated or Duco-coated cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with setscrews.

## 2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Advance Products & Systems, CALPICO, Inc., MatraFlex Company, or approved equal.
- B. Description:
  - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 2. Designed to form a hydrostatic seal of 20 psig minimum.
  - 3. Sealing Elements: EPDM-rubber, High-temperature-silicone, or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
  - 4. Pressure Plates: Carbon steel, Composite plastic, Stainless steel, or Stainless steel, Type 316.
  - 5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel, Stainless steel, Type 316, as appropriate, of length required to secure pressure plates to sealing elements.

## 2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Advance Products & Systems, CALPICO, Inc., MatraFlex Company, or approved equal.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.
- C. Plastic or rubber waterstop collar with center opening to match piping OD.

## 2.5 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.6 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.
  - 1. Manufacturers: Dow Corning Corporation, GE Construction Sealants, Polymeric Systems, Inc or approved equal.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
  - 1. Manufacturer: May National Associates or approved equal.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
  - 1. Manufacturers: Smooth-on or approved equal.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. 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.

3. Using grout or silicone sealant as appropriate, seal space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
  2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
  3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

### 3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
  3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
  4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  5. Use silicone sealant to seal around the outside of stack-sleeve fittings.
- B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- or smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

### 3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Use grout or silicone sealant as appropriate, to seal the space around outside of sleeve-seal fittings.

### 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Steel pipe sleeves
    - b. Piping NPS 6 and Larger: Steel pipe sleeves
  - 2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 3. Concrete Slabs-on-Grade:
    - a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 4. Concrete Slabs above Grade:
    - a. Piping Smaller Than NPS 6: Steel pipe sleeves.

- b. Piping NPS 6 and Larger: Steel pipe sleeves.
5. Interior Partitions:
- a. Piping Smaller Than NPS 6: Steel pipe sleeves.
  - b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 21 0517



## SECTION 210523 – GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING

### 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. Two-piece ball valves with indicators.
  - 2. Bronze butterfly valves with indicators.
  - 3. Iron butterfly valves with indicators.
  - 4. Check valves.
  - 5. Bronze OS&Y gate valves.
  - 6. Iron OS&Y gate valves.
  - 7. NRS gate valves.
  - 8. Trim and drain valves.

#### 1.3 DEFINITIONS

- A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- B. NRS: Non-rising stem.
- C. OS&Y: Outside screw and yoke.
- D. SBR: Styrene-butadiene rubber.

#### 1.4 ACTION SUBMITTALS

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

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, and weld ends.
  - 3. Set valves open to minimize exposure of functional surfaces.
- 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 operating handles or stems as lifting or rigging points.
- D. Protect flanges and specialties from moisture and dirt.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
1. Main Level: HAMV - Fire Main Equipment.
    - a. Level 1: HCBZ - Indicator Posts, Gate Valve.
    - b. Level 1: HLOT - Valves.
      - 1) Level 3: HLUG - Ball Valves, System Control.
      - 2) Level 3: HLXS - Butterfly Valves.
      - 3) Level 3: HMER - Check Valves.
      - 4) Level 3: HMRZ - Gate Valves.
  2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
    - a. Level 1: VQGU - Valves, Trim and Drain.
- B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
1. Automated Sprinkler Systems:
    - a. Valves.
      - 1) Gate valves.
      - 2) Check valves.
      - 3) Miscellaneous valves.
- C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.
- D. ASME Compliance:
1. ASME B16.1 for flanges on iron valves.
  2. ASME B1.20.1 for threads for threaded-end valves.
  3. ASME B31.9 for building services piping valves.
- E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

- F. NFPA Compliance: Comply with NFPA 24 for valves.
- G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.
- H. Valve Sizes: Same as upstream piping unless otherwise indicated.
- I. Valve Actuator Types:
  - 1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
  - 2. Handwheel: For other than quarter-turn trim and drain valves.
  - 3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

## 2.2 TWO-PIECE BALL VALVES WITH INDICATORS

- A. Manufacturers: Ames Fire & Waterworks, NIBCO, Inc. Victaulic Company or approved equal.
- B. Description:
  - 1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
  - 2. Minimum Pressure Rating: 175 psig.
  - 3. Body Design: Two piece.
  - 4. Body Material: Forged brass or bronze.
  - 5. Port Size: Full or standard.
  - 6. Seats: PTFE.
  - 7. Stem: Bronze or stainless steel.
  - 8. Ball: Chrome-plated brass.
  - 9. Actuator: Worm gear or traveling nut.
  - 10. Supervisory Switch: Internal or external.
  - 11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
  - 12. End Connections for Valves NPS 2-1/2: Grooved ends.

## 2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

- A. Manufacturers: Fivalco Inc., Globe Fire Sprinkler Corp., Milwaukee Valve Company or approved equal.
- B. Description:
  - 1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
  - 2. Minimum: Pressure rating: 175 psig.
  - 3. Body Material: Bronze.
  - 4. Seat Material: EPDM.
  - 5. Stem Material: Bronze or stainless steel.
  - 6. Disc: Stainless steel.
  - 7. Actuator: Worm gear or traveling nut.

8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

#### 2.4 IRON BUTTERFLY VALVES WITH INDICATORS

- A. Manufacturers: Anvil International, Fivalco Inc., Globe Fire Sprinkler Corp., NIBCO Inc., or approved equal.
- B. Description:
  1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
  2. Minimum Pressure Rating: 175 psig.
  3. Body Material: Cast or ductile iron with nylon coating.
  4. Seat Material: EPDM.
  5. Stem: Stainless steel.
  6. Disc: Ductile iron, nickel plated.
  7. Actuator: Worm gear or traveling nut.
  8. Supervisory Switch: Internal or external.
  9. Body Design: Grooved-end connections.

#### 2.5 CHECK VALVES

- A. Manufacturers: Ames Fire & Waterworks, Anvil International, NIBCO Inc., Fivalco Inc. Globe Fire Sprinkler Corp. or approved equal
- B. Description:
  1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
  2. Minimum Pressure Rating: 175 psig.
  3. Type: Single swing check.
  4. Body Material: Cast iron, ductile iron, or bronze.
  5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
  6. Clapper Seat: Brass, bronze, or stainless steel.
  7. Hinge Shaft: Bronze or stainless steel.
  8. Hinge Spring: Stainless steel.
  9. End Connections: Flanged, grooved, or threaded.

#### 2.6 BRONZE OS&Y GATE VALVES

- A. Manufacturers: Milwaukee Valve Company, NIBCO Inc., Zurn Industries, LLC or approved equal.
- B. Description:
  1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).

2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.

## 2.7 IRON OS&Y GATE VALVES

A. Manufacturers: American Cast Iron Pipe Company, Kennedy Valve Company, NIBCO Inc. or approved equal

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

## 2.8 NRS GATE VALVES

A. Manufacturers: American Cast Iron Pipe Company, Kennedy Valve Company, NIBCO Inc. or approved equal

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.9 INDICATOR POSTS – NOT APPLICABLE

2.10 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers: NIBCO Inc., Potter Roemer, LLC., Tyco Fire Products LP or approved equal.
2. Description:
  - a. Pressure Rating: 175 psig.
  - b. Body Design: Two piece.
  - c. Body Material: Forged brass or bronze.
  - d. Port size: Full or standard.
  - e. Seats: PTFE.
  - f. Stem: Bronze or stainless steel.
  - g. Ball: Chrome-plated brass.
  - h. Actuator: Handlever.
  - i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
  - j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Angle Valves:

1. Manufacturers: Fire Protection Products, NIBCO INC., United Brass Works, Inc.
2. Description:
  - a. Pressure Rating: 175 psig
  - b. Body Material: Brass or bronze.
  - c. Ends: Threaded.
  - d. Stem: Bronze.
  - e. Disc: Bronze.
  - f. Packing: Asbestos free.
  - g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:

1. Manufacturers: NIBCO INC., United Brass Works, Inc. or approved equal
2. Description:
  - a. Pressure Rating: 175 psig
  - b. Body Material: Bronze with integral seat and screw-in bonnet.
  - c. Ends: Threaded.
  - d. Stem: Bronze.
  - e. Disc Holder and Nut: Bronze.
  - f. Disc Seat: Nitrile.

- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. 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.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. 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.
- E. Do not attempt to repair defective valves; replace with new valves.

#### 3.2 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

- A. Comply with requirements in the following Sections for specific valve installation requirements and applications:
  - 1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for application of valves in fire-suppression water-service piping outside the building.
  - 2. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the pipe center.
- F. Install valves in position to allow full stem movement.

- G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.
- H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.
- I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 210523



## SECTION 210529 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger-shield inserts.
5. Fastener systems.
6. Equipment supports.

- B. Related Requirements:

1. Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for vibration isolation devices and seismic restraints.

#### 1.3 ACTION SUBMITTALS

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

- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

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

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.
- C. NFPA Compliance: Comply with NFPA 13.
- D. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
  - 2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- B. Copper Pipe and Tube Hangers:
  - 1. Description: Copper-coated-steel, factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
  - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.3 TRAPEZE PIPE HANGERS

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

2.4 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems: Not Used
- B. Non-MFMA Manufacturer Metal Framing Systems: Not used

2.5 THERMAL HANGER-SHIELD INSERTS

- A. Not used

2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved 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: Hilti, Inc. ITW Ramset / Red Head or approved equal
- B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, 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: Hilti, Inc. ITW Ramset / Red Head, or approved equal/
  - 2. Indoor Applications: Stainless steel.
  - 3. Outdoor Applications: Stainless steel.

2.7 EQUIPMENT SUPPORTS

- A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.8 MATERIALS

- A. Aluminum: ASTM B 221.
- B. Carbon Steel: ASTM A 1011/A 1011M.
- C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A 240/A 240M.

- E. Grout: ASTM C 1107/C 1107M, 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, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. 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 for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.
- D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
  - 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. 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.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping: Not Used

### 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 bearing surface smooth.
- 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/D1.1M 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 so 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 – Not Used

### 3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with NFPA requirements 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 finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Not used
- H. Not used
- I. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. 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 .
  2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
  3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
- J. 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 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Comply with NFPA requirements.
- L. Building Attachments: Comply with NFPA requirements. 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. C-Clamps (MSS Type 23): For structural shapes.
  3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- M. Saddles and Shields: Comply with NFPA requirements. 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.
- N. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 210529





## SECTION 210548 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

### 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. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Pipe-riser resilient supports.
5. Resilient pipe guides.
6. Elastomeric hangers.
7. Snubbers.
8. Restraint channel bracings.
9. Seismic-restraint accessories.
10. Mechanical anchor bolts.
11. Adhesive anchor bolts.

- B. Related Requirements:

1. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.
2. Section 230548 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

#### 1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

#### 1.4 ACTION SUBMITTALS

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

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
  - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
  - b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.
3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
4. Seismic-Restraint Details:
  - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
  - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
  - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
  - d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for fire-suppression piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.

- D. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
  - 1. Site Class as Defined in the IBC: D
  - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: verify with structural drawings of record
    - a. Component Importance Factor:
    - b. Component Response Modification Factor:
    - c. Component Amplification Factor:
  - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second):
  - 4. Design Spectral Response Acceleration at 1.0-Second Period:
  - 5. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
    - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least 4 times the maximum seismic forces to which they are subjected.

## 2.2 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads:
1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
  2. Size: Factory or field cut to match requirements of supported equipment.
  3. Pad Material: Oil and water resistant with elastomeric properties.
  4. Surface Pattern: Smooth pattern.
  5. Infused nonwoven cotton or synthetic fibers.
  6. Load-bearing metal plates adhered to pads.
  7. Sandwich-Core Material: Resilient and elastomeric.
    - a. Surface Pattern: Smooth pattern.
    - b. Infused nonwoven cotton or synthetic fibers.

## 2.3 ELASTOMERIC ISOLATION MOUNTS

- A. Double-Deflection, Elastomeric Isolation Mounts:
1. Mounting Plates:
    - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
    - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
  2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

## 2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

- A. Restrained Elastomeric Isolation Mounts:
1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
    - a. Housing: Cast-ductile iron or welded steel.
    - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene or other elastomeric material.

## 2.5 PIPE-RISER RESILIENT SUPPORT

- A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- (13-mm-) thick neoprene.
1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
  2. Maximum Load Per Support: 500 psig (3.45 MPa) on isolation material providing equal isolation in all directions.

## 2.6 RESILIENT PIPE GUIDES

- A. Description: Telescopic arrangement of two steel tubes or post-and-sleeve arrangement separated by a minimum 1/2-inch- (13-mm-) thick neoprene.
  - 1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

## 2.7 ELASTOMERIC HANGERS

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
  - 1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
  - 2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

## 2.8 SNUBBERS

- A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
  - 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
  - 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
  - 3. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.

## 2.9 RESTRAINT CHANNEL BRACINGS

- A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

## 2.10 SEISMIC-RESTRAINT ACCESSORIES

- A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.
- C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

- D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

#### 2.11 MECHANICAL ANCHOR BOLTS

- A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

#### 2.12 ADHESIVE ANCHOR BOLTS

- A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

### 3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete", if applicable.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Comply with requirements in Section 077200 "Roof Accessories" for installation of equipment supports and roof penetrations.
- D. Equipment Restraints:
  - 1. Install seismic snubbers on fire-suppression equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
  - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
  - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Piping Restraints:
  - 1. Comply with requirements in MSS SP-127.
  - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
  - 3. Brace a change of direction longer than 12 feet.
- F. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- J. Drilled-in Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

### 3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 211200 "Fire-Suppression Standpipes," Section 211313 "Wet-Pipe Sprinkler Systems," and Section 211316 "Dry-Pipe Sprinkler Systems" for piping flexible connections.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
  3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  5. Test to 90 percent of rated proof load of device.
  6. Measure isolator restraint clearance.
  7. Measure isolator deflection.
  8. Verify snubber minimum clearances.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

END OF SECTION 210548



## SECTION 21 0553 – IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

### 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. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Stencils.
  - 5. Valve tags.
  - 6. Warning tags.

#### 1.3 ACTION SUBMITTALS

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

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Brass, 0.032 inch stainless steel, 0.025 inch aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
  - 2. Letter Color: Black, Red or White.
  - 3. Background Color: Black, Red or White.
  - 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch or 1/8 inch thick, with predrilled holes for attachment hardware.
2. Letter Color: Black, Red or White.
3. Background Color: Black, Red or White
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

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

## 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch or 1/8 inch thick, with predrilled holes for attachment hardware.
- B. Letter Color: Black, Red or White
- C. Background Color: Black, Red or White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

### 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
- E. Pipe-Label Colors:
  - 1. Background Color: Safety Red.
  - 2. Letter Color: White.

### 2.4 STENCILS

- A. Stencils for Piping:
  - 1. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
  - 2. Stencil Material: Aluminum, brass or other metal.
  - 3. Stencil Paint: Safety Red, exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
  - 4. Identification Paint: White, exterior, acrylic enamel. Paint may be in pressurized spray-can form.

### 2.5 VALVE TAGS

- A. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032 inch, stainless steel, 0.025 inch or aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.

2. Fasteners: Brass wire-link chain or S-hook.
3. Valve-Tag Color: Safety Red.
4. Letter Color: White.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.6 WARNING TAGS

A. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

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

### 3.3 EQUIPMENT LABEL INSTALLATION

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

### 3.4 PIPE LABEL INSTALLATION

- A. Piping: Painting of piping is specified in Section 099123 "Interior Painting."
- B. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit a view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

### 3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
  - 1. Valve-Tag Size and Shape:
    - a. Wet-Pipe Sprinkler System: 1-1/2 inches.

### 3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 210553



## SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

- B. Related Requirements:

1. Section 230523 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

#### 1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig (1200-kPa) maximum.

#### 1.4 ACTION SUBMITTALS

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

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Sustainable Design Submittals: Not Used

- C. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Domestic water piping.
  - 2. Compressed air piping.
  - 3. HVAC hydronic piping.
  - 4. Items penetrating finished ceiling include the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers / Announcement System
    - d. Fire Alarm System
- B. Qualification Data: For qualified Installer and professional engineer.
- C. Design Data:
  - 1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- D. Welding certificates.
- E. Field Test Reports:
  - 1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
  - 2. Fire-hydrant flow test report.
- F. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.



## 1.8 QUALITY ASSURANCE

### A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
  - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

### B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

## 1.9 FIELD CONDITIONS

### A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Owner's written permission.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

#### A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

#### B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

#### C. Design:

1. Available fire-hydrant flow test records indicate the following conditions; contractor shall perform updated hydrant flow test:
  - a. Date: March 22, 2020
  - b. Time: 8:22 am
  - c. Performed by: BFPE & H2G0 Public Utilities
  - d. Static Pressure at Residual Fire Hydrant R: 69 psig
  - e. Measured Flow at Flow Fire Hydrant F: 1227 gpm
  - f. Residual Pressure at Residual Fire Hydrant R: 56 psig
2. Sprinkler system design shall be approved by authorities having jurisdiction.

- a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
  - b. Sprinkler Occupancy Hazard Classifications:
    - 1) All Areas (except noted below in #2): Light Hazard
    - 2) Clean Room, Soiled: Ordinary Hazard Group 1
  3. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft.
    - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft.
  4. Minimum Density for Deluge-Sprinkler Piping Design: Not Used
  5. Maximum Protection Area per Sprinkler: According to UL listing.
  6. Maximum Protection Area per Sprinkler:
    - a. Light Hazard: 225 sq. ft.
    - b. Ordinary Hazard Group 1: 130 sq. ft.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7

## 2.2 STEEL PIPE AND FITTINGS

- A. Standard-Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Black-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Thinwall Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- D. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 plain end.
- E. Nonstandard OD, Thinwall Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M thinwall with plain ends and wall thickness less than Schedule 10.
- F. Hybrid Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5.
- G. Schedule 5 Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M lightwall with plain ends.
- H. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- I. Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.

- J. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- K. Malleable- or Ductile-Iron Unions: UL 860.
- L. Cast-Iron Flanges: ASME 16.1, Class 125.
- M. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
  - 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8-inch-thick, ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.
    - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
  - 2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
- N. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
  - 1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- O. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Pressure Rating: 175-psig minimum.
  - 2. Painted or uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
  - 3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- P. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

2.3 COPPER TUBE AND FITTINGS – NOT USED

2.4 CPVC PIPE AND FITTINGS- NOT USED

2.5 COVER SYSTEM FOR SPRINKLER PIPING – NOT USED

2.6 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating:
  - 1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Alarm Valves:
  - 1. Standard: UL 193.
  - 2. Design: For horizontal or vertical installation.
  - 3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
  - 4. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
  - 5. 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.
- G. Deluge Valves: Not Used
- H. Automatic (Ball Drip) Drain Valves:
  - 1. Standard: UL 1726.
  - 2. Pressure Rating: 175-psig minimum.
  - 3. Type: Automatic draining, ball check.
  - 4. Size: NPS 3/4.
  - 5. End Connections: Threaded.

## 2.7 SPRINKLER PIPING SPECIALTIES

- A. Branch Outlet Fittings:
  - 1. Manufacturers: ARGCO, Grinnell or approved equal
  - 2. Standard: UL 213.
  - 3. Pressure Rating: 175-psig minimum
  - 4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
  - 5. Type: Mechanical-tee and -cross fittings.
  - 6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
  - 7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
  - 8. Branch Outlets: Grooved, plain-end pipe, or threaded.
- B. Flow Detection and Test Assemblies:
  - 1. Manufacturers: AGF Manufacturing, Inc. Reliable Automatic Sprinkler, Tyco Fire Products, LP or approved equal.
  - 2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
  - 3. Pressure Rating: 175-psig minimum.
  - 4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
  - 5. Size: Same as connected piping.
  - 6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

1. Manufacturers: AGF Manufacturing, Inc., Elkhart Brass Mfg. Co., Potter Electric Signal Co. or approved equal.
2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: AGF Manufacturing, Inc. Tyco Fire Products, LP. or approved equal.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers: CECA, LLC., Merit Manufacturing, or approved equal.
2. Standard: UL 1474.
3. Pressure Rating: 250-psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Fivalco Inc., Victaulic Company or approved equal.
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum
5. Size: Same as connected piping, for sprinkler.

2.8 SPRINKLERS

- A. Manufacturers: Reliable Automatic Sprinkler, Tyco Fire Products, LP, Victaulic Company or approved equal.
- B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- C. Pressure Rating for Residential Sprinklers: Not Used
- D. Pressure Rating for Automatic Sprinklers: 175-psig

- E. Automatic Sprinklers with Heat-Responsive Element:
  - 1. Early-Suppression, Fast-Response Applications: Not used
  - 2. Nonresidential Applications: UL 199
  - 3. Residential Applications: Not Used
  - 4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- F. Sprinkler Finishes: Concealed; color to match ceiling finish
- G. Special Coatings: Not Used
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  - 1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment.
  - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- I. Sprinkler Guards:
  - 1. Standard: UL 199.
  - 2. Type: Wire cage with fastening device for attaching to sprinkler.

## 2.9 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Motor-Operated Alarm:
  - 1. Manufacturers: Tyco Fire Products, LP, Victaulic Compay or approved equal
  - 2. Standard: UL 753.
  - 3. Type: Mechanically operated, with Pelton wheel.
  - 4. Alarm Gong: Cast aluminum with red-enamel factory finish.
  - 5. Size: 10 inch diameter.
  - 6. Components: Shaft length, bearings, and sleeve to suit wall construction.
  - 7. Inlet: NPS 3/4 (DN 20).
  - 8. Outlet: NPS 1 (DN 25) drain connection.
- C. Electrically Operated Alarm Bell:
  - 1. Manufacturers: Potter Electric Signal Company, Notifier, or approved equal
  - 2. Standard: UL 464.
  - 3. Type: Vibrating, metal alarm bell.
  - 4. Size: 6-inch minimum.
  - 5. Finish: Red-enamel factory finish, suitable for outdoor use.
  - 6. 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.

D. Water-Flow Indicators:

1. Manufacturers: Potter Electric Signal Co., Watts, Viking Corporation, and approved equal.
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig
7. Design Installation: Horizontal or vertical.

E. Pressure Switches:

1. Manufacturers: Tyco Fire Products, LP, Potter Electric Signal Co. or approved equal.
2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

F. Valve Supervisory Switches:

1. Manufacturers: Tyco Fire Products, LP, Potter Electric Signal Co. or approved equal.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.10 MANUAL CONTROL STATIONS: Not used

2.11 CONTROL PANELS: Not Used

2.12 PRESSURE GAGES

- A. Manufacturers: AGF Manufacturing, Inc., Ashcroft, Inc. or approved equal.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0- to 250-psig minimum.
- E. Label: Include "WATER" label on dial face.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

### 3.2 SERVICE-ENTRANCE PIPING: NOT USED

### 3.3 WATER-SUPPLY CONNECTIONS

### 3.4 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
  - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.



- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal and install where they are not subject to freezing.
- N. Not Used
- O. Fill sprinkler system piping with water.
- P. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Section 210533 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 210700 "Fire-Suppression Systems Insulation."
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

### 3.5 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
  - I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
  - J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
    1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
  - K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
  - L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
  - M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
  - N. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
  - O. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
  - P. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
  - Q. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. 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.
  - R. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
  - S. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
    1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
    2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

### 3.6 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

- A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 or NFPA 13R for supports.

### 3.7 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
  - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
  - 2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
  - 3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

### 3.8 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

### 3.9 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.10 FIELD QUALITY CONTROL

- A. Perform the following tests and inspection:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  4. Energize circuits to electrical equipment and devices.
  5. Coordinate with fire-alarm tests. Operate as required.
  6. Coordinate with fire-pump tests. Operate as required.
  7. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- 3.11 CLEANING
- A. Clean dirt and debris from sprinklers.
  - B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.
- 3.12 DEMONSTRATION
- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.
- 3.13 PIPING SCHEDULE
- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
  - B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
  - C. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.
  - D. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
    1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
    2. Standard-weight black-steel pipe with cut- or roll- grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
    3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

- E. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:
1. Standard-weight black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
  2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
  3. Standard-weight black-steel pipe with cut or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  4. Standard-weight black-steel pipe with plain ends; steel welding fittings; and welded joints.
  5. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  6. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

### 3.14 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers
  2. Rooms with Suspended Ceilings: Concealed sprinklers, match ceiling finish
  3. Wall Mounting: Sidewall sprinklers.
  4. Spaces Subject to Freezing: Not used
  5. Special Applications: Not used
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted to match ceiling
  2. Flush Sprinklers: Not Used
  3. Recessed Sprinklers: Not Used
  4. Residential Sprinklers: Not Used
  5. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211313



## SECTION 220000 - GENERAL PLUMBING

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. Instructions to Bidders, General Conditions of the Contract, Supplementary General Conditions and Division 01 Specifications Sections bound herewith are a component part of Division 22 specifications. Comply with all provisions, details and instructions of these sections in the accomplishment of work covered under Division 23.
- B. Furnish all labor, materials and equipment and incidentals required to make ready for use complete plumbing systems as shown on the Drawings and specified herein.
- C. Where Sub-Contracts are used to perform portions of the work, division of labor between sub trades is the responsibility of the Contractor.
- D. Furnish all labor, materials and equipment and incidentals required to make ready for use complete plumbing systems as shown on the Drawings and specified herein.
- E. Work includes furnishing, installing and testing the equipment and materials specified in other sections of the Division Specifications and shown on the Plumbing Drawings. It is the intent of these Specifications that the plumbing systems shall be suitable in every way for the intended usage. All material and all work which may be reasonably implied as being incidental to the work of this Division shall be furnished at no extra cost.
- F. The general scope work includes, but is not limited to, furnishing, coordinating, and installing the following.
  - 1. Sanitary waste and vent systems with connection to site utilities.
  - 2. Domestic water distribution systems with connection to site utilities.
  - 3. Roof drainage systems with connections to site utilities.
  - 4. Fuel gas piping with connection to site gas supply.
  - 5. Plumbing fixtures, specialties and equipment.
- G. Visit all areas of the existing site, buildings and structures (as applicable) in which work under these sections is to be performed. Inspect carefully the existing conditions prior to bidding. Bid submission is evidence that the Contractor has examined the site and existing conditions, understands conditions under which the work will be performed, and takes full responsibility for complete knowledge of all factors governing the work.
- H. Schedule all service interruptions in existing facilities at the Owner's convenience with 24 hours (minimum) notice. Obtain prior approval for each interruption.
- I. Thoroughly test all plumbing systems after installation and make any minor corrections, changes or adjustments necessary for proper functioning of the systems and equipment. All workmanship shall be of the highest quality; substandard work will be rejected.

## 1.2 SUBMITTALS

- A. Procedures for submittals: Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 01 Specifications Sections.

Transmit each shop drawing submittal with provided Shop Drawing Submittal Cover Form, attached herewith for each item of equipment/material or each specification section/paragraph.

- B. Clearly indicate proposed equipment and/or materials substitutions in shop drawings. Summarize all deviations from the specified quality, functionality, appearance or performance of proposed equipment and/or materials in the preface of each submittal. Include documentation to support deviations.
- C. Provide descriptive data on all materials and equipment as required to ascertain compliance with Specifications.
- D. Design layout shown on drawings is based on physical sizes of reputable equipment manufacturers. If equipment other than models indicated is installed, any resulting conflicts with space, maintenance access, clearances or codes are the responsibility of the Contractor to correct at his expense.
- E. Where specific models and manufacturers of materials and equipment are specified, substitutions as allowed by the specifications and State law will be considered. Substitutions must be equivalent in quality, function, suitability and arrangement to specified equipment. Architect/Engineer to have final authority as to equivalency of substitutions.
- F. Equipment model numbers noted in these specifications or on the drawings are intended to establish a minimum standard of quality and do not necessarily relate to specific options or arrangement as shown. Provide equipment with all standard features and optional features as stated and arranged as shown on the drawings.
- G. Where seismic design for supports is required, submit installation details for supports and engineering analysis as specified.

## 1.3 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with all applicable state and local codes, standards and regulations.
- B. Furnish all materials and labor which is be required for compliance with codes, standards and regulations, whether specifically mentioned in these specifications or shown on the drawings.
- C. Obtain required construction permit from the authority having jurisdiction and arrange, at the proper time, for all inspections required by such authority. Pay all permit and inspection costs required.



1.4 COORDINATION OF WORK

- A. Contractor is responsible for coordination of work between trades. Provide fully complete and functional systems.
- B. Compare plumbing drawings and specifications with the drawings and specifications for other trades.
- C. Coordinate plumbing installation with the work of other trades. Report any pertinent discrepancies to the Architect/Engineer and obtain written instructions for any necessary revisions. Before starting any construction, make proper provisions to avoid interferences in a manner approved by the Architect/Engineer. No extras will be allowed for rework of uncoordinated installations.
- D. Determine exact route and location of each plumbing item prior to fabrication and/or installation. Adjust location of piping and equipment, etc., to accommodate interferences anticipated and encountered.
- E. Right of Way: General priority for right of way is as follows:
  - 1. Items located per regulatory requirement.
  - 2. Piping with pitch requirement (plumbing drains, etc.).
  - 3. Ductwork.
  - 4. Piping without pitch requirement.
  - 5. Electrical wiring (conduits, etc.).
- F. Arrange all work to permit removal (without damage to other parts) of any equipment requiring periodic replacement.
- G. Provide clearance and easy access to any equipment which requires periodic maintenance. Arrange ducts, piping and equipment to permit ready access to valves, cocks, traps, starters, motors, control components, etc., and to clear the opening of swinging doors and access panels.

1.5 EQUIPMENT AND MATERIALS (GENERAL)

- A. Provide all new materials unless specifically indicated otherwise.
- B. Manufacturers and models listed in drawings and specifications are used for layout and to convey to bidders the general style, type, character and quality of product desired. Listed examples are used only to denote the quality standard of product desired and are not intended to restrict bidders to a specific brand, make, manufacturer or specific name.
- C. Adjust layout, system connections and coordinate with other trades as required to properly install equivalent products.
- D. Where equivalent products are submitted, include all associated costs related to substitution in bid.
- E. Furnish materials bearing the manufacturer's name and trade name. Provide UL label where a UL standard has been established for the particular material.

- F. Furnish standard products of manufacturers regularly engaged in production of equipment types required for the work. Use the manufacturer's latest approved design.
- G. Use the same manufacturer for equipment and materials of the same general type throughout the work to obtain uniform appearance, operation and maintenance.
- H. Protect equipment and materials from dirt, water, chemical or mechanical injury and theft at all times during construction. Provide covers or shelter as required.
- I. If materials or equipment are damaged at any time prior to final acceptance of the work, repair such damage at no additional cost. If materials or equipment are damaged by water, provide replacement no additional cost.
- J. Follow manufacturer's directions completely in the delivery, storage, protection and installation of all equipment and materials. Notify the Architect/Engineer in writing of any conflicts between any requirements of the contract documents and manufacturer's directions. Obtain written instructions before proceeding with the work. The Contractor is responsible for correction of any work that does not comply with the manufacturer's directions or written instructions from the Architect/Engineer at no additional cost.
- K. Repair any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. Repaint entire damaged panel or section per the field painting specifications in Division 09 at no additional cost.

#### 1.6 OPERATION AND MAINTENANCE MANUALS

- A. Refer to individual plumbing sections and Division 01.

#### 1.7 PAINTING

- A. Refer to Division 09.
- B. Protect fixtures, valves, trim, etc. from field painting operations. Do not install escutcheons and trim until painting is complete.

#### 1.8 LOCATIONS AND MEASUREMENTS

- A. Location of plumbing work is shown on the drawings as accurately as possible. Field-verify all measurements to insure that the work suits the surrounding trim, finishes and/or construction. Provide adjustment as necessary.
- B. Make minor relocations of work prior to installation as required or as directed by the Architect/Engineer at no additional cost.

1.9 SUPERVISION

- A. Contractor to provide an authorized and competent representative to constantly supervise the work from the beginning to completion and final acceptance. Insofar as possible, keep the same foreman and workmen throughout the project duration.
- B. Representatives of Architect/Engineer, Owner, and local inspection authorities will make inspections during the progress of the work. Contractor to accommodate such inspections and correct deficiencies noted.

1.10 QUALITY AND WORKMANSHIP

- A. Contractor to employ skilled tradesmen, laborers and supervisors. Final product to be a neat, well finished, and professional installation.
- B. Remove and replace any work considered substandard quality in the judgment of the Architect/Engineer.

1.11 EXCAVATION, TRENCHING AND BACKFILLING

- A. Provide all excavation, trenching and backfilling as required to complete the work under this Division.
- B. Contractor is responsible for investigating conditions prior to excavating and to exercise care during the excavation to avoid any utilities or other objects which may or may not be shown on the drawings.
- C. Excavate so as not to endanger or damage existing utilities and structures. If damage occurs, repair damage to the satisfaction of the Architect/Engineer at no additional cost.
- D. Lay out location of all ditching at grade and obtain approval from the Architect/Engineer prior excavating.
- E. Remove and dispose of all surplus earth from the site.
- F. Provide suitable backfill materials as required.
- G. Perform excavation, trenching and shoring in accordance with rules and regulations set forth in Article XXI, Bulletin 1 "Trenching" as published in a separate bulletin by the North Carolina Department of Labor, Division of Standards and Inspection Construction Bureau.
- H. Bid excavation work as unclassified with no extra payment for removal of rock, unsuitable soils, etc.

1.12 CLOSING IN WORK

- A. Do not cover up or enclose work until it has been inspected, tested and approved by authorities having jurisdiction over the work. Uncover any such work for inspection and/or test at no

additional cost. Restore the work to its original condition after inspection and/or test at no additional cost.

#### 1.13 CUTTING AND PATCHING

- A. Perform all cutting and patching necessary to install work under this Division.
- B. Perform cutting and patching in professional, workmanlike manner.
- C. Arrange work to minimize cutting and patching.
- D. Do not cut joists, beams, girders, columns or any other structural members without written permission from the Architect/Engineer.
- E. Cut opening only large enough to allow easy installation of piping, wiring or ductwork.
- F. Patching material to match material removed.
- G. Restore patched surface to its original appearance at completion of patching.
- H. Where waterproofed surfaces are patched, maintain integrity of waterproofing.
- I. Remove rubble and excess patching materials from the premises.

#### 1.14 INTERPRETATION OF DRAWINGS

- A. Drawings and specifications under this Division are complementary each to the other. Provide any work specified herein and/or indicated on the drawings.
- B. Drawings are diagrammatic and indicate generally the location of fixtures, piping, devices, equipment, etc. Follow drawings as closely as possible, but arrange work to suit the finished surroundings and/or trim.
- C. The words “furnish”, “provide”, and/or “install” as used in these drawings and specifications are interpreted to include all material and labor necessary to complete the particular item, system, equipment, etc.
- D. Any omissions from either the drawings or specifications are unintentional. Contractor is responsible for notifying the Architect/Engineer of any pertinent omissions before submitting a bid. Complete and working systems are required, whether every small item of material is shown and specified or not.

#### 1.15 ACCESSIBILITY

- A. Locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment to include, but not be limited to, valves, traps, cleanouts, motors, controllers and drain points. If required for accessibility, furnish access doors for this purpose. Minor deviations from drawings may be made to allow for better accessibility.

- B. Coordinate exact locations and size of access panels for each concealed device requiring service.
- C. Access panels: Steel construction with 16 gauge frames and 18 gauge panels, factory primed with rust inhibiting paint, finish paint by Contractor. Provide suitable UL listed doors where installed in rated construction.
- D. Coordinate access panel locations with architectural construction.
- E. Access panels are not required for access to work located above a lift-out "T" bar type ceiling.

1.16 ELECTRICAL WORK IN CONNECTION WITH PLUMBING WORK

- A. Comply with Division 26.

1.17 PLUMBING WORK IN CONNECTION WITH OTHER CONTRACTS

- A. Provide plumbing services as required for items furnished by other contractors or vendors as shown on the plumbing drawings. Include rough-ins and final connections to equipment. Locations of connections shown on the drawings are approximate and some adjustment of actual connection locations should be anticipated. Coordinate exact connection requirements. Make final connections only after approval of the other contractor or vendor, in the contractor's or vendor's presence.
  - 1. Natural Gas System- Provide complete gas piping supply from natural gas meter. Coordinate equipment gas requirements with supplier. Contractor is responsible for contacting natural gas supplier and complying with supplier connection and service piping requirements. Provide all required valves, regulators, accessories as shown on drawings.
  - 2. Site Utilities- In general, work under this Division covers work to five feet outside buildings. Extend and connect work under this Division to site utilities as required.
  - 3. Owner Furnished Equipment- Obtain exact plumbing requirements and rough-in locations for Owner furnished equipment. Provide complete plumbing installation for proper operation of equipment.
  - 4. Kitchen Equipment- Obtaining exact plumbing requirements and rough-in locations for kitchen equipment. Provide complete plumbing installation for proper operation of equipment.

1.18 ALTERNATE BIDS

- A. Alternate Bids are described in relevant sections of the General and Supplemental General Conditions and Division 1 Specification Sections.

1.19 PROJECT RECORD DRAWINGS

- A. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 01 Specification Sections.

- B. As the work progresses, legibly record all field changes on a set of project contract drawings, herein after called the “record drawings.”
- C. Accurately show the installed condition of plumbing work on record drawings.

1.20 PHASING OF THE WORK

- A. Schedule work in accordance with the relevant sections of the General and Supplemental General Conditions and Division 01 Specifications Sections.

1.21 PROJECT CLOSEOUT

- A. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 01 Specifications Sections.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 220000

## SECTION 220010 - EXISTING PLUMBING CONDITIONS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Procedures for plumbing work in existing building.

#### 1.2 PROJECT CONDITIONS

- A. Conform to the requirements of Division 01 for cutting and patching. Conform to the requirements of Division 2 and Section 220020 for demolition.
- B. Conduct work to minimize interference with adjacent and occupied building areas.
- C. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

### PART 2 - GENERAL

#### 2.1 PATCHING MATERIALS

- A. As specified in individual Sections.

### PART 3 - GENERAL

#### 3.1 PREPARATION

- A. Coordinate plumbing service interruptions with the Owner.
- B. Provide temporary and/or permanent plumbing as shown and/or as required by conditions to maintain existing systems in service during construction. Use hot-tapping valves if required.
- C. Existing Plumbing Systems: Maintain existing plumbing systems in service. Disable systems outside construction area only to make tie-ins or switchovers. Obtain permission from the Owner at least 24 hours before partially or completely disabling plumbing. Minimize duration. Make temporary connections as required to maintain service in areas adjacent to work area.
- D. Drawings are based on casual field observation and existing record documents. Survey the affected areas before submitting bid proposal. Report discrepancies to the Architect/Engineer before disturbing the existing installation.
- E. Field-verify existing conditions as related to interconnection of New Work. Determine exact methods of interface to obtain proper operation.

- F. Coordinate existing and New Work interface prior to beginning any work. Adjust work to suit existing conditions. Some deviations in plan layout vs. actual conditions should be expected.
- G. Provide, erect, and maintain temporary dust screens, safeguards, barricades, signage and similar measures, for protection of the public, Owner, Contractor=s employees, and existing construction to remain. Provide protective barriers indicated in the contract drawings.

### 3.2 EXISTING CONDITIONS

- A. Verify existing conditions in field and determine which affect plumbing work. Secure utilities as required to prevent spills, leakage, etc.
- B. Protect existing work to remain. Do not cut or remove any structural members.
- C. Rework existing services to remain which interfere with new work.

END OF SECTION 220010



## SECTION 220020 - PLUMBING DEMOLITION

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Selective plumbing demolition.
- B. Conform to the requirements of Division 01 for cutting and patching.
- C. Conform to the requirements of Division 02 for selective demolition

#### 1.2 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

#### 1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items 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, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

### PART 2 - GENERAL

#### 2.1 PATCHING MATERIALS

- A. As specified in individual Sections.

PART 3 - GENERAL

3.1 PREPARATION

- A. Demolition Drawings are based on casual field observation. No record documents are available. Survey the affected areas before submitting bid proposal. Report discrepancies to the Architect/Engineer before disturbing the existing installation.
- B. Provide, erect, and maintain temporary dust screens, safeguards, barricades, signage and similar measures, for protection of the public, Owner, Contractor's employees, and existing construction to remain. Provide protective barriers indicated in the contract drawings.
- C. Protect existing materials and existing improvements which are not to be demolished.
- D. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.

3.2 DEMOLITION

- A. Disconnect, remove, cap, and identify plumbing work as indicated. Secure utilities as required to prevent spills, leakage, etc.
- B. Demolish in an orderly and careful manner. Protect existing work to remain. Do not cut or remove any structural members.
- C. Terminate all demolition work in a neat finished manner.
- D. Conceal or enclose abandoned work within building construction except as specifically noted.
- E. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- F. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- G. Coordinate cutting and patching requirements.

END OF SECTION 220020

## SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

### 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. Sleeves.
- 2. Sleeve-seal systems.
- 3. Grout.
- 4. Silicone sealants.

- B. Related Requirements:

- 1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, anti-corrosion coated, with plain ends and integral welded waterstop collar.
- B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

## 2.2 SLEEVE-SEAL SYSTEMS

### A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20-psig.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Stainless steel.
5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

## 2.3 GROUT

- A. Description: Non-shrink, recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.4 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors and concrete walls as new slabs and walls are constructed.
1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  2. 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.
  3. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
  2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  3. Seal annular space between sleeve and piping or piping insulation; use sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal-system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls Above Grade:

- a. Piping Smaller Than NPS 6: Steel pipe sleeves.
- b. Piping NPS 6 and Larger: Steel pipe sleeves.

2. Concrete Slabs-on-Grade:

- a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.
  - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.
  - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs Above Grade:

- a. Piping Smaller Than NPS 6: Steel pipe sleeves.
- b. Piping NPS 6 and Larger: Steel pipe sleeves.

4. Interior Partitions:

- a. Piping Smaller Than NPS 6: PVC-pipe sleeves.
- b. Piping NPS 6 and Larger: PVC-pipe sleeves.

END OF SECTION 220517

## SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

### 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. Escutcheons.
  - 2. Floor plates.

#### 1.3 ACTION SUBMITTALS

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

### PART 2 - PRODUCTS

#### 2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated or polished brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.

#### 2.2 FLOOR PLATES

- A. Split Floor Plates: Steel with concealed hinge.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:
  - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
  - b. Insulated Piping: One-piece cast brass with polished, chrome-plated finish.
  - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
  - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
  - e. Bare Piping in Unfinished Service Spaces: One-piece cast brass with rough-brass finish.
  - f. Bare Piping in Equipment Rooms: One-piece cast brass with rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  1. New Piping: Split floor plate.

### 3.2 FIELD QUALITY CONTROL

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 220518



## SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

### 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. Bronze ball valves.
  - 2. Steel ball valves

#### 1.3 DEFINITIONS

- A. CWP: Cold working pressure.

#### 1.4 ACTION SUBMITTALS

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

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads.
  - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded-end valves.
  - 2. ASME B31.9 for building services piping valves.
- C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Refer to Plumbing Valve Schedule articles for applications of valves.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
  - 1. Handlever.
- H. Valves in Insulated Piping:
  - 1. Include 2-inch stem extensions.
  - 2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
  - 3. Memory stops that are fully adjustable after insulation is applied.
- I. Valve Bypass and Drain Connections: MSS SP-45.

### 2.2 BRONZE BALL VALVES

- A. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:
  - 1. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig.
    - c. CWP Rating: 400 psig.
    - d. Body Design: Two piece.
    - e. Body Material: Bronze.
    - f. Ends: Threaded.
    - g. Seats: PTFE.
    - h. Stem: Stainless steel.
    - i. Ball: Stainless steel, vented.

- j. Port: Full.

## 2.3 STEEL BALL VALVES

### A. Steel Ball Valves with Full Port, Class 150:

#### 1. Description:

- a. Standard: MSS SP-72.
- b. CWP Rating: 285 psig.
- c. Body Design: Split body.
- d. Body Material: Carbon steel, ASTM A 216, Type WCB.
- e. Ends: Flanged or threaded.
- f. Seats: PTFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel, vented.
- i. Port: Full.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. 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.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Install valves with unions at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- B. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below:

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
  - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
  - 2. Bronze ball valves, two-piece with full port and stainless-steel trim.
- B. Pipe NPS 2-1/2 and Larger:
  - 1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
  - 2. Steel ball valves, Class 150 with full port.

END OF SECTION 220523.12

SECTION 220523.14 - CHECK VALVES FOR PLUMBING PIPING

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. Bronze swing check valves.
  - 2. Iron swing check valves with closure control.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

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

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. 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 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded-end valves.
  - 2. ASME B16.1 for flanges on iron valves.
  - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 4. ASME B16.18 for solder joint.
  - 5. ASME B31.9 for building services piping valves.
- C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Bypass and Drain Connections: MSS SP-45.

### 2.2 BRONZE SWING CHECK VALVES

- A. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:
  - 1. Description:
    - a. Standard: MSS SP-80, Type 4.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded or soldered. See valve schedule articles.
    - f. Disc: PTFE.

### 2.3 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

- A. Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125:
  - 1. Description:

- a. Standard: MSS SP-71, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.
- h. Closure Control: Factory-installed, exterior lever and spring.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. 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.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. 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.
- E. Do not attempt to repair defective valves; replace with new valves.

#### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
  1. Swing Check Valves: In horizontal position with hinge pin level.
- F. Install valve tags. Comply with requirements for valve tags and schedules in Section 220553 "Identification for Plumbing Piping and Equipment."

3.3 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.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- B. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules.
  - 2. For Steel Piping, NPS 2-1/2 to NPS 6: Flanged ends.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
  - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
  - 2. Bronze Swing Check Valves with Nonmetallic Disc, Class 125.
- B. Pipe NPS 2-1/2 and Larger:
  - 1. NPS 2-1/2 to NPS 12: Iron swing check valves with lever and spring-closure control, Class 125.

END OF SECTION 220523.14



## SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Metal pipe hangers and supports.
- 2. Trapeze pipe hangers.
- 3. Thermal-hanger shield inserts.
- 4. Equipment supports.

- B. Related Sections:

- 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
- 2. Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment" for vibration isolation devices.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Pipe stands.

3. Equipment supports.

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

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

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

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

- B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.4 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.5 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-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, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal 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 for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. 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.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. 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 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.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
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 allowed by 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 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. Thermal-Hanger Shields: Install with insulation same thickness as piping ins.

### 3.2 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 bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 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/D1.1M 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 so contours of welded surfaces match adjacent contours.

### 3.4 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.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are 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 carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. 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.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.

11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
- I. 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 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- J. 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 for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-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.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 220529



## SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

### 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. Equipment labels.
- 2. Pipe labels.
- 3. Valve tags.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:

- 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- 2. Letter Color: Comply with ASME A13.1.
- 3. Background Color: Comply with ASME A13.1.
- 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.



2. Fasteners: Brass wire-link chain, beaded chain or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  1. Valve-tag schedule shall be included in operation and maintenance data.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

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

#### 3.2 GENERAL INSTALLATION REQUIREMENTS

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

#### 3.3 EQUIPMENT LABEL INSTALLATION

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

#### 3.4 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Paint and color-code all exposed piping located in equipment rooms. Piping shall be color coded as follows with flow arrows and labels located at 10 foot intervals, at all turns and at each floor or wall partition:
  - Domestic Cold Piping: Dark Blue
  - Domestic Hot Piping: Dark Red
  - Natural Gas Piping: Yellow
- B. Provide ceiling valve marker for valves located above lay-in ceilings. Above ceiling valve markers shall be 1/2 inch diameter self-adhesive color-coded circle. Color code as noted above. Attach valve marker to adjacent ceiling grid.

- C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- E. Pipe Label Color Schedule:
1. Domestic Water Piping
    - a. Background: Comply with ASME A13.1.
    - b. Letter Colors: Comply with ASME A13.1.
  2. Sanitary Waste and Storm Drainage Piping:
    - a. Background Color: Comply with ASME A13.1.
    - b. Letter Color: Comply with ASME A13.1.

### 3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Contractor to furnish valve schedule mounted behind glass in a frame located in main mechanical room.
- C. Contractor to furnish valve schedule in O&M manuals. Indicated valve tag number, location and service.
- D. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
    - a. Cold Water: 1-1/2 inches, round.
    - b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Colors:
  - a. Cold Water: Comply with ASME A13.1.
  - b. Hot Water: Comply with ASME A13.1.
  
3. Letter Colors:
  - a. Cold Water: Comply with ASME A13.1.
  - b. Hot Water: Comply with ASME A13.1.

END OF SECTION 220553



## SECTION 220719 - PLUMBING PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic cold-water piping.
  - 2. Domestic hot-water piping.
  - 3. Domestic recirculating hot-water piping.
  - 4. Supplies and drains for handicap-accessible lavatories and sinks.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Supply and Drain Protective Shielding Guards: ICC A117.1.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

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

#### 1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### 1.8 SCHEDULING

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

### PART 2 - PRODUCTS

#### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.



D. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

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

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
  1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  2. Service Temperature Range: Minus 20 to plus 180 deg F.
  3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
  1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  2. Service Temperature Range: Minus 20 to plus 180 deg F.
  3. Solids Content: 60 percent by volume and 66 percent by weight.
  4. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

## 2.6 SEALANTS

### A. ASJ Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

## 2.7 FACTORY-APPLIED JACKETS

### A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

## 2.8 FIELD-APPLIED CLOTHS

### A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and prezised a minimum of 8 oz./sq. yd..

## 2.9 FIELD-APPLIED JACKETS

### A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

### B. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14. Prime metal jacket with paint grip finish.
  - a. Sheet and roll stock ready for shop or field sizing.
  - b. Finish and thickness are indicated in field-applied jacket schedules.
  - c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
  - d. Factory-Fabricated Fitting Covers:
    - 1) Same material, finish, and thickness as jacket.
    - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

- 3) Tee covers.
- 4) Flange and union covers.
- 5) End caps.
- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.10 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  1. Width: 3 inches.
  2. Thickness: 11.5 mils.
  3. Adhesion: 90 ounces force/inch in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch in width.
  6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

## 2.11 SECUREMENTS

- A. Bands:
  1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.

## 2.12 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
  1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

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

### 3.2 PREPARATION

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

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install 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. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.

- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistant joint sealers.
- D. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
  4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of 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. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw 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 lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where metal jackets are indicated, install 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. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified in Section 220553 "Identification for Plumbing Piping and Equipment."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
  - a. Finish Coat Material: Interior, flat, latex-emulsion size.



3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold and Hot Water:
  - 1. Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Recirculated Hot Water:
  - 1. Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.
- C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

- D. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping, exposed insulated lines within 8 ft. above floor in occupied spaces:
  - 1. Painted Aluminum, Smooth: 0.024 inch thick, Color-Coded by System.
- C. Piping, exposed in equipment rooms:
  - 1. Painted field applied cloth woven glass fiber fabric, Color-Coded by System.

END OF SECTION 220719

## SECTION 221116 - 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 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Copper tube and fittings.
  - 2. Piping joining materials.
  - 3. Transition fittings.
- B. This Division is applicable to domestic cold and hot water piping within building to a point 5 feet outside the building.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G.
- C. Comply with NSF Standard 372 for low lead.

## 2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Copper Unions:
  - 1. MSS SP-123.
  - 2. Cast-copper-alloy, hexagonal-stock body.
  - 3. Ball-and-socket, metal-to-metal seating surfaces.
  - 4. Solder-joint or threaded ends.

## 2.3 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys.
- B. Flux: ASTM B 813, water flushable.

## 2.4 TRANSITION FITTINGS

- A. General Requirements:
  - 1. Same size as pipes to be joined.
  - 2. Pressure rating at least equal to pipes to be joined.
  - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Plastic-to-Metal Transition Fittings:
  - 1. Description:
    - a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
    - b. One end with threaded brass insert and one solvent-cement-socket end.
- D. Plastic-to-Metal Transition Unions:
  - 1. Description:
    - a. CPVC or PVC four-part union.
    - b. Solvent-cement-joint plastic end.
    - c. Rubber O-ring.
    - d. Union nut.

### PART 3 - EXECUTION

#### 3.1 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

#### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5. Do not locate joints below slab of building.
- D. Install shutoff valve, hose-end drain valve, pressure gage, and test tee with valve inside the building at domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install domestic water piping level without pitch and plumb.
- G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping to permit valve servicing.
- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.

- O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- P. Install pressure gages on suction and discharge piping for each plumbing pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
- Q. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."
- R. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

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

### 3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for 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 water-service piping with shutoff valve; extend and connect to the following:
  - 1. Water Heaters: Cold-water inlet 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 that required by plumbing code.
  - 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

- 1. Piping Inspections:

- a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
  - 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 authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- 2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. 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 it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

- B. Domestic water piping will be considered defective if it does not pass tests and inspections.

- C. Prepare test and inspection reports.



### 3.9 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
  2. Open shutoff valves to fully open position.
  3. Open throttling valves to proper setting.
  4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.10 CLEANING

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

3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Under-building-slab, domestic water, building-service piping shall be the following:
  - 1. Soft copper tube, ASTM B 88, Type K; no joints.
- C. Aboveground domestic water piping shall be any of the following:
  - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

3.12 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
  - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
  - 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
  - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

## SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Vacuum breakers.
2. Temperature-actuated, water mixing valves.
3. Strainers.
4. Drain valves.
5. Water-hammer arresters.

- B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 Annex G.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

### 2.3 VACUUM BREAKERS

- A. Hose-Connection Vacuum Breakers:
  - 1. Standard: ASSE 1011.
  - 2. Body: Bronze, nonremovable, with manual drain.
  - 3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
  - 4. Finish: Chrome or nickel plated.

### 2.4 TEMPERATURE-ACTUATED, WATER MIXING VALVES

- A. Individual-Fixture, Water Tempering Valves, MX1:
  - 1. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
  - 2. Pressure Rating: 125 psig minimum unless otherwise indicated.
  - 3. Body: Bronze body with corrosion-resistant interior components.
  - 4. Temperature Control: Adjustable.
  - 5. Inlets and Outlet: Threaded.
  - 6. Finish: Rough or chrome-plated bronze.
  - 7. Tempered-Water Setting: 110 deg F.
  - 8. Tempered-Water Design Flow Rate: 1.5 gpm.

### 2.5 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
  - 1. Pressure Rating: 125 psig minimum unless otherwise indicated.
  - 2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.
  - 3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
  - 4. Screen: Stainless steel with round perforations unless otherwise indicated.
  - 5. Perforation Size:
    - a. Strainers NPS 2 and Smaller: 0.033 inch.
    - b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
  - 6. Drain: Factory-installed, hose-end drain valve.

## 2.6 DRAIN VALVES

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

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

## 2.7 WATER-HAMMER ARRESTERS

### A. Water-Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
- B. Install Y-pattern strainers where indicated on plans and risers.
- C. Install water-hammer arresters in water piping according to PDI-WH 201.

### 3.2 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

### 3.3 LABELING AND IDENTIFYING

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

1. Double-check, backflow-prevention assemblies.
2. Calibrated balancing valves.

- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

#### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Test each double-check, backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

#### 3.5 ADJUSTING

- A. Set field-adjustable flow set points of balancing valves.
- B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

## SECTION 221123 - DOMESTIC WATER PUMPS

### 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. In-line, sealless centrifugal pumps.

#### 1.3 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.

- C. Comply with pump manufacturer's written rigging instructions for handling.

## PART 2 - PRODUCTS

### 2.1 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

- A. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.
- B. Pump Construction:
  - 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
  - 2. Casing: Bronze, with threaded or companion-flange connections.
  - 3. Impeller: Plastic.
  - 4. Motor: Single speed, unless otherwise indicated.
- C. Capacities and Characteristics: Refer to Plumbing Fixture Schedule on drawings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

### 3.2 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.
- C. Install continuous-thread hanger rods and hangers of size required to support pump weight.
  - 1. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- D. Install thermostats in hot-water return piping.

### 3.3 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.



- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
- D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping.
  - 1. Comply with requirements for valves specified in the following Sections:
    - a. Section 220523.12 "Ball Valves for Plumbing Piping."
    - b. Section 220523.14 "Check Valves for Plumbing Piping."
  - 2. Comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."
  - 3. Install pressure gage at suction of each pump and pressure gage at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

### 3.4 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

### 3.5 STARTUP SERVICE

- A. Perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Check piping connections for tightness.
  - 3. Clean strainers on suction piping.
  - 4. Set controls for automatic starting and stopping operation of pumps.
  - 5. Perform the following startup checks for each pump before starting:
    - a. Verify bearing lubrication.
    - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    - c. Verify that pump is rotating in the correct direction.
  - 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
  - 7. Start motor.
  - 8. Open discharge valve slowly.
  - 9. Adjust temperature settings on thermostats.
  - 10. Adjust timer settings.

3.6 ADJUSTING

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123

## SECTION 221126 - FACILITY LIQUEFIED-PETROLEUM GAS PIPING

### 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. Pipes, tubes, and fittings.
  - 2. Piping and tubing joining materials.
  - 3. Valves.
  - 4. Pressure regulators.

#### 1.3 DEFINITIONS

- A. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. 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, crawlspaces, and tunnels.
- D. LPG: Liquefied-petroleum gas.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
  - 1. For Piping Containing Only Vapor:
    - a. Piping and Valves: 125 psig unless otherwise indicated.
- B. LPG System Pressure within Buildings: Refer to drawings.
- C. Delegated Design: Design restraints and anchors for LPG piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
  - 2. Pressure regulators. Indicate pressure ratings and capacities.
  - 3. Dielectric fittings.
- B. Delegated-Design Submittal: For LPG piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of seismic restraints.
  - 2. Design Calculations: Calculate requirements for selecting seismic restraints.

### 1.6 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Data: Submit certification that piping will withstand seismic forces defined on structural drawings." Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

### 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For LPG equipment and accessories to include in emergency, operation, and maintenance manuals.

### 1.8 QUALITY ASSURANCE

- 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.

### 1.9 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 to prevent entrance of dirt, debris, and moisture.

1.10 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A53/A53M, black steel, Schedules 40 and 80, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

2.2 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for LPG.

2.3 MANUAL GAS SHUTOFF VALVES

- A. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
  - 1. Body: Bronze, complying with ASTM B584.
  - 2. Ball: Chrome-plated bronze
  - 3. Stem: Bronze; blowout proof.
  - 4. Seats: Reinforced TFE.
  - 5. Packing: Threaded-body packnut design with adjustable-stem packing.
  - 6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 7. CWP Rating: 600 psig.
  - 8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 9. Service: Suitable for LPG service with "WOG" indicated on valve body.

2.4 PRESSURE REGULATORS

- A. General Requirements:
  - 1. Single stage and suitable for LPG.
  - 2. Steel jacket and corrosion-resistant components.
  - 3. Elevation compensator.
  - 4. End Connections: Threaded for regulators NPS 2 and smaller.
- B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream and not exceed 150 percent of design discharge pressure at shutoff.
9. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
10. Maximum Inlet Pressure: 2 psig.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
8. Maximum Inlet Pressure: 1 psig.

## 2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  1. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 125 psig minimum at 180 deg F.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for LPG piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Inspect LPG piping according to NFPA 58 and North Carolina Fuel Gas Code to determine that LPG utilization devices are turned off in piping section affected.
- B. Comply with NFPA 58 and and North Carolina Fuel Gas Code requirements for prevention of accidental ignition.

### 3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 58 and and North Carolina Fuel Gas Code requirements for installation and purging of LPG piping.
- B. Install underground, LPG piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.
  - 1. If LPG piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, LPG piping according to ASTM D2774.
- D. Copper Tubing with Protective Coating:
  - 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
  - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- E. Install fittings for changes in direction and branch connections.
- F. Joints for connection to inlets and outlets on vaporizers, air mixers, regulators, and valves may be flanged or threaded to match the equipment.

### 3.4 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.

### 3.5 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. Threaded Joints:
  - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  - 2. Cut threads full and clean using sharp dies.
  - 3. Ream threaded pipe ends to remove burrs and restore full ID of pipe.
  - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
  - 5. 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.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Ch. 22, "Pipe and Tube."

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220000 "General Plumbing."
- B. Comply with requirements for pipe hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- C. Install hangers for steel piping with maximum spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Support horizontal piping within 12 inches of each fitting.
- E. Support vertical runs of steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### 3.7 CONNECTIONS

- A. Install LPG piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- B. Install piping adjacent to appliances to allow service and maintenance of appliances.
- C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliances and equipment. Install union between valve and appliances or equipment.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

### 3.8 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for piping and valve identification.



- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### 3.9 PAINTING

- A. Paint exposed, exterior metal piping, valves, regulators, service meters and earthquake valves, and piping specialties, except components with factory-applied paint or protective coating.

- 1. Alkyd System: MPI EXT 5.1D.

- a. Prime Coat: Alkyd anticorrosive metal primer.
- b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
- c. Topcoat: Exterior alkyd enamel (semigloss).
- d. Color: Gray.

- B. Paint exposed, interior metal piping, valves, and regulators except components with factory-applied paint or protective coating.

- 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

- a. Prime Coat: Alkyd anticorrosive metal primer.
- b. Intermediate Coat: Interior latex matching topcoat.
- c. Topcoat: Interior latex (semigloss).
- d. Color: Yellow.

- C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

### 3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- B. Tests and Inspections:

- 1. Test, inspect, and purge LPG according to NFPA 58 and North Carolina Fuel Gas Code] and requirements of authorities having jurisdiction.

- C. LPG piping will be considered defective if it does not pass tests and inspections.

- D. Prepare test and inspection reports.

### 3.11 DEMONSTRATION

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

3.12 OUTDOOR PIPING SCHEDULE

- A. Aboveground LPG vapor piping shall be the following:
  - 1. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES UP TO 2 PSIG

- A. Aboveground, piping shall be the following:
  - 1. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

3.14 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves shall be the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION

## SECTION 221316 - SANITARY WASTE AND VENT PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.

#### 1.2 ACTION SUBMITTALS

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

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

#### 2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

#### 2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.

- B. CISPI, Hubless-Piping Couplings:
  - 1. Standards: ASTM C 1277 and CISPI 310.
  - 2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.4 PVC PIPE AND FITTINGS

- A. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- B. Adhesive Primer: ASTM F 656.
- C. Solvent Cement: ASTM D 2564.

## 2.5 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
  - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
  - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  - 3. Unshielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1173.
    - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - c. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

## PART 3 - EXECUTION

### 3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. 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.
- J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. 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."
- L. Install underground PVC piping according to ASTM D 2321.
- M. Plumbing Specialties:
  - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
  - 2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

- O. Install sleeves for piping penetrations of walls, ceilings, and floors.
- P. Install sleeve seals for piping penetrations of concrete walls and slabs.
- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### 3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### 3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in OD's.
  - 2. In Drainage Piping: Unshielded and Shielded, nonpressure transition couplings.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 4. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
  - 5. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one 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 (1500 mm) with 3/8-inch (10-mm) rod.
  - 2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
  - 3. NPS 4: 60 inches (1500 mm) with 5/8-inch (16-mm) rod.

4. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).
- F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- 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.
  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.
  4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  5. 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 (DN 65) and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
  1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
  - C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  - D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
    1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
    2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). 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 (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
    5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
    6. Prepare reports for tests and required corrective action.

### 3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

### 3.10 PIPING SCHEDULE

- A. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
  1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
  3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.



- B. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
  - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  
- C. Underground, soil, waste, and vent piping shall be the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 221316



## SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Cleanouts.
  - 2. Air-admittance valves.
  - 3. Roof flashing assemblies.
  - 4. Through-penetration firestop assemblies.
  - 5. Miscellaneous sanitary drainage piping specialties.
- B. Related Requirements:
  - 1. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

## 2.2 CLEANOUTS

### A. Cast-Iron Exposed Cleanouts:

1. Standard: ASME A112.36.2M.
2. Size: Same as connected drainage piping
3. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

### B. Cast-Iron Exposed Floor Cleanouts:

1. Standard: ASME A112.36.2M for adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Threaded, adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Not required.
6. Outlet Connection: Threaded.
7. Closure: Brass plug with straight threads and gasket.
8. Adjustable Housing Material: Cast iron with threads.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Square.
11. Top Loading Classification: Medium Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

### C. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure Plug:
  - a. Brass.
  - b. Countersunk or raised head.
  - c. Drilled and threaded for cover attachment screw.
  - d. Size: Same as or not more than one size smaller than cleanout size.
5. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

## 2.3 ROOF FLASHING ASSEMBLIES

### A. Roof Flashing Assemblies:

1. Description: Manufactured assembly approved by roof manufacturer.

## 2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

## A. Through-Penetration Firestop Assemblies:

1. Standard: UL 1479 assembly of sleeve-and-stack fitting with firestopping plug.
2. Size: Same as connected soil, waste, or vent stack.
3. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

## 2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

## A. Open Drains:

1. Description: 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.
2. Size: Same as connected waste piping.

## B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
  - a. NPS 2: 4-inch-minimum water seal.
  - b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

## C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

## D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

## E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

- F. Stack Flashing Fittings:
1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
  2. Size: Same as connected stack vent or vent stack.
- G. Vent Caps:
1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
  2. Size: Same as connected stack vent or vent stack.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. 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 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- E. Assemble open drain fittings and install with top of hub 2 inches above floor.
- F. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- G. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  2. Size: Same as floor drain inlet.
- H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- I. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

- J. Install wood-blocking reinforcement for wall-mounting-type specialties.
- K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### 3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.3 FLASHING INSTALLATION

- A. Comply with roof manufacturer's requirements.

### 3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319





SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

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. Commercial, light-duty, storage, electric, domestic-water heaters.
  - 2. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- B. Source quality-control reports.
- C. Field quality-control reports.
- D. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- 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. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

- C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:
  - a. Structural failures including storage tank and supports.
  - b. Faulty operation of controls.
  - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
- 2. Warranty Periods: From date of Substantial Completion.
  - a. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:
    - 1) Storage Tank: Five years.
    - 2) Controls and Other Components: Two years.
  - b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:
  - 1. Standard: UL 174.
  - 2. Storage-Tank Construction: Steel, vertical arrangement.
    - a. Tappings: ASME B1.20.1 pipe thread.
    - b. Pressure Rating: 150 psig.
    - c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.
  - 3. Factory-Installed Storage-Tank Appurtenances:
    - a. Anode Rod: Replaceable magnesium.
    - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    - c. Drain Valve: ASSE 1005.

- d. Insulation: Comply with ASHRAE/IESNA 90.1.
  - e. Jacket: Steel with enameled finish.
  - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
  - g. Heating Elements: Two; electric, screw-in immersion type; wired for non-simultaneous operation.
  - h. Temperature Control: Adjustable thermostat.
  - i. Safety Control: High-temperature-limit cutoff device or system.
  - j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
4. Special Requirements: NSF 5 construction with legs for off-floor installation.
- B. Capacity and Characteristics:
1. Refer to Plumbing Fixture Schedule for additional information.
- ## 2.2 DOMESTIC-WATER HEATER ACCESSORIES
- A. Domestic-Water Compression Tanks:
1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
  2. Construction:
    - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    - b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    - c. Air-Charging Valve: Factory installed.
  3. Capacity and Characteristics:
    - a. Refer to Plumbing Fixture Schedule for additional information.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.
- D. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

- E. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

### 2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on floor or on domestic-water heater mounting bracket as indicated on plans.
  - 1. Maintain manufacturer's recommended clearances.
  - 2. Arrange units so controls and devices that require servicing are accessible.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Anchor domestic-water heaters to substrate.
- B. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- C. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- D. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

- E. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- F. Fill electric, domestic-water heaters with water.
- G. Charge domestic-water compression tanks with air.

### 3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

### 3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

### 3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters.

END OF SECTION 223300



## SECTION 224213.13 - COMMERCIAL WATER CLOSETS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Water closets.
  - 2. Toilet seats.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 WATER CLOSETS

- A. Refer to Plumbing Fixture Schedule on design drawings.

#### 2.2 TOILET SEATS

- A. Refer to Plumbing Fixture Schedule on design drawings.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Water-Closet Installation:
  - 1. Install level and plumb according to roughing-in drawings.
  - 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
- B. Install toilet seats on water closets.
- C. Wall Flange and Escutcheon Installation:
  - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
  - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
  - 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- D. Joint Sealing:
  - 1. Seal joints between water closets and walls using sanitary-type, one-part, mildew-resistant silicone sealant.
  - 2. Match sealant color to water-closet color.
  - 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

#### 3.3 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.



3.4 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

3.5 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13



## SECTION 224216.13 - COMMERCIAL LAVATORIES

### 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. Lavatories.
  - 2. Faucets.
  - 3. Supply fittings.
  - 4. Waste fittings.
  - 5. Supports.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
  - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 LAVATORIES AND FAUCETS

- A. Refer to Plumbing Fixture Schedule on design drawings for further information.

## 2.2 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
  - 1. NPS 1/2.
  - 2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

## 2.3 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 1-1/2 by NPS 1-1/4.
  - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
  - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

## 2.4 SUPPORTS

- A. Type II Lavatory Carrier:
  - 1. Standard: ASME A112.6.1M.
- B. Type III Lavatory Carrier:
  - 1. Standard: ASME A112.6.1M.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

#### 3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

#### 3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

## SECTION 224216.16 - COMMERCIAL SINKS

### 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. Sinks and faucets.
  - 2. Supply fittings.
  - 3. Waste fittings.

#### 1.3 ACTION SUBMITTALS

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

### PART 2 - PRODUCTS

#### 2.1 SINKS AND FAUCETS

- A. Refer to Plumbing Fixture Schedule on design drawings for further information.

#### 2.2 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:

1. NPS 1/2.
2. Chrome-plated, rigid-copper pipe.

### 2.3 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Trap:
  1. Size: NPS 1-1/2.
  2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install water-supply piping with stop on each supply to each sink faucet.
  1. Exception: Use ball valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping."
  2. Install stops in locations where they can be easily reached for operation.
- B. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- C. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

### 3.3 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."



3.4 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. Clean faucets and other fittings with manufacturers' recommended cleaning methods and materials.
- B. Provide protective covering for installed sinks and fittings.
- C. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16



SECTION 230000 – GENERAL MECHANICAL

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The work shall include furnishing, installing and testing the equipment and materials specified in other sections of the Mechanical Specifications and shown on the Drawings. It is the intent of these Specifications that the mechanical systems shall be suitable in every way for the intended usage. All material and all work which may be reasonably implied as being incidental to the work of this Division shall be furnished at no extra cost.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. Comply with all provisions, details and instructions of these sections in the accomplishment of work covered under Division 23.
- C. Furnish all labor, materials and equipment and incidentals required to make ready for use complete mechanical systems as shown on the Drawings and specified herein.
- D. Where Sub-Contracts are used to perform portions of the work, division of labor between sub trades is the responsibility of the Contractor.
- E. The general scope work includes, but is not limited to, furnishing, coordinating, and installing the following:
  - 1. Heating, air conditioning and ventilation equipment.
  - 2. Ductwork.
  - 3. HVAC piping, specialties and equipment.
  - 4. Controls and wiring.
  - 5. Testing and balancing.
- F. Visit all areas of the site, buildings and structures (as applicable) in which work under these sections is to be performed. Inspect carefully the existing conditions prior to bidding. Bid submission is evidence that the Contractor has examined the site and existing conditions, understands conditions under which the work will be performed, and takes full responsibility for complete knowledge of all factors governing the work.
- G. Schedule all service interruptions in existing facilities at the Owner's convenience with 24 hours (minimum) notice. Obtain prior approval for each interruption.
- H. Thoroughly test all mechanical systems at the completion of work and make any minor correction changes or adjustments necessary for all the proper functioning of the system and equipment. All workmanship shall be of the highest quality; substandard work will be rejected.

## 1.2 SUBMITTALS

- A. Procedures for submittals: Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

**Transmit each shop drawing submittal with provided Shop Drawing Submittal Cover Form, attached as Appendix B, for each item of equipment/material or each specification section/paragraph**

- B. Clearly indicate proposed equipment and/or materials substitutions in shop drawings. Summarize all deviations from the specified quality, functionality, appearance or performance of proposed equipment and/or materials in the preface of each submittal. Include documentation to support deviations.
- C. Provide descriptive data on all materials and equipment as required to ascertain compliance with Specifications.
- D. Design layout shown on drawings is based on physical sizes of reputable equipment manufacturers. If equipment other than models indicated is installed, any resulting conflicts with space, maintenance access, clearances or codes are the responsibility of the Contractor to correct at his expense.
- E. Where specific models and manufacturers of materials and equipment are specified, substitutions as allowed by the specifications and State law will be considered. Substitutions must be equivalent in quality, function, suitability and arrangement to specified equipment. Architect/Engineer to have final authority as to equivalency of substitutions.
- F. Equipment model numbers noted in these specifications or on the drawings are intended to establish a minimum standard of quality and do not necessarily relate to specific options or arrangement as shown. Provide equipment with all standard features and optional features as stated and arranged as shown on the drawings.

## 1.3 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with all applicable state and local codes, standards and regulations.
- B. Furnish all materials and labor which is be required for compliance with codes, standards and regulations, whether specifically mentioned in these specifications or shown on the drawings.
- C. Obtain required construction permit from the authority having jurisdiction and arrange, at the proper time, for all inspections required by such authority. Pay all permit and inspection costs required.

## 1.4 COORDINATION OF WORK

- A. Contractor is responsible for coordination of work between trades. Provide fully complete and functional systems.

- B. Compare mechanical drawings and specifications with the drawings and specifications for other trades.
- C. Coordinate mechanical installation with the work of other trades. Report any pertinent discrepancies to the Architect/Engineer and obtain written instructions for any necessary revisions. Before starting any construction, make proper provisions to avoid interferences in a manner approved by the Architect/Engineer. No extras will be allowed for rework of uncoordinated installations.
- D. Determine exact route and location of each mechanical item prior to fabrication and/or installation. Adjust location of ducts, piping and equipment, etc., to accommodate interferences anticipated and encountered.
- E. Right of Way: General priority for right of way is as follows:
  - 1. Items located per regulatory requirement.
  - 2. Piping with pitch requirement (plumbing drains, etc.).
  - 3. Ductwork.
  - 4. Piping without pitch requirement.
  - 5. Electrical wiring (conduits, etc.).
- F. Arrange all work to permit removal (without damage to other parts) of any equipment requiring periodic replacement.
- G. Provide clearance and easy access to any equipment which requires periodic maintenance. Arrange ducts, piping and equipment to permit ready access to valves, cocks, traps, starters, motors, control components, etc., and to clear the opening of swinging doors and access panels.

#### 1.5 EQUIPMENT AND MATERIALS (GENERAL)

- A. Provide all new materials unless specifically indicated otherwise.
- B. Manufacturers and models listed in drawings and specifications are used for layout and to convey to bidders the general style, type, character and quality of product desired. Listed examples are used only to denote the quality standard of product desired and are not intended to restrict bidders to a specific brand, make, manufacturer or specific name.
- C. Adjust layout, system connections and coordinate with other trades as required to properly install equivalent products.
- D. Where equivalent products are submitted, include all associated costs related to substitution in bid.
- E. Furnish materials bearing the manufacturer's name and trade name. Provide UL label where a UL standard has been established for the particular material.
- F. Furnish standard products of manufacturers regularly engaged in production of equipment types required for the work. Use the manufacturer's latest approved design.

- G. Use the same manufacturer for equipment and materials of the same general type throughout the work to obtain uniform appearance, operation and maintenance.
- H. Protect equipment and materials from dirt, water, chemical or mechanical injury and theft at all times during construction. Provide covers or shelter as required.
- I. If materials or equipment are damaged at any time prior to final acceptance of the work, repair such damage at no additional cost. If materials or equipment are damaged by water, provide replacement no additional cost.
- J. Follow manufacturer's directions completely in the delivery, storage, protection and installation of all equipment and materials. Notify the Architect/Engineer in writing of any conflicts between any requirements of the contract documents and manufacturer's directions. Obtain written instructions before proceeding with the work. The Contractor is responsible for correction of any work that does not comply with the manufacturer's directions or written instructions from the Architect/Engineer at no additional cost.
- K. Repair any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. Repaint entire damaged panel or section per the field painting specifications in Division 9 at no additional cost.

#### 1.6 OPERATION AND MAINTENANCE MANUALS

- A. Refer to individual mechanical sections and Division 1.

#### 1.7 PAINTING

- A. Protect sensors, controllers, etc. against painting. Do not install thermostats, devices or trim until painting is complete.

#### 1.8 LOCATIONS AND MEASUREMENTS

- A. Location of mechanical work is shown on the drawings as accurately as possible. Field verify all measurements to insure that the work suits the surrounding structure, trim, finishes and/or construction. Provide adjustment as necessary.
- B. Make minor relocations of work prior to installation as required or as directed by the Architect/Engineer at no additional cost.

#### 1.9 SUPERVISION

- A. Contractor to provide an authorized and competent representative to constantly supervise the work from the beginning to completion and final acceptance. Insofar as possible, keep the same foreman and workmen throughout the project duration.

- B. Representatives of Architect/Engineer, Owner, and local inspection authorities will make inspections during the progress of the work. Contractor to accommodate such inspections and correct deficiencies noted.

#### 1.10 QUALITY AND WORKMANSHIP

- A. Contractor to employ skilled tradesmen, laborers and supervisors. Final product to present a neat, well finished, and professional installation.
- B. Remove and replace any work considered substandard quality in the judgement of the Architect/Engineer.

#### 1.11 CLOSING IN WORK

- A. Do not cover up or enclose work until it has been inspected, tested and approved by authorities having jurisdiction over the work. Uncover any such work for inspection and/or test at no additional cost. Restore the work to its original condition after inspection and/or test at no additional cost.

#### 1.12 CUTTING AND PATCHING

- A. Perform all cutting and patching necessary to install work under this Division.
- B. Perform cutting and patching in professional, workmanlike manner.
- C. Arrange work to minimize cutting and patching.
- D. Do not cut joists, beams, girders, columns or any other structural members without written permission from the Architect/Engineer.
- E. Cut opening only large enough to allow easy installation of piping, wiring or ductwork.
- F. Patching material to match material removed.
- G. Restore patched surface to its original appearance at completion of patching.
- H. Where waterproofed surfaces are patched, maintain integrity of waterproofing.
- I. Remove rubble and excess patching materials from the premises.

#### 1.13 INTERPRETATION OF DRAWINGS

- A. Drawings and specifications under this Division are complementary each to the other. Provide any work specified herein and/or indicated on the drawings.
- B. Drawings are diagrammatic and indicate generally the location of fixtures, piping, devices, equipment, etc. Follow drawings as closely as possible, but arrange work to suit the finished surroundings and/or trim.

- C. The words “furnish”, “provide”, and/or “install” as used in these drawings and specifications are interpreted to include all material and labor necessary to complete the particular item, system, equipment, etc.
- D. Any omissions from either the drawings or specifications are unintentional. Contractor is responsible for notifying the Architect/Engineer of any pertinent omissions before submitting a bid. Complete and working systems are required, whether every small item of material is shown and specified or not.

#### 1.14 ACCESSIBILITY

- A. Locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment to include, but not be limited to, motors, controllers, and dampers. If required for accessibility, furnish access doors for this purpose. Minor deviations from drawings may be made to allow for better accessibility. Lack of access doors on drawings does not relieve Contractor of responsibility to provide access doors, if needed to properly service equipment.
- B. Coordinate exact locations and size of access panels for each concealed device requiring service.
- C. Access panels: Steel construction with 16 gauge frames and 18 gauge panels, factory primed with rust inhibiting paint, finish paint by Contractor. Provide suitable UL listed doors where installed in rated construction.
- D. Coordinate access panel locations with architectural construction.
- E. Access panels are not required for access to work located above a lift-out “T” bar type ceiling.

#### 1.15 ELECTRICAL WORK IN CONNECTION WITH MECHANICAL CONTRACTS

- A. Comply with Division 26. Any required Division 23 electrical work not specifically specified to be furnished by Division 26 Contractor shall be provided by Division 23 Contractor.
- B. All electrical work performed Division 23 shall comply with Division 26 specification requirements.
- C. Coordinate electrical interface of supplied mechanical equipment with electrical system. Division 26 electrical work for mechanical systems is based on values scheduled on mechanical drawings. Division 23 Contractor is responsible for any costs to modify the contracted electrical work to service equipment with electrical characteristics different than those scheduled.

#### 1.16 MECHANICAL WORK IN CONNECTION WITH OTHER CONTRACTS

- A. Provide mechanical services as required for items furnished by other contractors or vendors as shown on the Drawings. Actual requirements may vary from Drawings. Coordinate with equipment installed. Make final connections only after approval of the other contractor or vendor, in the contractor's or vendor's presence.



1.17 ALTERNATE BIDS

- A. Alternate Bids, IF ANY, are described in relevant sections of the General and Supplemental General Conditions and Division 1 Specification Sections.

1.18 PROJECT RECORD DRAWINGS

- A. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 1 Specification Sections. As the work progresses, legibly record all field changes on a set of project contract drawings, herein after called the "record drawings." Record drawings shall accurately show the installed condition of mechanical work.

1.19 PHASING OF THE WORK

- A. Schedule work in accordance with the relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

1.20 PROJECT CLOSEOUT

- A. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 230000



## SECTION 230010 – EXISTING CONDITIONS

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. Procedures for mechanical work in existing building.

#### 1.2 RELATED WORK

- A. Conform to the requirements of Division 1 for cutting and patching. Conform to the requirements of Division 2.
- B. Conduct work to minimize interference with adjacent and occupied building areas.
- C. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

### PART 2 - PRODUCTS

#### 2.1 PATCHING MATERIALS

- A. As specified in individual Sections.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Coordinate mechanical service interruptions with the Owner.
- B. Provide temporary and/or permanent mechanical as shown and/or as required by conditions to maintain existing systems in service during construction.
- C. Existing Mechanical Systems: Maintain existing mechanical systems in service. Disable systems outside construction area only to make tie-ins or switchovers. Obtain permission from the Owner at least 24 hours before partially or completely disabling mechanical. Minimize duration. Make temporary connections as required to maintain service in areas adjacent to work area.
- D. Drawings are based on casual field observation and existing record documents. Survey the affected areas before submitting bid proposal. Report discrepancies to the Architect/Engineer before disturbing the existing installation.

- E. Field-verify existing conditions as related to interconnection of New Work. Determine exact methods of interface to obtain proper operation.
- F. Coordinate existing and New Work interface prior to beginning any work. Adjust work to suit existing conditions. Some deviations in plan layout vs. actual conditions should be expected.
- G. Provide, erect, and maintain temporary dust screens, safeguards, barricades, signage and similar measures, for protection of the public, Owner, Contractor's employees, and existing construction to remain. Provide protective barriers indicated in the contract drawings.

### 3.2 EXISTING CONDITIONS

- A. Verify existing conditions in field and determine which affect mechanical work. Secure utilities as required to prevent spills, leakage, etc.
- B. Protect existing work to remain. Do not cut or remove any structural members.
- C. Rework existing services to remain which interfere with new work.

END OF SECTION 230010

## SECTION 230020 – MECHANICAL DEMOLITION

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. Selective mechanical demolition.
- B. Conform to the requirements of Division 01 for cutting and patching.
- C. Conform to the requirements of Division 02 for selective demolition

#### 1.2 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

### PART 2 - PRODUCTS

#### 2.1 PATCHING MATERIALS

- A. As specified in individual Sections.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Demolition Drawings are based on casual field observation and existing record documents. Survey the affected areas before submitting bid proposal. Report discrepancies to the Architect/Engineer before disturbing the existing installation.
- B. Provide, erect, and maintain temporary dust screens, safeguards, barricades, signage and similar measures, for protection of the public, Owner, Contractor's employees, and existing construction to remain. Provide protective barriers indicated in the contract drawings.
- C. Protect existing materials and existing improvements which are not to be demolished.
- D. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.

3.2 DEMOLITION

- A. Demolish mechanical work as indicated. Secure utilities as required to prevent spills, leakage, etc.
- B. Demolish in an orderly and careful manner. Protect existing work to remain. Do not cut or remove any structural members.
- C. Terminate all demolition work in a neat finished manner.
- D. Conceal or enclose abandoned work within building construction except as specifically noted.
- E. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- F. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- G. Coordinate cutting and patching requirements.

END OF SECTION 230020

## SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### 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. Equipment labels.
2. Pipe labels.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

- A. Plastic Labels for New and Existing Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
9. Engraved plastic laminated labels shall include equipment number, area(s) served (use actual room number), substantial completion date (S.C.), extended warranty period, number and size of filters and capacity. The following are examples of labelling to be used:

Air Handling Units: AC1 (Rm 22 Kitchen)  
S.C.: 08/08/2014 (5 Year Warranty)  
Filters: 2@ 24in. x 24in. x 1in.  
Capacity: 4,000 CFM @ 1.00" ESP.

Heat Pump: HP6 (Rm 22 Kitchen)  
S.C.: 08/08/2014 (5 Year Comp. Warranty)  
Capacity: 3 Tons

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

## 2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- B. Manufactured Pipe Markers: Preprinted, color-coded, with lettering indicating service.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
  1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  2. Lettering Size: Size letters according to ASME A13.1 for piping.

## PART 3 - EXECUTION

### 3.1 PREPARATION

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



### 3.2 GENERAL INSTALLATION REQUIREMENTS

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

### 3.3 EQUIPMENT LABEL INSTALLATION

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

### 3.4 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Comply with ASME A13.1.
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

END OF SECTION 230553



SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems (New systems, existing air distribution):
  - a. Constant-volume air systems.
  - b. Variable-air-volume systems

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. TAB: Testing, adjusting, and balancing.
- C. TABB: Testing, Adjusting, and Balancing Bureau.
- D. TAB Specialist: An entity engaged to perform TAB Work.

1.3 INFORMATIONAL SUBMITTALS

- A. Certified TAB reports.

1.4 QUALITY ASSURANCE

- A. Certify TAB field data reports and perform the following:
  1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- B. TAB Report Forms: Use standard TAB contractor's forms approved by Construction Manager.
- C. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

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.
- B. Examine systems for installed balancing devices. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- 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 system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- F. Examine test reports specified in individual system and equipment Sections.
- G. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- H. Examine terminal units and verify that they are accessible and their controls are connected and functioning.
- I. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- J. Examine operating safety interlocks and controls on HVAC equipment.
- K. 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. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Automatic temperature-control systems are operational.
  - 3. Equipment and duct access doors are securely closed.
  - 4. Balance, smoke, and fire dampers are open.
  - 5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

6. Windows and doors can be closed so 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 AABC's "National Standards for Total System Balance" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation."
- C. Mark equipment and balancing devices with paint or other suitable, permanent identification material 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. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

### 3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
1. Measure total airflow.
    - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical 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 the 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.
  3. Measure static pressure across each component that makes up an air-handling unit.
    - a. Report the cleanliness status of filters and the time static pressures are measured.
  4. Measure static pressures entering and leaving other devices under final balanced conditions.
  5. Obtain approval from Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  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 mode 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 airflow of submain and branch ducts.
    - 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. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
  3. 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 air 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 air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch 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 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Adjust the variable-air-volume systems as follows:
  - 1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
  - 2. Verify that the system is under static pressure control.
  - 3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
  - 4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
    - a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
    - b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
    - c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
    - d. Adjust controls so that terminal is calling for minimum airflow.
    - e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
    - f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.
    - g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.
  - 5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.

- a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
  - b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
  - c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
  - d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
  - e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
6. Measure fan static pressures as follows:
- a. Measure static pressure directly at the fan outlet or through the flexible connection.
  - b. Measure static pressure directly at the fan inlet or through the flexible connection.
  - c. Measure static pressure across each component that makes up the air-handling system.
  - d. Report any artificial loading of filters at the time static pressures are measured.
7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
- a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
  - b. Verify that terminal units are meeting design airflow under system maximum flow.
8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.
9. Verify final system conditions as follows:
- a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
  - b. Re-measure and confirm that total airflow is within design.
  - c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
  - d. Mark final settings.
  - e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
  - f. Verify tracking between supply and return fans.

### 3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.



### 3.8 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
  - 1. Equipment with Fans: Plus or minus 10 percent.
  - 2. Air Outlets and Inlets: Plus or minus 10 percent.

### 3.9 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

### 3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  - 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
  - 1. Field test reports prepared by system and equipment installers.
  - 2. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
  - 1. Title page.
  - 2. Project name.
  - 3. Project location.
  - 4. Architect's name and address.
  - 5. Engineer's name and address.
  - 6. Contractor's name and address.
  - 7. Report date.
  - 8. Signature of TAB supervisor who certifies the report.
  - 9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 10. 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.

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer's name, type, size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from indicated values.
14. Test conditions for fans and pump performance forms including the following:
  - a. Settings for outdoor-, return-, and exhaust-air dampers.
  - b. Conditions of filters.
  - c. Cooling coil, wet- and dry-bulb conditions.
  - d. Fan drive settings including settings and percentage of maximum pitch diameter.
  - e. Other system operating conditions that affect performance.

### 3.11 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

END OF SECTION 230593

## SECTION 230713 - DUCT INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

#### 1.2 SUMMARY

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply, return and outdoor air.
  - 2. Indoor, exposed supply, return and outdoor air.
- B. Related Sections:
  - 1. Section 230719 "HVAC Piping Insulation."

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

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

#### 1.6 DELIVERY, STORAGE, AND HANDLING

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

#### 1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

- B. Coordinate clearance requirements with duct Installer for duct insulation application
- C. Coordinate installation and testing of heat tracing.

## 1.8 SCHEDULING

- A. Schedule insulation application after testing. Insulation application may begin on segments that have satisfactory test results.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- D. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

### 2.2 ADHESIVES

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

### 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
  - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
  - 2. Service Temperature Range: 0 to 180 deg F.

3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. Color: White.

## 2.4 SEALANTS

### A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

## 2.5 FACTORY-APPLIED JACKETS

### A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.6 TAPES

### A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

### B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

## 2.7 SECUREMENTS

### A. Insulation Pins and Hangers:

1. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:

- a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square
  - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
  - c. Adhesive-backed base with a peel-off protective cover.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

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

#### 3.2 PREPARATION

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

#### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Keep insulation materials dry during application and finishing.
- F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- G. Install insulation with least number of joints practical.

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

### 3.4 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistant joint sealers.

### 3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, 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 either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not over-compress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped



pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

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

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.6 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

### 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
  1. Inspect ductwork, randomly selected by Architect. Extent of inspection shall be limited to two (2) location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  1. Indoor, concealed supply, return and outdoor air.
  2. Indoor, exposed supply, return and outdoor air.
- B. Items Not Insulated:
  1. Factory-insulated flexible ducts.
  2. Factory-insulated plenums and casings.
  3. Flexible connectors.

### 3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed supply, return and outside-air duct insulation shall be Mineral-Fiber Blanket, 2 inches thick and 0.75-lb/cu. ft. nominal density.

- B. Exposed supply, return and outside-air duct insulation shall be Mineral-Fiber Board, 2 inches thick and 2-lb/cu. ft. nominal density.

END OF SECTION 230713



## SECTION 233113 - METAL DUCTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

##### B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers.

#### 1.2 PERFORMANCE REQUIREMENTS

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

#### 1.3 ACTION SUBMITTALS

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

### PART 2 - PRODUCTS

#### 2.1 RECTANGULAR DUCTS AND FITTINGS

- ##### A. General Fabrication Requirements:
- Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- ##### B. Transverse Joints:
- Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.2 ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
  2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; galvanized.

## 2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  2. Tape Width: 4 inches.
  3. Sealant: Modified styrene acrylic.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  7. Service: Indoor and outdoor.
  8. Service Temperature: Minus 40 to plus 200 deg F.
  9. Substrate: Compatible with galvanized sheet steel.
- C. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
  2. Type: S.
  3. Grade: NS.
  4. Class: 25.
  5. Use: O.
- D. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
  2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

### PART 3 - EXECUTION

#### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.



- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

### 3.2 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. Unconditioned Space, Supply-Air Ducts: Seal Class B.
  - 3. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 4. Conditioned Space, Supply-Air Ducts: Seal Class C.
  - 5. Conditioned Space, Return-Air Ducts: Seal Class C.

### 3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Structural-steel fasteners appropriate for construction materials to which hangers are being attached.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.

3.6 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel.
- B. Supply Ducts:
  - 1. Ducts Connected to Constant-Volume Air-Handling Units:
    - a. Pressure Class: Positive 2-inch wg.
    - b. Minimum SMACNA Seal Class: B.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- C. Return Ducts:
  - 1. Ducts Connected to Air-Handling Units:
    - a. Pressure Class: Positive or negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: B.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
  - 1. Ducts Connected to Air-Handling Units:
    - a. Pressure Class: Positive or negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: B.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
- F. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
    - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      - 4) Radius-to Diameter Ratio: 1.5.
    - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
    - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- G. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
    - a. Rectangular Main to Rectangular Branch: 45-degree entry.
    - b. Rectangular Main to Round Branch: Spin in.
  2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
    - a. Velocity 1000 fpm or Lower: 90-degree tap.
    - b. Velocity 1000 to 1500 fpm: Conical tap.
    - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113



## SECTION 233300 - AIR DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Manual volume dampers.
2. Turning vanes.
3. Duct accessory hardware.
4. Flexible connectors.

#### 1.2 ACTION SUBMITTALS

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

#### 1.3 CLOSEOUT SUBMITTALS

- ##### A. Operation and maintenance data.

### PART 2 - PRODUCTS

#### 2.1 ASSEMBLY DESCRIPTION

- ##### A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- ##### B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

#### 2.2 MATERIALS

- ##### A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G90.
  2. Exposed-Surface Finish: Mill phosphatized.
- ##### B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

## 2.3 MANUAL VOLUME DAMPERS

### A. Standard, Steel, Manual Volume Dampers:

1. Standard leakage rating, with linkage outside airstream.
2. Suitable for horizontal or vertical applications.
3. Frames:
  - a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
  - b. Mitered and welded corners.
  - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:
  - a. Multiple or single blade.
  - b. Parallel- or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized-steel, 0.064 inch thick.
5. Blade Axles: Galvanized steel.
6. Bearings:
  - a. Molded synthetic.
  - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
7. Tie Bars and Brackets: Galvanized steel.

### B. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

## 2.4 TURNING VANES

### A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

### B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

### C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

- D. Vane Construction: Single wall.

## 2.5 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip [**3-1/2 inches**] [**5-3/4 inches**] wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected 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. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
  - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

## 2.6 DUCT ACCESSORY HARDWARE

- A. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers where indicated on plans.
  - 1. Install steel volume dampers in steel ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install flexible connectors to connect ducts to equipment.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300



## SECTION 233423 - HVAC POWER VENTILATORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Centrifugal roof ventilators.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also 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.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and 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. Belts: One set(s) for each belt-driven unit.

1.7 QUALITY ASSURANCE

- 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. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705.

1.8 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

- A. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
  - 1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- B. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- C. Accessories:
  - 1. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
  - 2. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
- D. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
  - 1. Configuration: Built-in cant and mounting flange.
  - 2. Overall Height: 12 inches above finished roof level.
  - 3. Metal Liner: Galvanized steel.
- E. Capacities and Characteristics:
  - 1. Refer to schedule on design drawings.

## 2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

## 2.3 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to 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. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Equipment Mounting:
  - 1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- C. Secure roof-mounted fans to roof curbs with stainless steel hardware.
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

### 3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.

- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Building Wire and Cable."

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Prepare test and inspection reports.

### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation. Adjust belt tension.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- C. Replace fan and motor pulleys as required to achieve design airflow. Lubricate bearings.

END OF SECTION

## SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Diffusers, registers, and grilles.

B. Related Sections:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

### PART 2 - PRODUCTS

#### 2.1 DIFFUSERS, REGISTERS, AND GRILLES

- A. Refer to schedule on design drawings for further information.

#### 2.2 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 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design

requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.2 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

## SECTION 237416.11 - PACKAGED ROOFTOP AIR-CONDITIONING UNITS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes packaged, small-capacity, rooftop air-conditioning units (RTUs).

#### 1.3 DEFINITIONS

- A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, small-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each RTU.
  - 1. Include manufacturer's technical data.
  - 2. Include rated capacities, dimensions, required clearances, characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
  - 1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.
  - 2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
  - 3. Wind-Restraint Details: Detail fabrication and attachment of wind restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

- B. Sample Warranty: For special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Filters: One set(s) of filters for each unit.

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of RTUs that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
- 2. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
- 3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 DESCRIPTION

- A. AHRI Compliance:

- 1. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
- 2. Comply with AHRI 270 for testing and rating sound performance for RTUs.

- B. AMCA Compliance:

- 1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
- 2. Damper leakage tested according to AMCA 500-D.
- 3. Operating Limits: Classify according to AMCA 99.

- C. ASHRAE Compliance:

- 1. Comply with ASHRAE 15 for refrigeration system safety.
- 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
- 3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."



- D. ASHRAE/IES Compliance: Comply with applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. NFPA Compliance: Comply with NFPA 90A or NFPA 90B.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design mounting and restraints for RTUs, including comprehensive engineering analysis.
  - 1. Design RTU supports to comply with wind performance requirements.

## 2.3 CAPACITIES AND CHARACTERISTICS

- A. Refer to schedule on design drawings.

## 2.4 MOTORS

- A. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

## 2.5 ADAPTOR ROOF CURBS

- A. Curbs shall be vibration isolation type custom made from 12 gauge or heavier as required galvanized steel with welded one-piece construction and insulated with 1-1/2" thick rigid insulation. Curb height shall be minimum of 14" high above the finished roof height. Secure curb to roof structure and unit to curb per manufacturer's recommendations for site's wind zone loading. Curbs shall have structural cross members.

## 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 RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Roof Curb: Install on roof structure or existing curb, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Install RTUs on curbs and coordinate roof

penetrations and flashing with roof construction. Secure RTUs to upper curb rail, and secure curb base to roof framing with anchor bolts.

- B. Install drain pipes from unit drain pans to roof drains. Provide manufactured roof pipe supports for condensate piping. Piping supports shall be designed specifically for support of condensate piping systems. Supports shall be UV resistant and suitable for installation on roofing material. Supports must comply with NCPC 301.10 for wind speeds up to 145 MPH.
  - 1. Drain Piping: Schedule 40 PVC pipe complying with ASTM D 1785, with solvent-welded fittings.
  - 2. Pipe Size: Same size as condensate drain pan connection.

### 3.3 CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:
  - 1. Install ducts to termination at top of roof curb.
  - 2. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
  - 3. Install return-air duct continuously through roof structure.
- B. Where installing piping adjacent to RTUs, allow space for service and maintenance.
- C. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- E. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
  - 1. Nameplate shall be laminated acrylic or melamine plastic signs as specified in Section 260553 "Identification for Electrical Systems."
  - 2. Nameplate shall be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch high.
  - 3. Locate nameplate where easily visible.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. RTU will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

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

END OF SECTION 237416.11



## SECTION 260500 - GENERAL ELECTRICAL

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. The Instructions to Bidders, General Conditions of the Contract, Supplementary General Conditions and Division 1 bound herewith are a component part of this Division of the specifications and shall apply to this Division with equal force and shall be consulted in detail for instructions pertaining to the work.
- B. Requirements generally applicable to all electrical Work on the Project, including but not limited to Work specified in Divisions 26, 27, and 28.
- C. Furnish all labor, materials and equipment and incidentals required to make ready for use complete electrical systems as shown on the Drawings and specified herein.
- D. It is the intent of these Specifications that the electrical systems shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Division shall be furnished at no extra cost.
- E. The work shall include, but not be limited to, furnishing, coordinating, and installing the following:
  - 1. Electrical distribution system for power, lighting, receptacles and miscellaneous power as shown on the contract drawings.
  - 2. Electrical lighting systems as shown on the contract drawings, complete with indicated switching, circuiting, etc.
  - 3. Electrical receptacle systems as shown on the contract drawings.
  - 4. Exit and emergency lighting systems.
  - 5. Power supplies for equipment furnished by others.
  - 6. Modifications to Existing Fire alarm system.
  - 7. Raceway and outlet systems for telecommunications, computer and other special systems.
  - 8. Grounding.
  - 9. Other special requirements and/or systems where shown.
- F. Each bidder (or Representative) shall, before preparing a proposal, visit all areas of the existing site. If the work includes demolition, restoration, renovation and/or addition; then existing buildings and structures should be carefully inspected. The submission of the proposal by this Bidder shall be considered evidence that the Bidder (or Representative) has visited the site and noted the locations and conditions under which the work will be performed and that the Bidder takes full responsibility for a complete knowledge of all factors governing the work.
- G. All power interruptions to existing equipment shall be at the Owner's convenience with 24 hours (minimum) notice. Each interruption shall have prior approval.
- H. The work shall include complete testing of all equipment and wiring at the completion of work and making any minor correction changes or adjustments necessary for all the proper

functioning of the system and equipment. All work shall be of the highest quality; substandard work will be rejected.

- I. Field verify and document all existing electrical equipment, devices, lighting fixtures, telecom devices fire alarm devices, etc. Once demolition begins, unless brought to the attention of the owner, it is assumed everything is in working order and the contractor is responsible for ensuring everything is in working order upon re-installation.

## 1.2 SUBMITTALS

- A. Shop drawings shall be submitted for all equipment, apparatus, and other items as required by the Architect/Engineer. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Submittals are required for all materials shown in the individual specifications sections.
- C. Submittals are required for materials and specific methods used for penetrations of rated assemblies.
- D. Proposed equipment and/or materials substitutions shall be clearly indicated in shop drawings. All deviations from the specified quality, functionality, appearance or performance of the proposed equipment and/or materials shall be clearly summarized in the preface of each submittal.
- E. The project shall be bid based on the equipment listed in these specifications and on the drawings. After award of the Electrical Contract the Contractor may wish to substitute equipment other than that specified, subject to approval. The Electrical Contractor shall bear the "burden of proof" for demonstrating substitute equipment equivalency and suitability.
- F. The Electrical Contractor shall be required to replace installed "equivalent" equipment if the operation of this equipment does not meet the full design intent of the specified system.
- G. Physical size of equipment used in the design layout are those of reputable equipment manufacturers. The Contractor is responsible for providing equipment which will fit the space provided. If the Contractor elects to use other manufacturer's equipment, any resulting conflicts with space clearance or codes shall be the responsibility of the Contractor to correct at the Contractor's expense.
- H. The Contractor assumes all responsibility for providing code clearances. Submit a scale drawing of each electrical equipment room showing exact size and location of all proposed electrical equipment with code clearances and working space clearly indicated.

## 1.3 COORDINATION OF WORK

- A. It is understood and agreed that the Contractor is, by careful examination, satisfied as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the general and local conditions and all other matters which can and may affect the work under this contract. The Contractor shall be held responsible for visiting the site and thoroughly familiarizing himself with the existing

conditions and also any contractual requirements as may be set forth in the other Divisions of these Specifications. No extras will be considered because of additional work necessitated by obvious job conditions that are not indicated on the drawings.

- B. The Contractor shall compare the electrical drawings and specifications with the drawings and specifications for other trades, and shall report any discrepancies between them to the Architect/Engineer and obtain written instructions for changes necessary in the electrical work. The electrical work shall be installed in cooperation with other trades installing interrelated work. Before installation, the Contractor shall make proper provisions to avoid interferences in a manner approved by the Architect/Engineer. All changes required in the work of the Contractor caused by neglect to do so shall be made at the expense of the Contractor.
- C. Location of electrical raceways, switches, panels, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The Contractor shall determine the exact route and location of each electrical raceway prior to make up and assembly.
  - 1. Right of Way: Lines which pitch shall have the right of way over those which do not pitch. For example, steam, condensate and plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
  - 2. Offsets and changes in direction of electrical raceways shall be made as required to maintain proper headroom and to clear pitched lines whether or not indicated on the drawings. The Contractor shall furnish and install elbows, pull boxes, etc., as required to affect these offsets, transitions, and changes in directions. Conflicts between electrical raceways, fixtures, etc., and ductwork or piping which cannot be resolved otherwise, will be resolved by the Architect/Engineer.
- D. Installation and Arrangements: The Contractor shall install all electrical work to permit removal (without damage to other parts) of any equipment requiring periodic replacement or maintenance. The Contractor shall arrange electrical raceways and equipment to permit ready access to valves, cocks, traps, starters, motors, control components, etc., and to clear the opening of swinging and overhead doors and of access panels.

#### 1.4 EQUIPMENT AND MATERIALS (GENERAL)

- A. In compliance with North Carolina General Statute 133.3, the Architect/Engineer has, wherever possible, specified the required performance and design characteristics of all materials utilized in this construction. In some cases it is impossible to specify the required performance and design characteristics and when this occurs the Architect/Engineer has specified three or more examples of equal design or equivalent design, establishing an acceptable range for items of equal or equivalent design. Cited examples are used only to denote the quality standard of product desired and do not restrict bidders to a specific brand, make, manufacturer or specific name and are used only to set forth and convey to bidders the general style, type, character and quality of product desired. Equivalent products will be acceptable.
- B. Substitution of materials, items, or equipment of equal or equivalent design shall be submitted to the Architect/Engineer for approval or disapproval. Equal or equivalent shall be interpreted to mean an item of material or equipment, similar to that named and which is suitable for the same use and capable of performing the same functions as that named, the Architect/Engineer being the judge of equality.

- C. The materials used in all systems shall be new, unused and as hereinafter specified and shall bear the manufacturer's name, trade name and third party testing agency label in every case where a standard has been established for the particular material. Equipment furnished under this specification shall be essentially the standard product of manufacturers regularly engaged in the production of the required type of equipment, and shall be the manufacturer's latest approved design. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or manufacturer's specifications shall be submitted for approval as required by the Architect/Engineer.
- D. Protection: Electrical equipment shall at all times during construction be adequately protected against damage. Equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury and theft. Electrical equipment shall not be stored out of doors. Electrical equipment shall be stored in dry, permanent shelters. If an apparatus has been damaged, such damage shall be repaired at no additional cost. If any apparatus has been subject to possible injury by water, it shall be replaced at no additional cost to the Owner. At the completion of the work, fixtures, equipment, and materials shall be cleaned and polished thoroughly and turned over to the Owner in a condition satisfactory to the Architect/Engineer. Damage or defects, developing before acceptance of the work shall be made good at the Contractor's expense.
- E. Any damage to factory applied paint finish shall be repaired using touch up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted per the field painting specifications in Division 9, at no additional cost to the Owner.
- F. Where materials such as wiring devices and plates, fire alarm equipment, paging system components, etc. are specified to match existing, provide materials to match existing equipment in finish, color, capacity, ratings, operating characteristics, performance, etc.
- G. Delivery and Storage: Equipment and materials shall be delivered to the site and stored in original containers, suitably sheltered from the elements, but readily accessible for inspection by the Architect/Engineer until installed.
- H. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance.
- I. Manufacturer's directions shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials. The Contractor shall promptly notify the Architect/Engineer, in writing, of any conflicts between any requirements of the Contract Documents and the manufacturer's directions and shall obtain the Architect/Engineer's written instructions before proceeding with the work. Should the Contractor perform any work that does not comply with the manufacturer's direction or such written instructions from the Architect/Engineer, the Contractor shall bear all costs arising in correcting the deficiencies.

#### 1.5 OPERATION AND MAINTENANCE MANUALS

- A. Submit under relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. The Contractor shall provide two compilations of catalog data, bound in suitable loose leaf binders, for each manufactured item of equipment used in the electrical work. These shall be



presented to the Architect/Engineer for transmittal to the Owner before the final inspection is made. Data shall include printed installation, operation and maintenance instructions for each item, indexed by product with heavy sheet dividers and tabs. All warranties shall be included with each item. Each manufacturer's name, address and telephone number shall be clearly indicated.

- C. Shop drawings with Architect/Engineer's "as noted" markings are not acceptable for the above. "Approved" shop drawings are acceptable if adequate information is contained therein. Generally, shop drawings alone are not adequate.

## 1.6 PAINTING

- A. The Electrical Contractor shall clean all exposed electrical work for painting. Should the Electrical Contractor delay in installing exposed conduit and outlets until the General Contractor has begun painting, the Electrical Contractor shall be required to paint all exposed electrical work at the Electrical Contractor's own expense. Such painting will be accomplished in accordance with the detailed specifications for the Project.
- B. Conductors exposed in boxes and cabinets shall be protected against painting. Devices, cover plates, trims, etc., for panel boards and cabinets shall not be installed until painting has been completed.
- C. The Electrical Contractor shall be responsible for touch up painting that may be required for electrical material or apparatus furnished with factory applied finish.

## 1.7 LOCATIONS AND MEASUREMENTS

- A. Outlets and appliances are shown and located on the drawings as accurately as possible. All measurements shall be verified on the project and in all cases the work shall suit the surrounding trim, finishes and/or construction. The locations of outlets for special appliances shall be installed so that when extended, they are flush with the finished wall or ceiling and permit the proper installation of fixtures and/or devices. Heights of all outlets shown on the drawings are approximate only. Slight relocations of outlets, devices and equipment shall be made by the Contractor as required or as directed by the Architect/Engineer at no additional cost to the Owner.

## 1.8 QUALITY OF WORK

- A. All work shall be executed as required by this specifications and the accompanying drawings and shall be done by skilled mechanics, and shall present a neat, trim, and mechanical appearance when completed. All work shall be performed as required by the progress of the job.

## 1.9 SUPERVISION

- A. The Contractor shall personally, or through an authorized and competent representative, constantly supervise the work from the beginning to completion and final acceptance. So far as

possible, the Contractor shall keep the same foreman and mechanics throughout the project duration.

- B. During the progress of the work it shall be subject to inspection by representatives of the Architect/Engineer, the Owner, and local inspection authorities, at which time the Contractor shall furnish such required information and data on the project as requested.
- C. The Electrical Contractor shall coordinate the electrical work with other Contractors and cooperate in the preparation and maintenance of a master schedule for the completion of the project.

#### 1.10 CLOSING IN WORK

- A. Work shall not be covered up or enclosed until it has been inspected, tested and approved by the authorities having jurisdiction over this work. Should any of the work be enclosed or covered up before such inspection and test, the Contractor shall uncover the work at the Contractor's expense; after it has been inspected, tested and approved, the Contractor shall restore the work to its original condition.

#### 1.11 REFERENCE STANDARDS

- A. All electrical equipment, materials, and installation shall be in accordance with the latest edition of the following codes and standards:
  - 1. American Association of Edison Illuminating Companies (AEIC)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Building Officials Code Administrators (BOCA)
  - 5. Institute of Electrical and Electronic Engineers (IEEE)
  - 6. Insulated Cable Engineers Association (ICEA)
  - 7. International Code Council (ICC)
  - 8. International Conference of Building Officials (ICBO)
  - 9. National Electrical Code (NEC) 2014 edition
  - 10. National Electrical Contractor's Association (NECA)
  - 11. National Electrical Installation Standards (NEIS)
  - 12. National Electrical Manufacturer's Association (NEMA)
  - 13. National Electrical Safety Code (NESC)
  - 14. National Fire Protection Association (NFPA)
  - 15. North Carolina Energy Conservation Code, 2012 (NCECC)
  - 16. North Carolina State Building Code (NCSBC)
  - 17. North Carolina Construction Manual with GS as listed (NCCM)
  - 18. Occupational Safety and Health Act (OSHA)
  - 19. Requirements of the Americans with Disabilities Act (ADA), latest edition.
  - 20. Underwriters Laboratories Inc (U.L.)
  - 21. Southern Building Code Congress International (SBCCI)
  - 22. Toxicity Characteristics Leaching Procedure (TCLP)
- B. All electrical equipment and material shall be listed by an approved third party testing agency approved by the NCBCC and shall bear the appropriate testing agency's listing mark or classification marking. Equipment, materials, etc. utilized not bearing a third party testing

agency certification shall be field or factory third party testing agency certified prior to equipment acceptance and use.

- C. Where reference is made to one of the above standards, the revision in effect at the time of the bid opening shall apply.

#### 1.12 ENCLOSURE TYPES

- A. Unless otherwise specified herein or shown on the Drawings, electrical enclosures shall have the following ratings:
  1. NEMA 1 for dry, indoor locations.
  2. NEMA 3R for outdoor locations, rooms below grade (including basements and buried vaults), "DAMP" and "WET" locations.
  3. NEMA 4X for locations subject to corrosion when specifically noted.

#### 1.13 CODES, INSPECTION AND FEES

- A. All equipment, materials and installation shall be in accordance with the requirements of the local authority having jurisdiction.
- B. The Electrical Contractor shall obtain all necessary permits and pay all fees required for permits and inspections of electrical work.
- C. The Electrical Contractor shall contact Code Officials to schedule any and all required inspections.

#### 1.14 TESTS AND SETTINGS

- A. Test all systems furnished under Division 26, 27 & 28 and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.
- B. Make the following minimum tests and checks prior to energizing electrical equipment:
  1. Mechanical inspection, testing and settings of all circuit breakers, disconnect switches, motor starters, control equipment, etc., for proper operation.
  2. Check all wire and cable terminations. Verify to the Architect/Engineer that connections meet the equipment torque requirements.
  3. Check rotation of motors, obtain permission from other contractors to start motor, and proceed to check for proper rotation. If the motor rotates in the wrong direction, correct it. Take all necessary precautions not to damage any equipment.
  4. Provide all instruments and equipment for the tests specified herein.
- C. All testing shall be scheduled and coordinated by the Contractor. Notify the Owner at least two (2) weeks in advance of conducting tests. The Contractor shall have qualified personnel present during all testing.
- D. All tests shall be completely documented with the time of day, date, temperature, and all other pertinent test information. All required documentation of readings indicated shall be submitted

to the Architect/Engineer prior to, and as one of the prerequisites for, final acceptance of the project.

- E. Electrical Distribution System Tests: All current carrying phase conductors and neutrals shall be tested as installed, and before load connections are made, for insulation resistance and accidental grounds. This shall be done with a 500 volt megger. The following procedures shall be as follows:
1. Minimum readings shall be one million (1,000,000) ohms or more for #6 AWG wire and smaller; 250,000 ohms or more for #4 AWG wire or larger. Measurement to be taken between conductors and between conductor and the grounded metal raceway.
  2. After all fixtures, devices and equipment are installed and all connections completed to each panel, the Contractor shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and grounded enclosure. If this reading is less than 250,000 ohms, the Contractor shall disconnect the branch circuit neutral wires from this neutral bar. The Contractor shall then test each one separately to the panel until the low reading ones are found. The Contractor shall correct troubles, reconnect and retest until at least 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.
- F. Electrical Grounding System Tests: Provide documentation showing values of earth ground impedance for the system ground. See Specifications Section 260526 for testing requirements.
- G. Patient Environment Electrical Grounding System Tests: Provide documentation showing values of impedance and equipotential voltage for each grounded point in a patient care area and showing the value of current leakage (with grounds in place and lifted) of each piece of fixed electrical equipment (see NFPA 99, Section 3 5.2.). Grounding systems shall be tested TO THE EXTENT REQUIRED by the NEC, the Division of Health Services Regulation, North Carolina Department of Human Resources (DHSR) and all local codes and ordinances. Provide written certification of tests and results in triplicate to the Owner, DHSR and the Architect/Engineer prior to final inspection. All testing shall be accomplished by competent personnel appropriately certified, accredited and accepted by the State of North Carolina to perform the required testing. Provide testing personnel credentials to the Architect/Engineer for approval prior to commencing tests. All tests shall be performed in the presence of the Owner and Architect/Engineer.

#### 1.15 SLEEVES AND FORMS FOR OPENINGS

- A. Anchor bolts, sleeves, inserts, supports, etc., that may be required for electrical work shall be furnished, located and installed by the Electrical Contractor. The Electrical Contractor shall give sufficient information (marked and located) to the General Contractor in time for proper placement in the construction schedule. Should the Electrical Contractor delay or fail to provide sufficient information in time, then the Electrical Contractor shall cut and patch construction as necessary and required to install electrical work. Such cutting and patching will be done by the General Contractor but paid for by the Electrical Contractor.
- B. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.
- C. Where exact locations are required by equipment for stubbing up and terminating conduit concealed in floor slabs, request shop drawings, equipment location drawings, foundation

drawings, and any other data required to locate the concealed conduit before the floor slab is poured.

- D. Where such data is not available in time to avoid delay in scheduled floor slab pours, the Architect/Engineer may elect to allow the installations of such conduits to be exposed. No additional compensation for such change will be allowed and written approval must be obtained from the Architect/Engineer.
- E. Seal all openings, sleeves, penetration, and slots as specified and as shown on the Contract Drawings.

#### 1.16 CUTTING AND PATCHING

- A. For the purposes of the Electrical Contract, “cutting and patching” shall be defined as that work required to introduce new electrical work into existing construction. Work required to install or fit electrical boxes, conduit, enclosures, equipment, etc. into new construction is not “cutting and patching”.
- B. The Electrical Contractor shall perform all cutting and patching necessary to install all equipment as required under his contract and shall re-establish all finishes to their original condition where cutting and patching occur.
- C. All cutting and patching shall be done in a thoroughly workmanlike manner.
- D. Core drill holes in existing concrete floors and walls as required.
- E. Install work at such time as to require the minimum amount of cutting and patching.
- F. Do not cut joists, beams, girders, columns or any other structural members without first obtaining written permission from the Architect/Engineer.
- G. Cut opening only large enough to allow easy installation of the conduit.
- H. Patching is to be of the same kind of material as was removed.
- I. The completed patching work shall restore the surface to its original appearance.
- J. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.
- K. Remove rubble and excess patching materials from the premises.
- L. Raceways and ducts penetrating rated floor, ceiling or wall assemblies shall be properly sealed in accordance with the corresponding Underwriters Laboratories approved method utilizing approved and listed materials.

#### 1.17 INTERPRETATION OF DRAWINGS

- A. The Electrical drawings and specifications are complementary each to the other and what may be called for by one shall be as binding as if called for by both. The drawings are diagrammatic

and indicate generally the location of outlets, devices, equipment, wiring, etc. Drawings shall be followed as closely as possible; however, all work shall suit the finished surroundings and/or trim.

- B. Do not scale electrical drawings. Refer to the architectural drawings for dimensions.
- C. Where the words “furnish and install” or “provide” are used, it is intended that this contractor shall purchase and install completely any and/or all material necessary and required for this particular item, system, equipment, etc.
- D. Where the words “the Contractor” or “this Contractor” appear in either the Electrical Drawings or Division 26 Specifications, it shall mean the Electrical Contractor.
- E. Any omission from either the drawings or these specifications are unintentional, and it shall be the responsibility of this Contractor to call to the attention of the Architect/Engineer any pertinent omissions before submitting a bid. Complete and working systems are required, whether every small item of material is shown and specified or not.
- F. Where no specific material or equipment type is mentioned, a high quality product of a reputable manufacturer may be used provided it conforms to the requirements of these specifications. These materials shall be listed or labeled by a Third Party Testing Agency accredited by the NCBC to label electrical equipment.
- G. The electrical drawings show the general arrangement of raceways, equipment, fixtures, and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. Some adjustment of routings and installation of conduit, cable tray and devices should be expected. The electrical work shall conform to the requirements shown on all of the drawings. General and Structural drawings shall take precedence over Electrical Drawings. Because of small scale of the electrical drawings, it is not possible to indicate offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings and accessories as may be required to meet such conditions, without additional cost to the Owner and as directed by the Architect/Engineer.
- H. Each 3 phase circuit shall be run in a separate conduit unless otherwise shown on the Drawings.
- I. Unless otherwise approved by the Architect/Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.
- J. Where circuits are shown as “home runs” all necessary fittings and boxes shall be provided for a complete raceway installation.
- K. Verify with the Architect/Engineer the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.
- L. Any work installed contrary to or without approval by the Architect/Engineer shall be subject to change as directed by the Architect/Engineer, and no extra compensation will be allowed for making these changes.
- M. The locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Architect/Engineer during

construction. Obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Architect/Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

- N. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.
- O. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of equipment.
- P. All connections to the equipment shall be made as required, and in accordance with the approved shop and setting drawings.
- Q. Redesign of electrical work, which is required due to the Contractor's use of an alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the Contractor at the Contractor's expense. Redesign and detailed plans shall be submitted to the Architect/Engineer for approval. No additional compensation will be provided for changes in the work, either the Electrical Contractor's or others, caused by such redesign.
- R. All floor mounted electrical equipment shall be placed on 4 inch thick concrete housekeeping pads. Edges shall be chamfered.

#### 1.18 SIZE OF EQUIPMENT

- A. Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his materials in sections sized to permit passing through such restricted areas in the structure.
- B. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer shall be required to suitably brace the equipment, to insure that the tilting does not impair the functional integrity of the equipment.

#### 1.19 EXISTING BUILDINGS AND CONSTRUCTION

- A. The Contractor is cautioned that some of the work to be performed under this contract is to be accomplished adjacent to existing occupied buildings.
- B. The Contractor shall, at all times, provide safety barriers, protective devices, screening, dust barriers, etc., as required to maintain the safety and comfort of the building's personnel and/or occupants in or near the work area.
- C. The Contractor shall do all cutting, patching, finishing, repairing, painting, etc., necessary for electrical work to be installed in existing buildings. All finishes shall be left to equal finish and condition prior to cutting. No cutting of structural members will be allowed. All cutting of walls, floors, roofs, etc., shall be repaired and/or replaced to equal finish prior to cutting. The Contractor shall route conduits and locate equipment as approved by the Owner and

Architect/Engineer. Routings and locations shall be firmly established and approved before proceeding with any phase of the work.

- D. The Contractor shall be responsible for any and all damage to the existing buildings, grounds, walkways, paving, etc., caused by the work, the Contractor and/or Contractor's personnel, and/or Contractor's equipment in the accomplishment of this work. Such damages shall be repaired and/or replaced by the Contractor at no additional cost to the Owner, to finish equal to that finish prior to damage. The Architect/Engineer shall be the judge as to equal finishes, etc.

#### 1.20 RECORD DRAWINGS

- A. As the work progresses, legibly record all field changes on one set of project contract drawings, herein after called the "record drawings".
- B. Record drawings shall accurately show the installed condition of the following items:
  1. Power distribution one line diagram(s).
  2. Panel schedule(s).
  3. Lighting fixture schedule(s).
  4. Service, feeder, branch circuit conduit and conductor sizes.
  5. Lighting fixture, receptacle, and switch outlets, interconnections and homeruns with circuit identification.
  6. Underground raceway routing.
  7. Fire alarm system.
  8. Telecommunications system.
  9. Cable tray system.

#### 1.21 CORROSION PROTECTION

- A. All equipment, raceways, hardware, etc., furnished under the electrical contract shall be protected from corrosion by factory applied coatings, paint and galvanizing, or shall be fabricated of high quality 300 series stainless steel. All exposed hardware shall be hot dip galvanized. The requirements of preceding section entitled "Delivery and Storage" shall be strictly followed. Touch up any scratched metallic surfaces immediately to prevent corrosion. Apply cold galvanizing compound to all galvanized surfaces damaged during installation, i.e., cutting, etc. Rusted or corroded materials shall be replaced before final acceptance of the work.

#### 1.22 GUARANTEE

- A. The Contractor shall guarantee the materials and workmanship covered by these drawings and specifications for a period of one year from the date of acceptance by the Owner. The Contractor shall repair and/or replace any parts of any system that may prove to be defective at no additional cost to the Owner within the guarantee period. All equipment warranties shall be as specified and included in the Contract Documents.



1.23 PHASING OF THE WORK

- A. The Electrical Contractor shall schedule his work as described in the relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

1.24 ALTERNATE BIDS

- A. Alternate bid items are described in relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

PART 2 - PRODUCTS                      Not Used

PART 3 - EXECUTION                      Not Used

END OF SECTION 260500



## SECTION 260510 – ELECTRICAL DEMOLITION

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. Selective electrical demolition shall be provided by the Electrical Contractor as described herein and as shown on the contract drawings. Gross demolition will be provided by the General Contractor. Identify active utilities, and at the appropriate time, disconnect and cap off such utilities and provide experienced personnel on site during General Contractor demolition operations to perform such operations and resolve issues. Remove materials noted for salvage and reuse.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition Drawings are based on limited field observation and existing record documents. Survey the affected areas before submitting bid proposal. Report discrepancies to the Architect/Engineer before disturbing the existing installation.
- D. Beginning of demolition means the Contractor accepts existing conditions.

#### 3.2 PREPARATION

- A. Disconnect and/or de-energize electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate power outages with the Owner and Utility Company.
- C. Provide temporary and/or permanent wiring and connections as shown and/or as required by conditions to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, and when such work is specifically approved by the Owner, use personnel experienced in such operations.

- D. Existing Electrical Service: Maintain existing systems in service. Disable systems only to make switchovers and connections. Obtain permission from the Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- E. Existing Fire Alarm System: Coordinate work with the Owner's fire alarm system vendor and maintain the existing system in service until the new system is accepted. Disable system only to make switchovers and connections. Notify the Owner and local fire service at least 24 hours before partially or completely disabling system. Limit outages to normal business hours only and minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

### 3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of relevant sections of the General and Supplemental General Conditions, Division 1 Specifications Sections, Section 260000 and this Section.
- B. Identify and mark wiring to remain for the General Contractor.
- C. Remove materials designated for salvage and reuse.
- D. Remove, relocate, and extend existing installations to accommodate new construction.
- E. Remove disconnected and abandoned wiring to source of supply.
- F. Remove electrical work associated with equipment scheduled for demolition except those portions indicated to remain or be reused. Remove unused/abandoned exposed conduit and wiring, including abandoned conduit above accessible ceiling finishes, back to point of concealment. Remove unused/abandoned wiring in concealed conduits back to source (or nearest point of usage). Cut conduit flush with walls and floors, and patch surfaces.
- G. Remove exposed wireways, outlet boxes, pull boxes, and hangers made obsolete by the alterations, unless specifically designated to remain.
- H. Where electrical systems pass through the demolition areas to serve other portions of the premises, they shall remain or be suitably relocated and the system restored to normal operation. Coordinate outages in systems with the Owner. Where duration of proposed outage cannot be allowed by the Owner, provide temporary connections as required to maintain service.
- I. Repair adjacent construction and finishes damaged during electrical demolition and extension work.
- J. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- K. Disconnect and remove electrical devices serving utilization equipment that has been removed.
- L. Disconnect and remove abandoned panelboards and distribution equipment.

- M. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- N. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- O. Continuous service is required on all circuits and outlets affected by these changes, except where the Owner will permit an outage for a specific time. Obtain Owner's consent before removing any circuit from continuous service.
- P. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

### 3.4 DISPOSAL, CLEANING AND REPAIR

- A. In general, it is intended that material and equipment indicated to be removed and disposed of by the Electrical Contractor shall, upon removal, become the Contractor's property and shall be disposed of, off the site, by the Contractor unless otherwise directed by the Owner. A receipt showing acceptable disposal of any legally regulated materials or equipment shall be given to the Owner.
- B. Clean and repair existing materials and equipment which remain or are to be reused.
- C. Panelboards: Clean exposed surfaces and check tightness. Provide new typed circuit directories showing revised circuiting arrangement.
- D. Luminaires: When specifically noted, remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.
- E. All salvageable materials shall be properly stored by the Electrical Contractor until installed in new construction.

### 3.5 INSTALLATION

- A. Install relocated materials and equipment under the provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

END OF SECTION 260510



## SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Connectors, splices, and terminations rated 600 V and less.

##### B. References:

1. ANSI/NFPA 70 National Electrical Code.
2. B. NECA Standard of Installation (National Electrical Contractors Association).

#### 1.2 ACTION SUBMITTALS

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

#### 1.3 INFORMATIONAL SUBMITTALS

- ##### A. Test and Field quality-control reports. Indicate procedures and values obtained.
- ##### B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

#### 1.4 QUALIFICATIONS

- ##### A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

#### 1.5 PROJECT CONDITIONS

- ##### A. All homeruns shall be installed in conduit.
- ##### B. Conductor sizes are based on 75° C. copper.
- ##### C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.
- ##### D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
  - 1. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
  - 2. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 3. RoHS compliant.
  - 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide.
- B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 and UL 83 for Type THHN/THWN-2/THW and THW-2.
- C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 and UL 1569 for metal-clad cable, Type MC with ground wire or Type HCF (Health Care Facilities) cables with redundant ground where indicated.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Minimum #12 AWG, maximum 500 KCMil.
- B. Insulation/Voltage Rating: 600 volts.
- C. Color Coding:

	<u>120/240 volts</u> and <u>208/120 volts</u>	<u>480/277 volts</u>
Phase A -	Black	Brown
Phase B -	Red	Orange
Phase C -	Blue	Yellow
Neutral -	White	Gray



Ground - Green Green

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

- A. Feeders: Type THHN/THWN-2, single conductors in raceway.
- B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway, Metal-clad cable, Type MC or Type MC/HCF.
- C. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Completely and thoroughly swab raceway before installing wire.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. Use solid conductor for feeders and branch circuits 10 AWG and smaller, and Class B stranded for larger conductors.
- H. Use conductor not smaller than 12 AWG for power and lighting circuits. Use conductor not smaller than 14 AWG for fire alarm and control circuits.
- I. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet (23 m) or branch circuit homeruns longer than 50 feet.
- J. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- K. Clean conductor surfaces before installing lugs and connectors.

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.
- C. Conductors shall be installed continuous from outlet to outlet with no splicing except within outlet or junction boxes, troughs and gutters. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- D. Use mechanical connectors for copper conductor splices and taps, 8 AWG and larger, except main grounding conductors, which shall be terminated with compression lugs. Tape un-insulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor or use third party testing agency-approved insulating covers.
- E. Use insulated spring wire connectors with plastic caps for copper conductors, 10 AWG and smaller, splices and taps in junction boxes, outlet boxes and lighting fixtures, "Push wire" type connectors are not acceptable.
- F. "Sta-Kon" or other permanent type crimp connectors shall not be used for branch circuit connections.
- G. Joints in stranded conductors shall be spliced by approved mechanical connectors and gum rubber tape or friction tape. Solderless mechanical connectors for splices and taps, provided with U.L approved insulating covers, may be used instead of mechanical connectors plus tape.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.7 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly

3.8 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Inspect wire for physical damage and proper connection.
- C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- D. Verify continuity of each branch circuit conductor
- E. Prior to energizing, feeders, sub-feeders and service conductor cables shall be tested for electrical continuity and short circuits.

END OF SECTION 260519



## SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

#### 1.2 REFERENCES

- A. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
- B. NFPA 70 - National Electrical Code.

#### 1.3 GROUNDING SYSTEM DESCRIPTION

- A. The neutral of each secondary electrical distribution system shall be grounded at one point only which shall be at the main disconnecting device. From the main disconnecting device, a copper grounding conductor sized in accordance with the NEC shall be extended to the earth electrode. Main grounding conductors #8 AWG through and including #4 AWG shall be insulated and identified by a green colored insulation. All grounding conductors shall be installed in conduit sized in accordance with the NEC. Conduit carrying a grounding conductor shall also be grounded at the earth electrode.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. The ground resistance of the earth electrode shall not exceed 5 ohms. The Electrical Contractor shall test the earth electrode using a standard three point ground resistance tester and shall advise the Architect/Engineer of the results of such tests in writing. Where tests show the resistance to ground exceeds 5 ohms, appropriate action shall be taken to reduce the resistance to 5 ohms, or less, by driving additional ground rods or other approved methods. Compliance shall be demonstrated by retesting.

#### 1.5 ACTION SUBMITTALS

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

#### 1.6 SUBMITTALS FOR CLOSEOUT

- A. Contract Closeout: Procedures for submittals as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Project Record Documents: Record actual locations of components and grounding electrodes.

- C. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.
- D. Test Reports: Indicates overall resistance to ground and resistance of each electrode.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Burndy; Part of Hubbell Electrical Systems.
  - 2. ERICO International Corporation.
  - 3. O-Z/Gedney; a brand of Emerson Industrial Automation.

### 2.2 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

### 2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
  - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

### 2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Ground clamps shall not be fabricated from aluminum or any aluminum alloy.

## 2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel 3/4 inch by 10 feet.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

- D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
  3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. All connections to ground conductors shall be accessible for inspection and made with approved solderless connectors, brazed or bolted to the equipment or structure to be grounded. All contact surfaces shall be thoroughly cleaned before connections are made to insure good metal to metal contact.
- C. All equipment housings and/or enclosures, and all non-current carrying metallic parts of electrical equipment, raceway systems, etc., shall be effectively and adequately bonded to ground.
- D. Grounding type insulated bonding bushings and jumpers shall be provided where concentric, eccentric or over-sized knockouts are encountered. The jumpers shall be sized per NEC Table 250-66 for services and transformers, and per Table 250-122 for branch circuits.
- E. All metallic raceways entering or leaving panelboards (branch circuits less than 30 amperes in lighting and appliance branch circuit panelboards excepted), switchboards, transfer switches, enclosed circuit breakers, safety switches, transformers, etc. shall be provided with insulated grounding and bonding bushings and each separate piece of raceway shall be individually bonded to the equipment ground bus or metallic enclosure, as applicable, by means of copper conductor sized in accordance with the National Electrical Code, Tables 250-66 for services and transformers and 250-122 for other circuits.
- F. An equipment ground bus shall be installed in each panelboard for terminating equipment grounding conductors.
- G. All wiring devices equipped with grounding connections shall be permanently and securely connected to the enclosure in which they are mounted with a copper grounding jumper.
- H. The frame of all lighting fixtures shall be securely grounded to the equipment ground system with grounding conductors.
- I. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond reinforcing steel together.



- J. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- K. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- L. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- M. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install jumper to bond across flexible duct connections to achieve continuity.

### 3.4 EXISTING WORK

- A. If the work includes renovation and/or addition to existing conditions:
  - 1. Modify existing grounding system to maintain continuity and to accommodate renovations.
  - 2. Extend existing grounding system using materials and methods specified.

### 3.5 LABELING

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

### 3.6 FIELD QUALITY CONTROL

#### A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Make tests at ground rods before any conductors are connected.

#### B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

#### C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

## SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

#### 1.2 ACTION SUBMITTALS

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

##### B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

##### A. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

#### 2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

##### A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.

1. Manufacturers:
  - a. Unistrut.
  - b. B-line.
  - c. Erico.
  - d. Substitutions: As permitted in relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.
2. Material: Provide material and finishes with adequate corrosion resistance.
3. Channel Width: 1-5/8 inches, or as required to carry load.
4. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
5. Channel Dimensions: Selected for applicable load criteria.

##### B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Steel Structural Elements: Use beam clamps.
  - 2. Concrete Surfaces: Use self drilling anchors and expansion anchors.
  - 3. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
  - 4. Solid Masonry Walls: Use expansion anchors.
  - 5. Sheet Metal: Use sheet metal screws or bolts
  - 6. Wood Elements: Use wood screws..

### 2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- D. Do not use powder actuated anchors.
- E. Obtain permission from Architect/Engineer before drilling or cutting structural members.
- F. Install surface mounted cabinets and panelboards with minimum of four anchors. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch (25 mm) off wall.
- G. Conduits installed on the interior of exterior building walls shall be spaced away from the wall surface a minimum of 1/4 inch (65mm) using "clamp-backs" or struts.

- H. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- I. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 PAINTING

- A. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529



## SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

#### 1.3 SUBMITTALS FOR CLOSEOUT

- A. Contract Closeout: Submittals for Project closeout. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Accurately record actual routing of conduits larger than 2 inches.

#### 1.4 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- D. ANSI/NFPA 70 - National Electrical Code.
- E. NECA "Standard of Installation".
- F. NEMA TC2 - Schedule 40 PVC.
- G. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Provide Products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle Products to site under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Accept conduit and boxes on site. Inspect for damage.
- C. Protect conduit and boxes from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

1.7 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. EMT: Comply with ANSI C80.3 and UL 797.
- D. FMC: Comply with UL 1; zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
  - 2. Fittings for EMT:



- a. Material: Steel.
  - b. Type: compression.
- G. Joint Compound for IMC, or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. RNC: Type EPC-40-PVC or RNC, Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- C. LFNC: Comply with UL 1660.
- D. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- E. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- F. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- G. Fittings for LFNC: Comply with UL 514B.

## 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, NEMA rating in accordance with environment, 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.
- B. 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.

## 2.4 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.

- C. The raceway shall be a one-piece design with a base and cover factory assembled. Total width shall be approximately 0.75" by 0.66" deep with a cross sectional area of approximately 0.25 square inches. The raceway base and cover shall have an approximate thickness of .040".
- D. A hand operated cutting tool shall be available for the base and cover to ensure clean, square cuts.
- E. A full complement of fittings shall be available including but not limited to mounting clips and straps, couplings, flat, internal and external elbows, cover clips, tees, entrance fittings, conduit connectors and bushings. The covers shall be painted with an enamel finish, in to match the raceway. They shall overlap the raceway to hide uneven cuts. All fittings shall be supplied with a base where applicable.
- F. Raceway shall be white.

## 2.5 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Galvanized steel. Comply with NEMA OS 1 and UL 514A.
  - 1. Junction, switch, receptacle and outlet boxes for interior use in dry locations shall be zinc coated or cadmium plated sheet steel, 4" square and 2 1/8" deep, unless otherwise indicated on the contract drawings. Smaller and shallower outlet boxes will be permitted only by special permission of the Architect/Engineer where such boxes are necessary due to structural conditions encountered. Where larger junction boxes are required, they shall be fabricated from No. 10, 12, 14 or 16 gauge sheet steel as required by the Underwriters Laboratories, Inc., and galvanized after fabrication.
  - 2. All junction boxes shall have screw fastened covers.
  - 3. Outlet boxes shall be provided with extension plaster rings where required by structural and finish conditions. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover and threaded hubs.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- G. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, NEMA Rating appropriate for environment with continuous-hinge cover with flush latch unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

H. Cabinets:

1. NEMA 250, NEMA Rating appropriate for environment, 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 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC, IMC, EMT, RNC, Type EPC-40-PVC.
3. Underground Conduit: RNC, Type EPC-40-PVC or Type EPC-80-PVC.
  - a. More than Five Feet from Foundation Wall: Use nonmetallic conduit.
  - b. Within Five Feet from Foundation Wall: Use rigid steel conduit.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or Type 4.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: EMT or RNC.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include, but are not limited to, the following:
  - a. Loading dock.
  - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
  - c. Mechanical rooms.
  - d. Gymnasiums.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT (MC Cable with insulated Ground is allowed in concealed locations).
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC or IMC.
7. 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 Raceway Size: 1/2-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. 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 fittings. Comply with NEMA FB 2.10.
  - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### 3.2 INSTALLATION

- A. Size: Conduit shall be sized in accordance with the latest edition of the NEC unless shown otherwise, with minimum conduit size of ½ inch, except homeruns minimum size shall be 3/4". Flexible metal and watertight ("sealtite") conduit in size ½ inch and larger are acceptable for motor, appliance and fixture connections provided green ground wire is installed (see Section 260526) and NEC is followed.
- B. Verify locations of floor boxes and outlets prior to rough in.
- C. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- D. Set wall mounted boxes at elevations to accommodate mounting heights indicated and specified in section for outlet device. Boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet (3 m) if required to accommodate intended purpose.
- E. Outlets, junction, taps, etc., on exposed rigid metal conduit shall be cast metal conduit fittings or cast metal boxes of the type and size appropriate for the location. Sheet steel outlet boxes shall not be permitted on exposed raceway runs except at or near a ceiling for interior construction.
- F. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- G. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes. Use flush mounting outlet box in finished areas. Use stamped steel bridges to fasten flush mounting outlet box between studs.

- H. Circuiting is shown schematically. Exact routing of branch circuits may be varied to suit building construction; however, the combination of circuits within raceways and panelboard connections shall not be changed from those shown on the drawings.
- I. Raceways shall be installed concealed in finished areas. Where construction does not permit concealed raceways and where indicated on the drawings, raceways shall be run exposed. All raceways shall be run parallel to, or at a right angle with the building walls.
- J. Where any run of rigid conduit may change to a run of EMT or vice-versa, each change shall be made in a junction or outlet box with each conduit terminated separately therein. Rigid conduit to EMT (or vice-versa) adapters shall not be permitted.
- K. Arrange conduit to maintain headroom and present neat appearance.
- L. Cut conduit square using saw or pipecutter and de-burr cut ends.
- M. Bring conduit to shoulder of fittings; fasten securely.
- N. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows, or hydraulic one-shot bender, to fabricate bends in metal conduit larger than 2 inch size.
- O. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- P. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Q. The use of "LB's" shall be limited where possible. Where necessary to use "LB's" sized above 2 inch, mogul units shall be installed.
- R. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- S. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- T. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- U. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- V. All metallic raceways entering or leaving panelboards (branch circuits less than 30 amperes in lighting and appliance branch circuit panelboards excepted), switchboards, transfer switches, enclosed circuit breakers, safety switches, transformers, etc. shall be provided with insulated grounding and bonding bushings and each separate piece of raceway shall be individually bonded to the equipment ground bus or metallic enclosure, as applicable, by means of copper conductor sized in accordance with the National Electrical Code.
- W. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

- X. Support conduit within 12 inches (300 mm) of enclosures to which attached. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports. Do not attach conduit to ceiling support wires.
- Y. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified under Division 7
- Z. Stub-ups to Above Recessed Ceilings:
1. Use EMT for raceways.
  2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- AA. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- BB. PVC schedule 40 shall not be used exposed or concealed in gypsum walls, but may be used in CMU walls.
- CC. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- DD. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- EE. Install pull wires in empty raceways. 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 raceways designated as spare above grade alongside raceways in use.
- FF. Surface Raceways:
1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
  2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- GG. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- HH. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where an underground service raceway enters a building or structure.
  3. Where otherwise required by NFPA 70.
- II. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
  2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- JJ. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.
- KK. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.
- LL. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- MM. Locate boxes so that cover or plate will not span different building finishes.
- NN. 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.
- OO. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS
- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- 3.4 PROTECTION
- A. Protect coatings, finishes, and cabinets from damage and deterioration.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.
- 3.5 ADJUSTING
- A. Contract Closeout: Adjust installed work under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Adjust floor box flush with finish flooring material.

- C. Adjust flush mounting outlets to make front flush with finished wall material.
- D. Install knockout closures in unused box openings

3.6 CLEANING

- A. Contract Closeout: Clean installed work under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

END OF SECTION 260533



## SECTION 260553 - ELECTRICAL IDENTIFICATION

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Nameplates and labels.
- B. Wire and cable markers.
- C. Conduit markers.
- D. Wiring device plates marking.

#### 1.2 REFERENCES

ANSI/NFPA 70 - National Electrical Code.

#### 1.3 SUBMITTALS

- A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Product Data: Provide catalog data for nameplates, labels, and markers.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

#### 1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

### PART 2 PRODUCTS

#### 2.1 NAMEPLATES AND LABELS

- A. Nameplates: Engraved three-layer laminated plastic as follows:

Furnish and install engraved laminated phenolic nameplates for all electrical equipment supplied under this contract for identification of system, equipment controlled or served, phase, voltage, ampacity, etc. Nameplates shall be securely attached to equipment with stainless steel screws, and shall identify by name the equipment controlled, attached, etc. Embossed, self adhesive plastic tape is not acceptable for marking equipment. Nameplate material colors shall be, unless otherwise directed at submittal stage:

1. Black surface with white core for all 120/208 volt equipment.

2. Yellow surface with black core for 277/480 volt equipment.
3. Bright red surface with white core for all equipment related to fire alarm system.
4. Dark red (burgundy) surface with white core for all equipment related to Security.
5. Green surface with white core for all equipment related to “emergency” systems.
6. Orange surface with white core for all equipment related to telephone systems.
7. Brown surface with white core for all equipment related to data systems.
8. White surface with black core for all equipment related to paging systems.
9. Purple surface with white core for all equipment related to TV systems.

B. Locations:

1. Each electrical distribution and control equipment enclosure (safety switches, panelboards, transformers, etc.)
2. Communication cabinets.
3. Pull and splice boxes.

C. Letter Size: Letters shall be a minimum of 1/2 inch (13 mm) high.

D. See details on the Drawings for additional requirements.

## 2.2 WIRE MARKERS

A. Description: Split sleeve type wire markers or approved equivalent.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.

C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on drawings.
2. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams on drawings.

D. Multiwire branch circuit phase conductors shall be clearly identified in each branch circuit panelboard. Attach a yellow flag type plastic cable tie to each phase conductor of a multiwire branch circuit at approximately 2” from the circuit breaker terminal. Install a yellow with black letter identification label in the panelboard door stating “Yellow cable tie flags on conductors indicate the conductor is part of a common neutral multiwire branch circuit. DO NOT MOVE CONDUCTOR TO ANOTHER BREAKER”.

## 2.3 CONDUIT, RACEWAY AND BOX MARKING

Paint visible surfaces of exposed junction and outlet boxes and covers of raceway systems above lay-in and other accessible ceilings. Paint all boxes and covers before installation. Paint exposed conduit and raceways at ten foot minimum intervals with a 6 inch wide band in accordance with the color scheme outlined above. Mark conduits at junction boxes above accessible ceilings with the panelboard and circuit numbers of the circuits contained in the raceway using a permanent black marking pen.

## 2.4 WIRING DEVICE PLATES MARKING

A. Description:

1. Adhesive backed, laminated plastic receptacle device plate labels identifying the circuit feeding the device. Labels shall be label machine printed, black lettering on a clear background, to indicate panel and circuit number and shall be Casio, Brother, T&B or approved equal.
  2. Print circuit number on flag type plastic cable tie with a permanent marker (Sharpie, etc.) and attach to conductors in outlet box. Flag shall be readily visible upon removal of device plate.
- B. Locations: Each receptacle device plate. Apply centered on the upper portion below the receptacle, parallel to the upper surface.
- C. Legend: Typed labels to indicate panel and circuit number feeding the device (i.e., RPA-24).

### PART 3 EXECUTION

#### 3.1 PREPARATION

Degrease and clean surfaces to receive nameplates and labels.

#### 3.2 APPLICATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using stainless steel machine screws, lockwashers and acorn nuts as shown on the Drawings. Stainless steel screws and nylon locknuts may be used in lieu of lockwashers and acorn nuts if the screw threads are not exposed.
- C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- D. Install receptacle identification labels at top of each device plate, parallel to upper surface.
- E. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by tags with string or wire attached to conduit or outlet.
- F. Update all existing panelboard directories where changes are made. Provide new panel schedule cards as required to maintain legibility.
- G. Identify underground conduits using one underground warning tape per trench at 6 - 8 inches below finished grade.
- H. Install adhesive backed labels only when ambient temperature and humidity conditions for adhesive use are within range recommended by manufacturer.

END OF SECTION



## SECTION 262726 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Wall switches.
- B. Wall box dimmers.
- C. Receptacles.
- D. Wall plates.

#### 1.2 DESCRIPTION

Provide wiring devices in types, characteristics, grades, colors and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL, NEMA and DSCC (Fed Spec) standards.

#### 1.3 REFERENCES

- A. NECA - Standard of Installation.
- B. NEMA WD 1 - General Requirements for Wiring Devices.
- C. NEMA WD 6 - Wiring Device - Dimensional Requirements.
- D. NFPA 70 - National Electrical Code.
- E. Underwriters Laboratories (UL 20, 244A, 498, 514C, 1472).
- F. DSCC (Fed Spec) W-C-596G

#### 1.4 SUBMITTALS FOR REVIEW

- A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

#### 1.5 SUBMITTALS FOR INFORMATION

- A. Submittals: Submittals for information. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Submit manufacturer's wiring and installation instructions.

- C. Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

#### 1.6 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.

#### 1.7 WARRANTY

Provide manufacturer's full 1 year warranty minimum, unless specified otherwise.

#### 1.8 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Provide Products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

### PART 2 - PRODUCTS

#### 2.1 WALL SWITCHES

- A. Manufacturers:
  - 1. Hubbell Model HBL1221 Series.
  - 2. Leviton 1221.
  - 3. Pass and Seymour PS20AC1.
  - 4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Description: NEMA WD 1, UL, DSCC, heavy-duty, AC only, general-use, grounding type, back and side wired, single pole, three-way and four-way as indicated, snap switch with hex-head equipment grounding screw. Switches shall have a steel, nickel plated bridge with integral ground, one piece rivetless copper alloy spring contact arm and terminal plate and large silver cadmium oxide contacts. All switches shall have quiet operating mechanisms without the use of mercury switches. All switches shall be approved by a third party agency, approved for the voltage and current indicated.
- C. Body and Handle: White plastic with toggle handle.
- D. Indicator Light: Neon lighted handle type switch; red color handle. Voltage per system rating.
- E. Locator Light: Neon lighted handle type switch; green color handle. Voltage per system rating.
- F. Ratings:
  - 1. Voltage: 120-277 volts AC.

2. Current: 20 amperes.

## 2.2 WALL BOX LED DIMMERS

### A. Manufacturers:

1. Lutron Nova T dimmer and switch.
2. Leviton.
3. Arrow Hart.
4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

- ### B. Description: Solid-state electronic (0-10V) dimmers; high end minimum of 92% of line voltage; provide voltage compensation to assure flicker free dimming through common voltage variations.

- ### C. Body and Handle: White plastic with preset slider.

- ### D. Voltage: 120/277 volts.

- ### E. Rating: Match load shown on drawings.

## 2.3 RECEPTACLES

### A. Manufacturers:

1. Hubbell Model HBL 5362.
2. Leviton 5362.
3. Pass and Seymour 5362A.
4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

- ### B. Description: NEMA WD 1, UL, DSCC, heavy-duty, 20 ampere, 120 volt, general use, duplex, straight blade, grounding type receptacle arranged for back and side wiring, with separate single or double grounding terminals. Receptacles shall have a full wrap around brass bridge with integral ground and standup double wipe contacts. Self grounding or automatic type grounding receptacles are not acceptable in lieu of receptacles with separate grounding screw lugs and a direct, green insulated conductor connection to the equipment grounding system.

- ### C. Device Face and Body: White nylon or reinforced thermoplastic.

- ### D. Configuration: NEMA WD 6, type as specified and indicated.

- ### E. Convenience Receptacle: Type 5-20R.

## 2.4 HOSPITAL-GRADE RECEPTACLES, 125 V, 20 A (PROVIDE IN ALL EXAM ROOMS, ULTRASOUND, X-RAY, P.O.C., MEDS, AND BLOOD DRAW)

### A. Hospital-Grade, Single Receptacles, 125 V, 20 A:

1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Two pole, three wire, and self-grounding.

2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 Supplement sd and FS W-C-596.
4. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- B. Hospital-Grade, Duplex Receptacles, 125 V, 20 A:
  1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Two pole, three wire, and self-grounding.
  2. Configuration: NEMA WD 6, Configuration 5-20R.
  3. Standards: Comply with UL 498 Supplement sd and FS W-C-596.
  4. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- C. Hospital-Grade, Duplex GFCI Receptacles, 125 V, 20 A <Insert drawing designation>:
  1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Single-piece, rivetless, nickel-plated, all-brass grounding system.
  2. Configuration: NEMA WD 6, Configuration 5-20R.
  3. Type: Feed through.
  4. Standards: Comply with UL 498 supplement sd, UL 943 Class A, and FS W-C-596.
  5. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.

## 2.5 GROUND FAULT CIRCUIT INTERRUPTERS (GFI)

- A. Manufacturers:
  1. Hubbell Model GFR8300.
  2. Leviton.
  3. Pass and Seymour.
  4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Description: NEMA WD 1, UL, DSCC, heavy-duty, 20 ampere, 120 volt, general use, duplex, straight blade, grounding type receptacle arranged for back and side wiring, with separate single or double grounding terminals. Receptacles shall have a full wrap around brass bridge with integral ground and standup double wipe contacts. The electronic component's circuit board shall be all glass with a conformal coating. Self grounding or automatic type grounding receptacles are not acceptable in lieu of receptacles with separate grounding screw lugs and a direct, green insulated conductor connection to the equipment grounding system.
- C. Device Face and Body: White nylon or reinforced thermoplastic.
- D. Configuration: NEMA WD 6, type as specified and indicated.
- E. Convenience Receptacle: Type 5-20R.

## 2.6 WALL PLATES

- A. Manufacturers:
  1. Hubbell.
  2. Leviton.
  3. Pass and Seymour.



4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Cover Plate: Single and combination, of types, sizes and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Material shall be plastic in same color as devices.
- C. Weatherproof Cover Plate: Exterior mounted receptacles, and those noted to be weatherproof, shall be provided with weatherproof PVC transparent cover plates, standard size, and shall be single or ganged as indicated on the contract drawings. Weatherproof plates shall be "approved" third party listed as "raintight while in use".

### PART 3 - EXECUTION

#### 1. INSTALLATION

- a) Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- b) Coordination with Other Trades:
  1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
- c) Conductors:
  1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
  4. Existing Conductors:
    - 1 Cut back and pigtail, or replace all damaged conductors.
    - 2 Straighten conductors that remain and remove corrosion and foreign matter.
    - 3 Pigtailling existing conductors is permitted, provided the outlet box is large enough.
- d) Device Installation:
  1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
  5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- e) Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
  2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- f) Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- g) Dimmers:
1. Install dimmers within terms of their listing.
  2. Verify that dimmers used for fan-speed control are listed for that application.
  3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.
- h) Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- i) Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.
2. GFCI RECEPTACLES
- a) Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.
3. IDENTIFICATION
- a) Comply with Section 260553 "Identification for Electrical Systems."
  - b) Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

- c) Essential Electrical System: Mark receptacles supplied from the essential electrical system to allow easy identification using a self-adhesive label.

4. FIELD QUALITY CONTROL

- a) Test Instruments: Use instruments that comply with UL 1436.
- b) Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- c) Perform the following tests and inspections:
  - 1. In healthcare facilities, prepare reports that comply with NFPA 99.
  - 2. Test Instruments: Use instruments that comply with UL 1436.
  - 3. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- d) Tests for Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- e) Test straight-blade convenience outlets in patient-care areas and hospital-grade outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).
- f) Wiring device will be considered defective if it does not pass tests and inspections.
- g) Prepare test and inspection reports.

END OF SECTION 262726



## SECTION 262727 - OCCUPANCY SENSORS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

Wall box and remote sensor type occupancy sensors and accessories.

#### 1.2 REFERENCES

- A. NECA - Standard of Installation.
- B. NEMA WD 1 - General Requirements for Wiring Devices.
- C. NEMA WD 6 - Wiring Device -- Dimensional Requirements.
- D. NFPA 70 - National Electrical Code.

#### 1.4 SUBMITTALS FOR REVIEW

- A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, ratings and configurations.

#### 1.5 SUBMITTALS FOR INFORMATION

- A. Submittals: Submittals for information. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Submit manufacturer's installation instructions.

#### 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

#### 1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Provide Products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

### PART 2 - PRODUCTS

2.1 GENERAL

- A. The Occupancy Sensor system shall sense the presence of human activity within the spaces indicated and fully control the “On” / “Off” function of the lighting loads automatically. Sensors shall turn “On” the load upon entrance into the room and shall not initiate “On” outside of entrance.
- B. Acceptable technology is Passive Infrared (PIR), Ultrasonic and Microphonic. Dual Technology is required utilizing PIR and one of the other technologies.
- C. Occupancy sensors shall have a minimum of 2 contacts (1 will be utilized for HVAC control).
- D. Occupancy sensors shall be field convertible to operate in either the occupancy or vacancy mode.
- E. Sensors shall automatically adjust time delays and sensitivity based on the activity level in the space.
- F. All line voltage devices shall be UL Listed under Energy Management Equipment, or Industrial Control Equipment. UL Listing under Appliance Control shall not be accepted.
- G. Product shall be manufactured in the USA and be warranted for 5 years.

2.2 WALL SWITCH LINE & LOW VOLTAGE SENSORS FOR SMALL AREAS

- A. Description: Line and Low voltage, single gang, wall mounted occupancy sensor switch with one override or two (as shown) switch(es). Switch shall recess into single gang switch box and fit a standard GFI receptacle plate opening. Switches shall be compatible with standard three and four-way toggle switches. The low voltage device shall operate in conjunction with a line voltage power pack to control the connected lighting loads. All switches shall be approved by a third party agency, approved for the voltage and current indicated. Provide hard lens switches in storage rooms and other location subject to abuse.
- B. Manufacturers
  - 1. Hubbell.
  - 2. Sensor Switch.
  - 3. Wattstopper.
  - 4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- C. Body and Handle: White or gray plastic.
- D. Ratings:  
Voltage: 120-277 volts AC.  
Minimum Load Rating: 800 watts at 120 VAC, 1200 watts at 277 VAC. Sensors shall be compatible with LED lighting load types and require no minimum load

2.3 CEILING MOUNTED LOW VOLTAGE SENSORS FOR LARGE AREAS

- A. Sensor Switches: Low voltage, recess ceiling mounted occupancy sensor switch. The device shall operate in conjunction with a line voltage power pack to control the connected lighting loads. Sensors shall operate on a class 2, three-conductor system. Multiple sensors shall be connectable to a single power pack. Sensor shall recess into a two gang outlet box. All devices shall be approved by a third party agency, approved for the voltage and current indicated.  
Manufacturers:
1. Hubbell.
  2. Sensor Switch.
  3. Wattstopper.
  4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Control units/Power packs: Devices shall be rated 20A at 120-277 volts and shall be compatible with LED lighting. They shall have the capacity to power additional remote heads or additional relays. Control relays may be paralleled to accommodate extra load or more than three heads or additional relays. Additional relay shall be used where there is more than one circuit being controlled or where there is a need to control multiple voltages.  
Manufacturers:
1. Hubbell.
  2. Sensor Switch.
  3. Wattstopper.
  4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- C. Sensor Body: White plastic.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Ensure that outlet boxes are installed at proper height.
- B. Ensure that wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

#### 3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

#### 3.3 INSTALLATION

- A. Install in accordance with NECA "Standard of Installation."
- B. Install in locations in accordance with manufacturers recommendation.

- C. Install devices vertically, plumb and level.
- D. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

#### 3.4 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 260534 to obtain mounting heights specified and indicated on drawings.
- B. All wiring devices shall be installed at heights as required by the A.D.A.
- C. Install wall switch 48 inches (1.2 m) above finished floor, measured to bottom of outlet box.

#### 3.5 FIELD QUALITY CONTROL

- A. Quality Control. As required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Inspect each wiring device for defects.
- C. Operate each system with circuit energized and verify proper operation.

#### 3.6 ADJUSTING

- A. Contract Closeout: Adjust installed work under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Adjust devices and wall plates to be flush and level.

#### 3.7 CLEANING

- A. Contract Closeout: Clean installed work under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 262727



## SECTION 262813 - FUSES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Fuses.

#### 1.2 REFERENCES

- A. NFPA 70 - National Electric Code.
- B. NEMA FU 1 - Low Voltage Cartridge Fuses.

#### 1.3 SUBMITTALS

- A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Product Data: Provide data sheets showing electrical characteristics including time-current curves.

#### 1.4 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Record actual fuse sizes.

#### 1.5 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

#### 1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

#### 1.7 EXTRA MATERIALS

- A. Provide no less than 10% of each fuse size and type installed, with a minimum of at least one set of three of each.

### PART 2 - PRODUCTS

#### 2.1 FUSE REQUIREMENTS

- A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.
- B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.
- C. UL Listed.


<u>Circuit Type</u>	<u>Fuse type</u>
1. Service Entrance and Feeder Circuits over 600Amp 200K Amp interrupting rating.	Class L
2. Service Entrance and Feeder Circuits 600Amp or less 200K Amp interrupting rating.	Class RK1 or J
3. Motor, Motor Controller and Transformer Circuits 200K Amp interrupting rating.	RK5
- D. For individual equipment where fault current does not exceed 50KA use Class K5 fuses with 50KA interrupting rating.
- E. Fusible safety switches with short-circuit withstand ratings of 100KA or 200KA require Class R or Class J rejection fuse block feature.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fuses in accordance with manufacturer's instructions.
- B. Install fuse with label oriented such that manufacturer, type, and size are easily read.
- C. Install spare fuse cabinet in main electrical equipment room or adjacent to the main service equipment.

END OF SECTION 262813

## SECTION 262816 - ENCLOSED SWITCHES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Fusible switches.
- B. Nonfusible switches.

#### 1.2 RELATED SECTIONS

- A. Section 260529 – Supporting Devices.
- B. Section 260553 – Electrical Identification.
- C. Section 262813 – Fuses.

#### 1.3 REFERENCES

- A. NECA - Standard of Installation (published by the National Electrical Contractors Association).
- B. NEMA FU1 - Low Voltage Cartridge Fuses.
- C. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (published by the International Electrical Testing Association).
- E. NFPA 70 - National Electrical Code.

#### 1.4 SUBMITTALS FOR REVIEW

- A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Product Data: Provide switch ratings and enclosure dimensions.

#### 1.5 SUBMITTALS FOR CLOSEOUT

- A. Contract Closeout: Submittals for project closeout. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Record actual locations of enclosed switches in project record documents.

1.6 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Cutler Hammer.
- B. General Electric.
- C. Siemens.
- D. Square D.
- E. Substitutions: As permitted in relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

2.2 RATINGS

- A. Service Conditions:
  - 1. Temperature: 104°F. (40°C.).
  - 2. Altitude: N/A.
  - 3. Terminal Rating: 75°C. minimum.
- B. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical, or as indicated.

2.3 FUSIBLE SWITCH ASSEMBLIES

- A. Description: NEMA KS 1, Type HD with externally operable handle interlocked (defeatable) to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Mechanisms shall be non-teasible, positive, quick make-quick break type. Handle lockable in ON or OFF position. Switches shall have handles whose positions are easily recognizable in the ON or OFF position.
- B. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.

## 2.4 NONFUSIBLE SWITCH ASSEMBLIES

Description: NEMA KS 1, Type HD with externally operable handle interlocked (defeatable) to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Mechanisms shall be non-teasible, positive, quick make-quick break type. Handle lockable in ON or OFF position. Switches shall have handles whose positions are easily recognizable in the ON or OFF position.

## 2.5 ENCLOSURES

- A. Fabrication: NEMA KS 1.
  - 1. Interior Dry Locations: Type 1.
  - 2. Exterior Locations: Type 3R.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with NECA “Standard of Installation”.
- B. Switches shall be installed in a manner to be fully compliant with the seismic restraint requirements of the North Carolina State Building Code. Provide mounting devices and hardware, bracing, fittings, etc. as required for seismic restraint. See Section 260500, Paragraph 1.22 for additional requirements.
- C. Install fuses in fusible disconnect switches serving Division 26 equipment.
- D. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

### 3.2 FIELD QUALITY CONTROL

- A. Quality Control: Field inspection, testing and adjusting as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Inspect and test in accordance with NETA ATS, except Section 4, or provide for qualified technicians to perform testing according to the manufacturer’s recommendations.

END OF SECTION 262816



## SECTION 265100 - INTERIOR LUMINAIRES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Interior solid-state luminaires that use LED technology.
- B. Building mounted exterior luminaires.
- C. Luminaire accessories.

#### 1.2 DEFINITIONS

- A. Retain terms that remain after this Section has been edited for a project.
- B. CCT: Correlated color temperature.
- C. CRI: Color Rendering Index.
- D. Fixture: See "Luminaire."
- E. IP: International Protection or Ingress Protection Rating.
- F. LED: Light-emitting diode.
- G. Lumen: Measured output of lamp and luminaire, or both.
- H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.3 SUBMITTALS FOR REVIEW

- A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.
- D. Submittal information will include IES and Photometric files with the fixture specifications. IES Photometric and LM79 data for the submitted LED fixtures, IES file must be from an NVLAP (National Voluntary Laboratory Accreditation Program) accredited laboratory. Submittal information will also include a referenced location for a current installation of the proposed products where the operational performance of these proposed products can be observed and evaluated by the Owner. Provide photometric calculation for the following:
  - 1. Waiting room.
  - 2. Typical exam room.
  - 3. Each interior floor plan with emergency lighting fixtures only.

4. Corridors.

1.4 SUBMITTALS FOR INFORMATION

- A. Submittals: Submittals for information. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.5 SUBMITTALS FOR CLOSEOUT

- A. Contract Closeout: Submittals for project closeout. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Submit manufacturer's operation and maintenance instructions for each product.

1.6 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 101.
- C. Lighting systems shall comply with the North Carolina State Energy Code.
- D. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 EXTRA PRODUCTS

- A. Furnish one replacement LED lighting module for each type. Furnish one replacement LED lighting module for each 24 of each module type, but no less than one.
- B. Furnish one replacement LED driver type for each 24 of each type, but no less than one.
- C. Furnish one replacement exit lighting fixture for each 24 of each type, but no less than one.

PART 2 - PRODUCTS

2.1 LUMINAIRES

- A. Furnish Products as scheduled. Refer to relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections for substitutions and product options.



- B. All lighting fixtures shall be approved by third party testing agencies and NFPA and shall bear their label.
- C. All fixtures shall have a stock, or standard finish unless otherwise specified. Fixtures subject to corrosive or damp environments shall have corrosion resistant hardware and finishes.
- D. All fixtures shall be installed complete and operational.
- E. Lighting fixture types shall be furnished as required by the Lighting Fixture Schedule as indicated on the drawings. Catalog numbers are provided as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers listed will be acceptable upon approval of the Architect/Engineer. The Contractor shall verify from the contract drawings the type ceilings or walls the fixture is to be used with and shall provide compatible mounting attachments and trim. Provide all accessories or additional materials required to maintain the ceiling fire rating as required by regulatory authorities.
- F. Interior Area LED Fixtures/Lamps:
1. Kelvin temperature of in the range of 3500k to 4000k unless otherwise indicated in schedule.
  2. 75 plus lumens per watt minimum.
  3. CRI 80 or greater.
  4. 5-year warranty minimum with L70 of 50,000 hours or greater.
  5. Modular design for field replacement of parts.
  6. Series parallel matrix for prevention of LED string outages (not applicable to exit lights and recessed can fixtures).
  7. Tool less access to driver and LED modules.
  8. UL certified up to 90F degrees operating temperature.
- G. LED Drivers: Suitable for environment in which they are to be installed.
1. Power Factor: 90 percent, minimum.
  2. Load regulation shall be +/-1% from no load to full load.
  3. Total Harmonic Distortion Rating: Less than 20 percent.
  4. Case temperature shall be rated for -40 deg C through +80 deg C and provided with thermal protection and self-limited short circuit and overload protection.
  5. Output shall be isolated.
  6. Driver Life Rating shall have less than 0.5% failure rate at the LED module's maximum L70 rated life.
  7. Driver manufacturer to be an industry leader, such as Advance or approved equal

## 2.2 LENSES

Lenses shall be clear virgin acrylic material with uniform 3/16" square based female cone prisms aligned 45° to the length and width of the lens panel. Minimum prism depth shall be 0.080" with a nominal panel thickness of 0.156" and a minimum overall panel thickness of 0.150" to 0.160" inches.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
  - B. Where a recessed fixture replaces a section or part of an acoustical ceiling tile, or a section or part of a suspended gypsum board ceiling, the fixture shall be supported at two (2) diagonal corners to the steel frame of the building. Supports shall be provided with the same type of wire as used to support the lay-in ceiling track or GWB ceiling system and shall be distinguished by color and tag. Attach one end of the wire to one corner of the fixture and the other end to the building's structural system. The lay-in or flange fixture shall then be screwed to the main runners of the lay-in ceiling track or GWB ceiling system at all four (4) corners using sheet metal screws. For fire rated suspended ceiling, luminaire shall be supported to the Building Structure as per the Ceiling Design Criteria, luminaire shall then be screwed to the main runners of the suspended ceiling track at all four (4) corners using sheet metal screws. The Electrical Contractor shall be responsible for coordination work with the ceiling contractor; however, the ceiling contractor will provide framed openings for reception of lighting fixtures. All recessed fixtures shall be furnished with all necessary mounting accessories. Also, see the ASTM Section "E-580-02" items 3.3, 4.3, 5.5 & 5.6 and the NEC 300.11 & 410-36(B)
  - C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
  - D. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
  - E. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling grid members using bolts or screws.
  - F. Install recessed luminaires to permit removal from below.
  - G. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
  - H. Install wall mounted luminaires, emergency lighting units and exit signs at height as indicated on Drawings.
  - I. Install accessories furnished with each luminaire.
  - J. Connect luminaires, emergency lighting units and exit signs to branch circuit outlets provided under Section 260533 using flexible conduit.
  - K. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
  - L. Bond products and metal accessories to branch circuit equipment grounding conductor.
  - M. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.
- 3.2 FIELD QUALITY CONTROL
- A. Quality Assurance: Field inspection, testing and adjusting shall be as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

- B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

### 3.3 ADJUSTING

- A. Contract Closeout: Adjust installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Aim and adjust luminaires as directed.

### 3.4 CLEANING

- A. Contract Closeout: Clean installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.

### 3.5 DEMONSTRATION AND INSTRUCTIONS

- A. Contract Closeout: Demonstrate installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Demonstrate luminaire operation for minimum of two hours.

### 3.6 PROTECTION OF FINISHED WORK

- A. Contract Closeout: Protect installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Relamp luminaires that have failed lamps at Substantial Completion. Replace LED modules in which more than 5% of the LEDs have failed lamps at Final Acceptance of the Work.

END OF SECTION 265100



## SECTION 265200 - EMERGENCY AND EXIT LIGHTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

Section includes emergency egress lighting units and exit signs.

#### 1.2 STANDARDS

- A. UL 924
- B. NFPA 101 - Life Safety Code.
- C. NFPA 70 - National Electrical Code.
- D. North Carolina State Building Code including Energy Code.
- E. NEMA - Standards

#### 1.3 SUBMITTALS FOR REVIEW

- A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.

#### 1.4 SUBMITTALS FOR INFORMATION

- A. Submittals: Submittals for information. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

#### 1.5 SUBMITTALS FOR CLOSEOUT

- A. Contract Closeout: Submittals for project closeout. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Submit manufacturer's operation and maintenance instructions for each product.

#### 1.6 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing products specified in this section with

minimum three years documented experience.

## 1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 101.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated. Products shall also meet or exceed the standards listed in Part 2.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All lighting fixtures shall be listed as emergency lighting equipment and third party testing agency and NFPA approved and shall bear their label.
- B. All fixtures shall have a stock, or standard finish unless otherwise specified.
- C. All emergency lighting fixtures shall be completely self-contained, provided with maintenance free battery, automatic charger and other features. They shall be installed complete with lamps, batteries, etc. which shall be new and unused at time of final inspection of the project for acceptance.
- D. Lighting fixture types shall be furnished as required by the Lighting Fixture Schedule on the contract drawings and as herein specified. Catalog numbers are provided as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers listed will be acceptable upon approval of the Architect/Engineer. The Contractor shall verify from the contract drawings the type of ceilings or walls the fixture is to be used with and shall provide compatible mounting attachments and trim. Provide all accessories or additional materials required to maintain the ceiling fire rating as required by regulatory authorities.
- E. Emergency lighting fixtures and exit signs shall be as shown on the lighting fixture schedule on the contract drawings, and as herein specified.
- F. Emergency Lighting Fixture Warranty: The entire unit shall be warranted for three years. The battery must have a additional two more years pro-rated warranty. Warranty shall date from the date of final project acceptance and be included in the contract document.

### 2.2 EMERGENCY LIGHTING (EGRESS) UNITS

- A. Product Description: Self-contained incandescent emergency lighting unit automatically activated when the line voltage drops below 80%.
- B. Battery: Ten year normal life expectancy, 12 volt, sealed, maintenance-free, lead calcium type, with 1.5 hour minimum capacity at 50 watts load. Battery shall be a high temperature type with an operating range of 0° C. to 60° C., contain a resealable pressure vent and sintered positive and negative terminals. A low voltage disconnect switch shall be included if a Lead battery is

used, to disconnect the battery from the load and prevent damage from a deep discharge during an extended power outage.

- C. Battery Charger: Automatic, solid state, full wave rectification, surge protected, current-limiting, dual-rate type, with filtered output of sufficient capacity to recharge discharged battery to full charge within twelve hours. Provide fused output circuit, low voltage battery disconnect, brownout and short circuit protection. Thermal protection shall sense circuitry temperature and adjust charge current to prevent overheating and charger failure. Thermal compensation shall adjust charger output to provide optimum charge voltage relative to ambient temperature. Regulated charge voltage shall maintain constant charge voltage over a wide range of line voltages. AC lockout circuit shall allow battery connection before AC power is applied and prevent battery damage due to deep discharge.
- D. Lamps: Two twenty (20) watt minimum, glass, sealed beam halogen type in nickel or chrome plated steel housing. Heads shall rotate for aiming.
- E. Mounting: Surface wall or recessed ceiling as indicated by the drawings.
- F. Housing: White polycarbonate, with steel backbox/housing or steel with white finish. Wall mount unit with hinged faceplate and adjustable mounting hardware. Ceiling mount unit with T bar hangar kit.
- G. Self-Diagnostics: Electronics shall automatically, or manually upon demand, conduct self test on battery condition (including actual discharge), charger, lamps and internal wiring integrity per NEC and NFPA at prescribed intervals. A pilot light shall indicate the unit is connect to AC power. Provide test switch and visual indicator(s) of unit operational condition including charger status, ready and service code. Test switch shall simulate operation of the unit upon loss of AC power by energizing lamps from the battery, and also exercise the transfer relay.
- H. Electrical Connection: Conduit connection.
- I. Input Voltage: Dual voltage input (120/277 volts).

### 2.3 EXIT LIGHTING UNITS

- A. Product Description: Exit lighting unit as scheduled.
- B. Lamps: LED, discrete or diffuse. Maximum failure rate shall be 25% within a seven year period, otherwise, if exceeded the manufacturer shall replace the entire unit at no cost to the Owner.
- C. Face:
  - 1. Standard Unit: Single or dual face as indicated or required. Translucent plastic face with red letters on white background.
  - 2. Architectural/Edge Lit Unit: Clear transparent plastic panel with red letters on clear or mirrored background.
- D. Directional Arrows: As indicated or universal type for field adjustment.
- E. Mounting: Universal, surface wall, back or end mount, or ceiling, top or pendant mount.

- F. Housing: White polycarbonate for standard unit, metallic enclosure with clear plexiglass signage panel for architectural/edge lit unit.
- G. Electrical Connection: Conduit connection.
- H. Input Voltage: Dual voltage input (120/277 volts).

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install suspended exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend sign at indicated height.
- B. Install surface-mounted emergency lighting units and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- C. Install wall-mounted emergency lighting units and exit signs at height as indicated.
- D. Install accessories furnished with each emergency lighting unit and exit sign.
- E. Emergency and exit lighting fixtures shall be installed in a manner to be fully compliant with the seismic restraint requirements of the North Carolina State Building Code. Provide mounting devices and hardware, bracing, fittings, etc. as required for seismic restraint. See Specifications Section 260500, Paragraph 1.23 for additional requirements.
- F. Connect emergency lighting units to branch circuit outlets provided under this Division as indicated.
- G. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling grid members using bolts or screws.
- H. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within unit.
- I. Install specified lamps in each emergency lighting unit.
- J. Ground and bond emergency lighting units and exit signs under the provisions of Section 260526.
- K. Locate emergency lighting fixtures and exit signs as indicated on reflected ceiling plan.
- L. Install recessed luminaires to permit removal from below.
- M. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- N. Install screws to secure recessed grid-supported luminaires in place.



- O. Install accessories furnished with each luminaire.
- P. Paint a 3/8" diameter red dot on each emergency lighting fixture to provide ready identification of emergency fixtures. Exact location shall be coordinated with the Architect/Engineer.

### 3.2 FIELD QUALITY CONTROL

- A. Quality Assurance: Field inspection, testing and adjusting shall be as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

### 3.3 ADJUSTING

- A. Contract Closeout: Adjust installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Aim and adjust emergency lighting fixture heads to illuminate paths of egress.

### 3.4 CLEANING

- A. Contract Closeout: Clean installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.

### 3.5 DEMONSTRATION AND INSTRUCTIONS

- A. Contract Closeout: Demonstrate installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Demonstrate normal luminaire operation for minimum of ninety minutes after the unit has been permanently installed and charged for a minimum of 24 hours. The battery run time test shall be completed a minimum of 10 days prior to final inspection by Architect and representatives of the North Carolina State Construction Office. Any unit which fails the test shall be repaired or replaced, and tested again. A copy of the test report shall be sent to the North Carolina State Construction Office, through the Architect.

### 3.6 PROTECTION OF FINISHED WORK

- A. Contract Closeout: Protect installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Relamp emergency lighting units and exit signs that have failed lamps at Substantial Completion. Replace exit signs in which more than 5% of the LEDs have failed lamps at

Substantial Completion.

END OF SECTION 265200

SECTION 270500 - DATA AND VOICE COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

Section includes termination devices, and racks for telephone and data communication circuits by certified manufacturers and contract installers with certification and testing of all equipment and cabling.

1.2 REFERENCES

TIA/EIA 568 (Telecommunications Industries Association/Electronic Industries Association) - Commercial Building Telecommunication Wiring Standard.

TIA/EIA 569 (Telecommunications Industries Association/Electronic Industries Association) - Commercial Building Standard for Telecommunications Pathways and Spaces.

TIA/EIA 606A Administrative Standard (Labeling).

TIA/EIA 607 - Commercial Building Grounding/Bonding Requirements.

NETA ATS (International Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

NFPA 70 - National Electrical Code.

UL 969 - Standard for Marking and Labeling Systems.

ISO/IEC 11801 - Information Technology, Generic cabling for customer premises.

BISCI - Building Industries Consulting Services International.

BISCI TDMM - Telecommunications Distribution Methods Manual.

BISCI CO-OSP - Customer Outside Plant Design Manual

1.3 SYSTEM DESCRIPTION

A. Provide a system that includes, but not be limited to, patch panels, racks, faceplates, connectors, hardware, accessories, connections, grounding, and all other material, labor and operations required for a complete system in this building.

B. Cabling will be installed by owner.

C. SUBMITTALS

A. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Submit catalog data for each termination device, rack, etc.

- C. Test Reports: Indicate procedures and results for specified field testing and inspection.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Project Record Documents: Record actual locations and sizes of pathways and outlets.
- C. Provide marked up Drawings showing additions, deletions, and modifications.
- D. Provide electronic copies of marked up final Drawings.

#### 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, the manufacturers offering products that may be incorporated into the Work are limited to the following
  - 1. Siemons
  - 2. CommScope
  - 3. Panduit
  - 4. Leviton

#### 2.2 COMMUNICATIONS FACEPLATES AND CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-C.1.
- B. Workstation Outlets:
  - 1. Two-port-connector assemblies mounted in single faceplate.
  - 2. Four-port-connector assemblies mounted in multigang faceplate.
  - 3. See drawings for other outlet quantities for number of ports. Mount assemblies in multigang faceplate.
  - 4. Faceplate: Plastic, complying with requirements in Section "Wiring Devices."
  - 5. Flush mounting snap-in jacks.
  - 6. Provide blanks for unused portions of faceplates.
  - 7. Legend: Machine printed, in the field, using adhesive-tape label.

#### 2.3 RACKS, PATCH PANELS AND IDF CABINETS.

- A Racks: Racks shall be two post rack with 44 rack mount spaces of 19” width and an overall interior depth of 28”; black paint with matte (satin) finish. For singular or multiple rack configurations, provide tops, rear doors, and one set of side panels for a singular viewing aspect of each configuration. Secure to floor and wall and cable tray (if utilized) with manufacturers recommended hardware and accessories providing a stable rack, racks shall be connected to the electrical ground system in compliance with TIA/EIA 607. Horizontal and vertical cable management panels shall be provided installed above and below each data patch panel to provide neat and orderly routing of patch cables. Cable management panels shall be sized to accommodate the maximum number of patch cables for the patch panels.
- B Station cable terminations shall be accomplished using patch panels with 66 style IDC connectors. Patch panels will not exceed 2 RU (3.5”) in height.
- C Each rack shall have (2) horizontal Power Distribution Units.
- D Patch Panels: TIA/EIA 568C Category 6a compliant rack-mounted assembly or terminals and accessory patch cords, with adequate capacity for all active and 25% spare circuits.
- E Communication Cable Management and Ladder Rack
1. Horizontal Cable managers shall be provided for routing of cable between termination points and active components. Provide cable managers for each patch panel and/or fiber enclosure in a rack plus one spare. Provide cable managers for each patch panel and/or fiber enclosure in a rack plus one spare. Example, if an TR rack has three switches it would receive 4 wire managers. The passive rack has three patch panels and one fiber enclosure. It would receive 5 wire managers. All patch panels shall be located at top of rack followed by management, switch, management, switch, switch, management, switch, switch management and UPS.
  2. Vertical Cable managers shall be provided for routing of cable between termination points and active components. Provide 12”wide vertical cable managers of appropriate height. Provide one manager for exterior of each rack and one in between racks if more than one rack is installed.
  3. A system of overhead ladder racks shall be installed in each TR to support and distribute all cabling from where it enters the room to its appropriate termination location. Racks shall be 12” wide min. with 9” spacing between support rungs.
  4. Overhead ladder racks shall be installed below finished ceiling, mounted at 7’ - 4” and attached to the equipment racks and walls. They shall be supported at least every 6”. One cable runway support bracket shall be mounted on top of each equipment rack. Ladder rack shall be bolted to the top of each cable runway support bracket to allow attachment to the equipment rack.
  5. Vertical ladder racks shall be installed to tie into any wireways and conduits that enter the TR above 9’ AFF. All vertical ladder racks shall be connected to the horizontal ladder rack system.
- J Station cable terminations shall be accomplished using patch panels with 66 style IDC connectors. Patch panels will not exceed 2 RU (3.5”) in height.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Notify the Owner when ready for Owner-furnished equipment and cabling to be installed.
- B. All penetrations through walls and floors shall be sleeved. All sleeves shall have permanently attached bushings.
- C. Install pullwire in each empty telephone or data conduit.

### 3.2 GROUNDING AND BONDING

- A. Ground and bond pathways, cable shields, racks and equipment under the provisions of Section 260526 and TIA/EIA - 607 - Commercial Building Grounding/Bonding Requirements.
- B. Grounding conductors shall be installed neatly, with as few bends as possible, and routed such as to minimize the length of the conductor runs.
- C. The grounding conductors may be wall mounted or fastened to ladder racks with plastic cable ties. While they may be routed adjacent to telecommunications cables, they should not be attached to them in any way.
- D. An acceptable bond between the grounding conductor and painted metal surfaces is required. In these cases, a small area of the paint should be removed by blade or wire brush prior to the attachment of the ground lug. In TRs, this typically applies to the surface of metal wire ways and to the surface of equipment racks.
- E. Definitions
  - 1. Bonding conductor (BC) for telecommunications. This conductor links the telecommunications grounding system to the main electrical power grounding system for the building. It originates in the TR.
  - 2. Telecommunications main grounding bus bar (TMGB). This bar is located in the TR and serves as the hub for the telecommunications grounding system in the entire building. Bond the TMGB to the BC, TBB, and local building steel.
  - 3. Telecommunications bonding backbone (TBB). This conductor links the TGB in each TC back to the TMGB.
- F. Required Grounding Configuration
  - 1. TGB. One telecommunications grounding busbar shall be installed onto the plywood on the wall of each TC. It shall be installed at 24" AFF. The bar shall be electrically insulated from its mounting bracket.
    - 2. TBB. One insulated, stranded, #6 copper wire shall be installed from the TGB in the TC to the TMGB in the TR. This conductor shall be routed inside the riser conduit system along side the telecommunications riser cables. It shall be fastened to the TGB.
  - 3. Equipment racks. A #6 grounding conductor shall be installed between one equipment rack and the TGB using the appropriate grounding lug. The remaining equipment racks shall be connected together in series to the first rack to provide a continuous connection to all racks..
    - 4. Ladder racks. A #6 grounding conductor shall be installed between one section of overhead ladder rack to the TGB or to one of the equipment racks.
  - 5. Pathway components. A #6 grounding conductor shall be installed from each distinct wireway or conduit (over 1" in diameter) which exits the TR and houses either horizontal or

riser cabling back to the TGB, ladder rack, or equipment rack. As needed, these components may be connected in series to provide a continuous connection to all components. Grounding lugs shall be used to connect the conductor to wireways. Grounding bushings should be installed on conduit ends to connect these conduits to the conductor.

### 3.3 LABELING

- A. **Manufacturers Identification:** Each major component of equipment shall have the manufacturers name, address, model number, and rating on a plate securely affixed in a conspicuous place. NEMA code ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible.
- B. **Custom Panel Identification and Nomenclature:** Switches, connectors, jacks, receptacles, outlets, shall be logically and permanently marked in a manner approved by the Owner. Custom panel nomenclature shall be engraved, etched, or screened.
- C. **Terminal Blocks and Rack Mounted Equipment Identification:** All terminal blocks, rack mounted equipment, and active slots of card frame systems shall be clearly and logically labeled in a manner acceptable to the Owner as to their function, circuit, or system as appropriate. Labeling on manufactured equipment shall be engraved plastic laminate with white lettering on black background or dark background. Handwritten identification is not permitted. The contractor may substitute metallized polyester permanent identification labels with black printing on silver, white, or another light color background for the phenolic labels above.

### 3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing shall be performed under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Inspect, test and certify all cabling and equipment and terminations as specified and in accordance with TIA/EIA 568 C.

END OF SECTION 270500





## SECTION 270510 - TELECOMMUNICATIONS PATHWAYS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Equipment and terminal backboards.
- B. Premises wiring raceways and outlets.

#### 1.2 REFERENCES

NFPA 70 - National Electrical Code.

#### 1.3 SYSTEM DESCRIPTION

Individual and combination telecommunications/data outlets shall be installed where shown on the contract drawings. Raceways shall be installed as straight as possible and shall contain not more than the equivalent of three quarter bends.

#### 1.4 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Record actual locations and sizes of pathways and outlets.

#### 1.5 QUALITY ASSURANCE

- A. Telephone Utility: Field verify.
- B. Perform Work in accordance with telephone utility's rules and regulations.

#### 1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish Products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

### PART 2 - PRODUCTS

#### 2.1 TELECOM TERMINATION BACKBOARDS

- A. Material: Grade A/C Fire retardant treated plywood.
- B. Size: 4 x 8 feet (1.2 x 2.4 m), 3/4 inch (19 mm) thick.

#### 2.2 TELECOMMUNICATIONS OUTLETS

Outlets shall consist of standard, square cornered boxes 4-11/16" wide by 4-11/16" high by 2-1/8" deep, minimum, flush mounted at the height indicated on the contract drawings. Provide a single gang plaster ring for the square cornered boxes 4-11/16" wide by 4-11/16" high by 2-1/8" deep.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Finish paint termination backboards with durable white enamel under the provisions of Division 9 prior to installation of equipment.
- B. Support raceways and backboards under the provisions of Section 260529.
- C. Install termination backboards plumb, and attach securely to building wall at each corner.
- D. Install #14 gauge steel or approved, 200 lb. nylon cord pull wire in each empty conduit run. The maximum bends between pull points shall be 180 degrees.
- E. The maximum distance between pull boxes shall be 100 feet.

END OF SECTION 270510

## SECTION 270536 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of cable tray.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS FOR CABLE TRAYS

- A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.
- B. Sizes and Configurations: See the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.
- C. Structural Performance: See articles on individual cable tray types for specific values for uniform load distribution, concentrated load, and load and safety factor parameters.

#### 2.2 WIRE-BASKET CABLE TRAYS

##### A. Description:

1. Configuration: Wires are formed into a standard 2-by-4-inch (50-by-100-mm) wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along entire length of section.
2. Materials: High-strength-steel longitudinal wires with no bends.
3. Safety Provisions: Wire ends along wire-basket sides (flanges) rounded during manufacturing to maintain integrity of cables and installer safety.
4. Sizes:
  - a. Straight sections shall be furnished in standard 118-inch (3000-mm) lengths.
  - b. Wire-Basket Depth: 6-inch (150-mm) usable loading depth by 18 inches (450 mm), 24 inches (600 mm) wide (See drawings for sizes and locations).
5. Connector Assemblies: Bolt welded to plate shaped to fit around adjoining tray wires and mating plate. Mechanically joins adjacent tray wires to splice sections together or to create horizontal fittings.
6. Connector Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
7. Hardware and Fasteners: Steel, zinc plated according to ASTM B 633.

## 2.3 MATERIALS AND FINISHES

### A. Steel:

1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1008/A 1008M, Grade 33, Type 2.
2. Steel Tray Splice Plates: ASTM A 1011/A 1011M, HSLAS, Grade 50, Class 1.
3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
4. Finish: Mill galvanized before fabrication.
  - a. Hardware: Chromium-zinc plated, ASTM F 1136.

## 2.4 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Barrier Strips: Same materials and finishes as for cable tray.
- C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

## 2.5 WARNING SIGNS

- A. Lettering: 1-1/2-inch- (40-mm-) high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."
- B. Comply with requirements for fasteners in Section 260553 "Identification for Electrical Systems."

## 2.6 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect cable trays according to NEMA FG 1.

## PART 3 - EXECUTION

### 3.1 CABLE TRAY INSTALLATION

- A. Install cable trays according to NEMA FG 1.
- B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- C. Fasten cable tray supports to building structure.
- D. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb (90 kg). Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems."

- E. Support wire-basket cable trays with trapeze hangers.
- F. Support trapeze hangers for wire-basket trays with 1/4-inch- (6-mm-) diameter rods.
- G. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.
- H. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA FG 1. Space connectors and set gaps according to applicable standard.
- I. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Penetration Firestopping."
- J. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- K. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.
- L. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.
- M. Install warning signs in visible locations on or near cable trays after cable tray installation.

### 3.2 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems."
- B. Cable trays with communications cable shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- C. Cable trays with control conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- D. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

### 3.3 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket.
- C. Fasten cables on vertical runs to cable trays every 18 inches (450 mm).
- D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables

independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches (1800 mm).

- E. Tie MI cables down every 36 inches (900 mm) where required to provide a 2-hour fire rating and every 72 inches (1800 mm) elsewhere.
- F. In existing construction, remove inactive or dead cables from cable trays.

### 3.4 CONNECTIONS

- A. Connect raceways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

### 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorqued in suspect areas.
7. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
8. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

- B. Prepare test and inspection reports.

### 3.6 PROTECTION

- A. Protect installed cable trays and cables.

END OF SECTION 270536

## SECTION 283111 - FIRE DETECTION AND ALARM SYSTEM

### PART 1 - GENERAL

#### 1.1 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. NFPA 72 - National Fire Alarm Code.
- C. NFPA 101 - Life Safety Code.
- D. North Carolina State Building Code.

#### 1.2 SYSTEM DESCRIPTION

- A. This document outlines modifications to existing Fire-Lite MS-10UD for the devices shown on the plans. The fire alarm system shall comply with applicable provisions of the NC Building Code, NFPA 70 - National Electrical Code (NEC) and NFPA 72 -National Fire Alarm Code. The Contractor shall furnish all parts, materials, and labor customarily required or provided for a complete and operating system, in accordance with all requirements applicable, even if each needed item is not specifically shown or described in the project plans or specifications.

#### 1.3 SUBMITTALS

- A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.
- B. Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification.
- C. Product Data: Provide electrical characteristics and connection requirements, and provide mA draw for each device submitted and the listed minimum voltage required to operate.
- D. The fire alarm contractor shall submit complete Shop Drawings to the Architect/Engineer for review, prior to performing any work. Any non-compliant features shall be fully described.
- E. The submitted shop drawings shall show equipment, device identification numbers and locations, and connecting wiring of entire fire alarm system. Include wiring and riser diagrams. Wiring diagrams shall be based on the project floor plans, with devices and proposed cable routing. The distance and route for each NAC (Notification Appliance Circuit) shall be shown. Riser diagrams shall show consecutive connections for all devices with addresses and candela and candela ratings. Provide detailed battery and communications amplifier(s) capacity calculations.
- F. Architect/Engineer's approval (with or without comments) of contractor's Shop Drawings, samples, cut sheets, etc., is for general conformance with the contract documents and design concept. It shall not relieve the contractor of responsibility for full compliance with the project plans and specifications, EXCEPT for any specific non-compliant features for which the Architect/Engineer gives written authorization.

- G. Installation Instructions: The contractor shall submit to the Architect/Engineer the manufacturer's detailed installation instruction for the Fire Alarm Control Panel and all duct mounted smoke detectors, flow switches, tamper switches, supervisory switches, and similar items which require mechanical installation.
- H. Battery Calculations:
1. Include a copy of system battery sizing calculations with the shop drawing submittal to the Architect/Engineer. Use manufacturer's battery discharge curve to determine expected battery voltage after 60 hours of providing standby power. Then use calculated Notification Appliance Circuit current draw in the alarm mode to determine expected voltage drop at End of the Line Resistor (EOL), based on conductor resistance per manufacturer's data sheet or NEC.
  2. Fire Alarm Vendor's calculations shall be submitted with the shop drawings, and prior to installation of equipment. In the submittal package identify Notification Appliance Circuits (NAC) current draws and voltage drops for each circuit. In no case shall the calculated voltage at any notification appliance fall below the minimum listed operating voltage for the devices used.
  3. The voltage drop at EOL shall not exceed 14% of the expected battery voltage, after the required standby time plus alarm time. (Typically, for a 24 volt system, this limits the voltage drop from the battery to the EOL to 3 volts). Determine "worst case" voltage at far end of each NAC, by subtracting its calculated V-drop from the expected battery voltage. The result shall be no less than the minimum listed operating voltage for the alarm notification appliances used.
  4. All of these calculations shall be placed on a dedicated sheet of as-built drawings, for future reference by fire alarm service technicians. NAC voltage drop is to be verified during system tests.
- I. Maintenance Data: The contractor shall submit maintenance data and parts lists for each type of fire alarm equipment installed, including furnished specialties and accessories. This data, product data, and shop drawings shall be included in the maintenance manual.
- J. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and commissioning of products.

#### 1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of Project. Products of firms that do not maintain factory authorized service organization and spare parts are not acceptable.
- B. Installer: Company specializing in installing the products specified in this section with minimum five years documented experience installing fire detection and alarm systems similar in size and scope of the project. The fire alarm contractor shall be authorized by his respective factory to ensure proper specification adherence, final connection, test, certification, warranty compliance, and service. Additionally, the fire alarm contractor shall submit a letter of authorization on official letterhead of the company product stating the company is an authorized distributor of that product. The company shall maintain a service organization with adequate spare parts inventory within 75 miles of the installation site.



- C. All connections to the FACP and the system's programming shall be done only by the manufacturer, or by an authorized distributor that stocks a full complement of spare parts for the system. The technicians are required to be trained and individually certified by the manufacturer, for the FACP model/series installed. This training and certification shall have occurred within the most recent 24 months, except that a NICET Level III certification shall extend this to 36 months. Copies of the certifications shall be part of the Shop Drawing submittal to the Designers, prior to installation. The submittal cannot be approved without this information.

## 1.5 REGULATORY REQUIREMENTS

- A. Equipment and installation shall conform to requirements of NFPA 70, NFPA 72, NFPA 101, North Carolina State Building Code and shall be FM approved.
- B. Furnish products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Fire-Lite by Honeywell

### 2.3 ALARM APPLIANCES

- A. Strobe Lights shall be located as shown on the Drawings. Strobe lights indicated for use exterior to the building shall be mounted at the indicated elevation and listed for use in wet locations. Strobe lights shall operate with synchronized flash output and have the following specifications:
  - 1. Voltage: Strobe lights shall operate on 24 VDC nominal.
  - 2. Maximum pulse duration: 2/10ths of one second.
  - 3. Strobe intensity and flash rate: Shall meet minimum requirements of UL 1971. Provide strobe lights with minimum intensity Candela (Cd) rating of 15/75 Cd, or greater if such is indicated adjacent to the device symbol on the Drawings.
- B. Audible Devices:
  - 1. Horns: Where provided, shall provide average ambient sound level of dBA as listed in the NEPA 72.
  - 2. Audible/Visual Combination Devices (Horn/Strobes) shall comply with all applicable requirements for Horns, and Strobe Lights.

### 2.4 INITIATING DEVICES

- A. Addressable Devices - General: All initiating devices shall be individually addressable. Addressable devices shall comply with the following requirements:
  - 1. All addressable spot type and duct smoke detectors shall be the analog type and the alarm system shall automatically compensate for detector sensitivity changes due to ambient

- conditions and dust build-up within detectors. This feature shall be armed and sensitivities set prior to acceptance of the system.
2. Address Setting: Addressable devices shall provide an address-setting means.
  3. Connections: Addressable devices shall be connected to a Signaling Line Circuit (SLC) with two (2) wires.
  4. Operational Indications: Addressable initiation devices shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating that the device is operational and in regular communication with the control panel. Both LEDs shall be placed into steady illumination by the FACP to indicate that an alarm condition has been detected. The flashing mode operation of the detector LEDs shall be optional through the system field program. An output connection shall also be provided in the device base to connect an external remote alarm LED.
  5. Intelligent Initiation Devices: All smoke detectors shall be the "intelligent" in that smoke detector sensitivity shall be set through the FACP and shall be adjustable in the field through the field programming of the system. Sensitivity shall be capable of being automatically adjusted by the FACP on a time-of-day basis. Using software in the FACP, detectors shall be capable of automatically compensating for dust accumulation and other slow environmental changes that may affect performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
  6. Spot-type detectors shall be the plug-in type, with a separate base (not a mounting ring), to facilitate their replacement and maintenance. The base shall have integral terminal strips for circuit connections, rather than wire pigtailed. Each detector or detector base shall incorporate an LED to indicate alarm.
  7. Device mounting Base: Unless otherwise specified all detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
  8. Test Means: The detectors shall provide a test means whereby they shall simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel when in the "test" condition.
  9. Device Identification: Detectors shall store an internal identifying type code that the control panel shall use to identify the type of device. Device identifications shall be ION or PHOTO, or THERMAL.
  10. Photoelectric Smoke Detectors: Photoelectric smoke detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
  11. Ionization Smoke Detector: Ionization smoke detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.
  12. Thermal Detectors: Thermal Detectors shall be intelligent addressable devices rated at 135°F (58°C) and shall have a rate-of-rise element rated at 15° F. (9.4°C) per minute. It shall connect via two wires to the Fire Alarm Control Panel Signaling Line Circuit. Up to 99 intelligent heat detectors may connect to one SLC loop. Thermal detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.
  13. Non-Rate of Rise Detectors: Provide thermal detectors with non-rate of rise thermal elements. Non-rate of rise detectors are indicated by NRR adjacent to the thermal detector symbol.
  14. Specialized Element Temperature Ratings: Provide thermal detectors with specialized element temperature ratings. Specialized element temperatures are indicated by a temperature rating adjacent to the thermal detector symbol, e.g. 195°F.

15. Duct Smoke Detector: In-Duct Smoke Detector Housings shall accommodate a velocity rated photoelectric detector. The device, independent of the type used, shall provide continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal shall be initiated at the FACP.
16. Addressable Pull Stations - General: Addressable pull stations shall, on command from the Control Panel, send data to the panel representing the state of the manual switch. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key. All pull stations shall be dual-action, have a positive, visual indication of operation and utilize a key type reset. The Glass-break rods are not allowed.

## 2.5 AUXILIARY DEVICES

### A. Addressable Dry Contact Monitor Module:

1. Addressable Monitor Modules shall be provided to connect one supervised zone (either Style D or Style B) of non-addressable Alarm Initiating Devices (any Normally Open [N.O.] dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings.
2. Indication of Operation: An LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.
3. Supervision: Unless specifically noted otherwise on the drawings provide one monitor module for each sprinkler switch.
4. Two Wire Detector Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised IDC zone, Class B (Style D or Style B operation) of non-addressable 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops.
5. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings. Indication of Operation: Unless otherwise indicated on the Drawings an LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.

### B. Addressable Control Module:

1. Addressable Control Modules shall be provided to supervise and control the operation of one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized Audio/Visual (A/V) Notification Appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contact relay. The control module shall provide address-setting means using DIP switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel.
2. Configuration:
  - a. The control module NAC circuit may be wired for Style Y (Class A/B) with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form C) relay. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC. The relay coil shall

be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

- b. Power Source: Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, 3rd party listed remote power supply. A/V power sources and connections are not shown on the Drawings
- c. Test Switch: A magnetic test switch shall be provided to test the module without opening or shorting its NAC wiring.

C. Isolator Module:

1. Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. Modules shall be readily accessible (not above ceiling) and clearly labeled.
2. Operation: Isolator Modules shall operate such that if a wire-to-wire short occurs, the Isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section. The Isolator Module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after its normal operation.
3. The Isolator Modules shall provide a single LED that shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

D. Serially Connected Remote Annunciators:

1. Annunciators shall communicate with the fire alarm control panel via an EIA-485 communications loop (four-wire) and shall individually annunciate all zones in the system. System zones shall be as indicated on the Drawings. Up to 10 annunciators may be connected to the EIA-485 communications loop.
2. Annunciator Indicators: The annunciator shall provide a red Alarm LED per zone, and a yellow Trouble LED per zone. The annunciator shall also have an "ON-LINE" LED, local piezo sounder, local acknowledge/lamp test switch, and custom zone/function identification labels. Annunciator switches may be used for System control such as, Global Acknowledge, Global Signal Silence, and Global System Reset. All annunciator switches and indicators shall be software programmable.
3. LCD Alphanumeric Display Annunciator: The Alphanumeric Display Annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text. The LCD Annunciator shall display all alarms and trouble conditions in the system.
4. System Capacity: The system shall allow a minimum of four LCD annunciators. In addition to annunciation functions, each LCD annunciator shall be capable of the following software programmed system functions: Acknowledge, Signal Silence and Reset.
5. Connections: The annunciator shall connect to a two-wire EIA-485 interface. The two-wire connection shall be capable operation at distances of 6,000 feet. Provide interface to fiber optic cable systems and/or repeater units where such are indicated on the Drawings.
6. Remote Annunciator Indicator Lights (RAIL): RAILS shall be provided with a key type switch for testing of the annunciated device. RAILS shall operate on 24 VDC nominal.

## E. Wiring:

1. Addressable loop (signaling line) circuits shall be wired with type FPL/FPLR/FPLP fire alarm cable, AWG 18 minimum, low capacitance, twisted shielded copper pair. Cable shield drain wires are to be connected at each device on the loop to maintain continuity, taped to insulate from ground, and terminated at the FACP. Acceptable cables include Atlas 228-18-1-1STP, BSCC S1802s19 (same as EEC 7806LC), West Penn D975, D991 (AWG 16), D995 (AWG 14), or equal wire having capacitance of 30pf/ft. maximum between conductors. Belden 5320FJ acceptable if only FPL rating needed. The cable jacket color shall be red, with red (+) and black (-) conductor insulation.
2. Unshielded cable, otherwise equal to the above, is permitted to be used if the manufacturer's installation manual requires, or states preference for, unshielded cable.
3. In underground conduit, Type TC or PLTC cable (PE insulated) shall be used to avoid problems from moisture.

## PART 3 - EXECUTION

## 3.1 FIRE ALARM SYSTEM

- A. All equipment supplied shall be specifically listed for its intended use and shall be installed in accordance with the manufactures recommendations. The contractor shall consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Contractor shall refer to the Riser/Connection diagram for all specific system installation/termination/wiring data.
- B. All system components shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load. Adhesives are not permitted to mount fire alarm system components to building surfaces or structure.
- C. When programming the system activate the automatic drift compensation feature for all spot-type smoke detectors. Systems with alarm verification are not to have this feature activated without written direction from the owner's representative or the AHJ. Alarm verification shall not be used with multi-sensor/multi-criteria detectors under any circumstances, as inadequate system response may result. Most applications of analog addressable smoke detectors do not require alarm verification to reduce nuisance alarms, as they are better able to discriminate between fire and common non-fire ambient events. A short operational test with normal occupancy can determine if transient ambient events are a problem.
- D. Set spot-type smoke detector sensitivities to normal/medium, unless directed otherwise by the Architect/Engineer or Owner's rep. High sensitivity may be appropriate in relatively benign, clean environments such as art museums and libraries, to improve system response time without causing nuisance alarms.
- E. Print a complete System Status and Programming Report after the above steps have been done. This shall include the program settings for each alarm initiating device and the current sensitivity of each analog addressable smoke detector.

## 3.2 ADDRESSABLE INTERFACE MODULES (Control and Monitor Modules)

- A. Addressable interface modules (used to monitor all contact type initiating devices) shall be located in conditioned space, unless they are tested, listed, and marked for continuous duty across the range of temperatures and humidity expected at their installed location.
- B. One module may serve as many as 3 sprinkler system valve supervisory switches in a single space; otherwise provide one module per switch. One module may serve as many as 6 heat detectors in a single space
- C. Sprinkler system supervisory circuits for monitoring valve position, air pressure, water temperature, pump status, etc., shall cause distinct audible and visible indications at the FACP. The audible supervisory signal shall either be a 4" diameter bell or a pulsing piezo-electric alarm. Provide the following engraved label adjacent to the bell/alarm: "SPRINKLER STATUS ABNORMAL". If only valve position is supervised, provide an engraved label reading: "SPRINKLER VALVE CLOSED"

3.3 CONDUIT AND WIRING

- A. The exterior of all junction boxes containing fire alarm conductors shall be painted red; box interiors shall not be painted. Box covers for junction boxes containing fire alarm conductors shall be painted red on both sides.
- B. Box covers shall be labeled to indicate the circuit(s) or function of the conductors contained therein. Labels shall be neatly applied black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.
- C. All fire alarm system wiring shall be in metal conduit or surface metal raceway, concealed above ceiling may be run in free air. All fire alarm system raceway, couplers, and connectors shall meet the performance and installation requirements of Electrical Specification Section "RACEWAYS".
- D. If cable size and the requirement to maintain a Class "A" loop on all Signaling Line Circuits cause conduit fill to exceed specified maximums for the 1/2" size; 3/4" raceway shall be used.
- E. All conduits that penetrate outside walls from air conditioned space shall have internal sealing (duct-seal), to prevent condensation from infiltrating humid air.
- F. All wiring shall be color coded All the circuits in the system shall be wired with AWG 14, minimum, stranded copper, THHN/THWN conductor, installed in metallic conduits. Color Coded wires shall be in accordance with the following scheme, which shall be maintained throughout the system, without color change in any wire run;
  - 1. Initiating Circuits, general Red (+)/White (-)
  - 2. Initiating Circuits, smoke only Violet (+)/Gray (-)
  - 3. Signal Line Circuit cable Red jacket with Red(+)/Black(-)
  - 4. Alarm Indicating Appliance Circuits Blue (+)/Black (-)
  - 5. AHU Shutdown Circuits Yellow (+)/Brown (-)
  - 6. Door Control Circuits Orange
  - 7. Elevator Capture Circuits Brown
- G. To minimize wiring fault impact, isolation modules shall be provided in all of the locations listed below. If ceiling height  $\leq 10$  feet, isolator base type initiating devices are permitted to be used to satisfy any or all of the following:

1. In or immediately adjacent to the FACP, at each end of the addressable loop. These two isolators shall be in the same room and within 15 feet of the FACP.
  2. After each 20 initiating devices and control points on the addressable loop, or a lesser number where recommended by the manufacturer. (Check instructions.)
  3. For loops with 20 devices and control points, install an isolator at the approximate middle of the loop (in addition to those at the FACP).
  4. Near the point any addressable circuit extends outside the building, except for those attached to the building exterior walls and well sheltered by walkways.
  5. For loops covering more than one floor, install isolator at terminal cabinet on each floor (with additional isolator[s] on any floor with over 20 addresses).
  6. Each isolation module shall be clearly labeled, readily accessible for convenient inspection (not above a lay-in ceiling), and shown on as-built drawings.
- H. Detection or alarm circuits shall not be included in raceways containing AC power or AC control wiring. Within the FACP, any 120 VAC control wiring or other circuits with an externally supplied AC/DC voltage above the nominal 24 VDC system power shall be properly separated from other circuits and the enclosure shall have an appropriate warning label to alert service personnel to the potential hazard.
- I. Style 6 Circuits Required: Systems with one or more addressable sub-panels that (1) have an integral addressable loop controller, or (2) monitor multiple non-addressable initiation zones, shall comply with the NFPA 72 requirements for Style 6 circuits.
- J. There shall be no splices in the system other than at device terminal blocks, or on terminal blocks in cabinets. "Wire nuts" and crimp splices shall not be permitted. Permanent wire markers shall be used to identify all connections at the FACP and other control equipment, at power supplies, and in terminal cabinets. All terminal block screws shall have pressure wire connectors of the self lifting or box-lug type.
- K. All wiring shall be checked for grounds, opens, and shorts, prior to termination at panels and installation of detector heads. The minimum resistance to ground or between any two conductors shall be ten (10) megohms, as verified with a megger. Provide advance notice to the Architect/Engineer of these tests.
- L. The system shall be electrically supervised for open or (+/-) ground fault conditions in SLC, alarm circuits, and control circuits. Removal of any detection device, alarm appliance, plug-in relay, system module, or standby battery connection shall also result in a trouble signal. Fire alarm signal shall override trouble signals, but any pre-alarm trouble signal shall reappear when the panel is reset.
- 3.4 NOTIFICATION DEVICES
- A. Both audible and visible alarm signals shall be provided. Visible signals shall be the strobe (flash discharge) type, with white or clear lens, and shall comply with current ADA requirements for intensity and placement.
- B. Alarm notification appliance (NAC) circuits shall be NFPA 72 Style Y (Class B). The load connected to each circuit shall not exceed 80% of rated module output and the coverage of each circuit shall not exceed 3 floors (to limit the effect of faults, and to facilitate trouble-shooting). The NAC voltage drop during alarm shall not exceed 14% of the voltage measured across the batteries at that time. To achieve this, the design shall consider wire size, length of circuit,

device load, inherent voltage loss within the FACP's power supply, etc. The contractor shall use power outage testing to verify that the NAC circuit was designed and installed properly.

- C. End of Line (EOL) Device: The end of line device shall be installed in accessible terminal cabinets or dedicated accessible boxes, to facilitate testing and maintenance.

### 3.5 DETECTORS

- A. Detectors used for elevator: Primary, alternate recall points and the machine room & the shaft shall be indicated on the control Matrix. Elevator capture or control signals shall come from the FACP as relayed by control modules.
- B. When installed in a room, detectors shall be oriented so their alarm light is visible from the nearest door to the corridor, unless Remote Alarm Indicator Light (RAIL) equipped.
- C. Spot-type smoke detectors shall secure the head to the base thru the built-in locking device. For detector mounted within 12 feet of the floor, activate this lock after the system has been inspected and given final acceptance.
- D. Unless suitably protected against dust, paint, etc., spot type smoke detectors shall not be installed until the final construction clean-up has been completed. In the event of contamination during construction, the detectors shall be replaced by the contractor at no additional cost to the Owner. Covers supplied with smoke detector heads do not provide protection against heavy construction dust, spray painting, etc., and shall not be used for that purpose. They are suitable only during final, minor cleanup or touchup operations.
- E. A detector installed where accidental damage or deliberate abuse is expected shall be provided with a guard that is listed for use with it and is acceptable to the AHJ.
- F. Identification of individual detectors is required. Assign each a unique number as follows, in sequence starting at the FACP: (Addressable Loop # -- Device #) Show on the as-built plans, and also permanently mount on each detector's base so that it's readable standing on the floor below without having to remove the smoke detector. Exception: For detectors with housings (i.e., air duct, projected beam, air sampling, flame), apply the identification to a suitable location on exterior of their housing. Device labels may not be affixed to the device. Identification labels shall be printed labels with black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.
- G. Duct Mounted Smoke Detectors:
  - 1. All air duct/plenum detectors shall have a Remote Alarm Indicator Lamp (RAIL) installed in the nearest corridor or public area and identified by an engraved label affixed to the wall or ceiling. Where detectors are in close proximity, RAIL devices shall be grouped as shown on the Drawings. Duct smoke detectors are permitted to be installed only inside an air duct. It is not appropriate to mount them in front of a return air opening. Duct detectors shall also be installed in a manner that provides suitable, convenient access for required periodic cleaning and calibration. The numbers of detectors per duct shall be per NFPA 72 requirements based on the size of the air duct, air duct configuration, air speed, and duct manufacture's installation requirements.
  - 2. Each duct detector installation shall have a hinged or latched duct access panel, 12x12 inches minimum, for sampling tube inspection and cleaning. Indicate airflow direction on the duct, adjacent to the detector, using stencil or permanent decal.



3. Duct detector sampling tubes shall extend the full width of the duct. Those over 36 inches long shall be provided with far end support for stability. The preferred method for providing support is to extend the intake tube through the far side of the duct, seal around the tube where it penetrates the duct wall, and plug the end with a rubber stopper. This facilitates visual inspection, intake tube cleaning, and injection of smoke or equivalent aerosol for testing the detector.
4. Duct smoke detector mounting position and air sampling tube orientation are critical for proper operation. The Manufacturer's detailed installation instructions shall be followed. The contractor shall mark the direction of air flow on the duct at each duct detector location.
5. Unless the AHJ requires otherwise, all duct smoke detectors shall be programmed for fire alarm (not for supervisory annunciation).

### 3.6 AIR HANDLER UNIT (AHU) SHUTDOWN

- A. A supervised "AHU Shutdown Defeat" switch shall be provided in/adjacent to the FACP or as a key-operated function in the Remote Annunciator (if provided). If the FAA option is utilized, provide an informative engraved label at the FACP about this function. The switch shall cause a system "trouble" indication when it's placed in the off-normal ("Shutdown Defeated") position. This is to provide the Owner with a convenient means to temporarily resume HVAC operation in the event an unwanted alarm shall not clear, prior to arrival of the fire alarm service technician.
- B. If the system includes AHU shutdown or smoke removal startup, silencing the alarm (without resetting) shall not reverse the shutdown. A supervised "AHU Shutdown Defeat" switch shall be provided in the FACP. The switch shall be labeled and its "Normal" position indicated. Provide supervised Hand-Off-Auto switch(es) at the FACP for any building smoke control equipment (pressurization or exhaust fans).

### 3.7 ANNUNCIATOR

- A. Each addressable fire alarm system shall include an LED-type "zone" annunciator at (or in) the FACP, or in another location if acceptable to the AHJ. As a minimum, this annunciator shall indicate the specific type of alarm or supervisory signal (smoke detector, water-flow, sprinkler valve closed, etc.), for groups of addressable devices. The area ("zone") that is represented by each LED shall not exceed 1 floor or 22,500 square feet, and shall not cross building fire walls or smoke compartments.
  1. Systems in 1 or 2-story buildings, which have 30 or fewer initiating devices, are permitted to omit the LED-type "zone" annunciator.
  2. Systems with a Graphic Annunciator (GA) are permitted to omit the LED-type "zone" annunciator.
  3. The LED annunciator is permitted to be omitted if the FACP has a multi-line display that automatically defaults to displaying the first alarm, plus the first 3 (minimum) water-flow alarms and the last alarm. This is permitted to be done using 2 automatically alternating screens. If there is no sprinkler system, program the FACP to show the first 4 alarms plus the last alarm received.

### 3.8 ALARM VERIFICATION FOR SMOKE DETECTORS

- A. The fire alarm system shall be equipped with Alarm Verification.

- B. System shall provide as a feature an alternate signal processing algorithm to verify the presence of smoke. The algorithm shall be selectable during system programming. The total effective delay created by the verification algorithm shall not exceed 60 seconds.

### 3.9 REMOTE ALARM TRANSMISSION REQUIREMENTS

- A. Each system with automatic fire detection, or which monitors a sprinkler system, shall be equipped with a 4-channel (minimum) Digital Alarm Communicator Transmitter (DACT) for transmission of fire alarm, supervisory, and trouble signals to a Central Station, Remote Supervising Station, or Proprietary Supervising Station. DACT shall be dual line type in accordance with NFPA 72.
- B. As applicable the following signals shall be reported:
  - 1. Fire Alarm
  - 2. Fire Alarm System AC Power Trouble (only if 120vac interrupted for 1 to 8 hours)
- C. In lieu of a DACT, the use of an addressable network is acceptable. Other appropriate means of transmitting fire alarm system signals off-premises may be permitted to be used, at the discretion of the AHJ who approves the plans.
- D. The Contractor shall provide a type of DACT that is compatible with the owner's alarm receiving equipment, or the Supervising Station selected by the owner, as applicable. He shall also program the PROM, connect each DACT to the telephone line(s) provided to him, and verify proper signal receipt by the Supervising Station. The transmission means shall comply with NFPA 72 (which does not permit VOIP).
  - 1. See NFPA 72 for means of transmission requirements. It permits the phone line(s) to be shared, since the DACT can capture a line that's busy if needed. However, PBX station circuits are not permitted to be used. Contact the AHJ if VOIP, cellular, derived local channel, or RF technology is intended for the reporting means
  - 2. Where leased or dedicated lines are available back to the Owner's security station provide a polarity reversal type alarm module. Polarity reversal type alarm modules report only Alarm, Line Trouble, and OK conditions.

### 3.10 SPRINKLER SYSTEM MONITORING

- A. The following sprinkler system alarm and supervisory functions shall be provided as a part of the fire alarm system:
  - 1. Water-flow alarm, by sprinkler zone (not to exceed one floor).
  - 2. Supervision of each control valve.
- B. Sprinkler supervisory monitoring of flow switches, tamper switches, and similar functions shall be accomplished with a separate system address for each activity monitored.

### 3.11 SYSTEM DOCUMENTATION, TRAINING AND MAINTENANCE

- A. Maintenance: The manufacturer, or authorized distributor, shall maintain software version records on the system installed. The system software shall be upgraded free of any charge if a new VER is released during the warranty period. For new VER to correct operating problems, free upgrade shall apply during the entire life of the system.

- B. System Report in addition to the Shop Drawing submittal described elsewhere, the fire alarm system contractor shall provide the Architect/Engineer two bound copies of the following technical information, for transmittal to the owner:
1. As-Built wiring diagram showing all loop numbers and device addresses, plus terminal numbers where they connect to control equipment.
  2. As-built wiring and conduit layout diagrams, including wire color code and/or label numbers, and showing all interconnections in the system.
  3. Electronic circuit diagrams of all control panels, modules, annunciators, communications panels, etc.
  4. Manufacturer's detailed maintenance requirement.
  5. Technical literature on all control equipment, isolation modules, power supplies, batteries, detectors, manual stations, alarm/supervisory signal initiating devices, alarm notification appliances, relays, remote alarm transmission means, etc.
  6. The as-built "calculations" sheet.
- C. Electronic archive: Complete configuration data (site-specific programming) for the system shall be stored on electronic media and archived by the fire alarm system manufacturer or authorized distributor. A diskette or CD copy of this data shall be submitted to the Architect/Engineer for transmission to the owner on the day the system is commissioned. The contractor shall provide the owner with one copy of the following:
1. All software required, both for the installed fire alarm system and personal computer (PC) necessary to access the fire alarm system for trouble shooting, programming, modifications, monitoring, de-bugging, or similar functions, (if Owner does not have the needed PC to check the system).
  2. Complete documentation for all software for both the installed fire alarm system and for any interface PC software necessary for system functions as described above.
  3. Framed floor plans, mounted at the FACP. Plans shall show all system devices with the unique device identification numbers indicated adjacent to each device. The identification numbers shall match those represented in the as-built drawings and those reported at the FACP and the LCD annunciator.
  4. Interconnection cable where such is required to connect the fire alarm system to a PC; (if Owner does not have the needed PC to check the system).
- D. Training; the manufacturer's authorized representative shall instruct the owner's designated employees in operation of the system, and in all required periodic maintenance. Two copies of a written, bound summary shall be provided, for future reference.
1. Some facilities maintain their own systems and require more in-depth training. Check to verify needs and requirements.
  2. Scheduling of training shall be arranged to meet the Owner's schedule. Additional training shall be available at a cost to be mutually agreed upon by the Owner and the Contractor.
  3. Training shall be in the Owner's provided classroom.
  4. The training may not be waived, deleted or reduced in the number of hours required.
  5. Training shall cover as minimum the following topics:
    - a. Preventive maintenance service techniques and schedules, including historical data trending of alarm and trouble records.

- b. Overall system concepts, capabilities, and functions. Training shall be in depth, so that the owner shall be able to take any device out of service and return any device to service without need of Manufacture's approval or assistance.
- c. Explanation of all control functions, including training to program and operate the system software.
- d. Methods and means of troubleshooting and replacement of all field wiring devices.
- e. Methods and procedures for troubleshooting the main fire alarm control panel, including field peripheral devices as to programming, bussing systems, internal panel and unit wiring, circuitry and interconnections.
- f. Manuals, drawings, and technical documentation. Actual system software used for training shall be provided in digital form and shall be left with the Owner at the completion of training for the Owner's use in the future.
- g. The owner shall be trained to perform all NFPA 72 required maintenance. The training shall include both demonstration and supervision of a "hands-on" replacement of heads. Panel modifications required to take detector heads out of service and return them to service shall be "hands-on" training session. The training shall be in a minimum of two 4-hour sessions provided on separate days. The schedule shall be coordinated with the owner. A written competency test shall be submitted to the Architect/Engineer and to the owner as a sample prior to using the written competency test at the site. A written description of a hands-on test shall be provided to the Architect/Engineer and owner for review prior to using the test at the site. As a minimum the following tests shall occur during certification of the owner's employee:
  - 1) Three smoke heads shall be taken offline at the panel and removed physically.
  - 2) Three smoke heads shall be reinstalled and returned to service at the fire alarm panel.
  - 3) The vendor shall provide three dirty smoke detector heads to be installed at various positions in the building. The owner shall print a sensitivity report and the employees shall find the "dirty" smoke detector heads by reviewing the sensitivity report.
  - 4) A ground fault and an isolation problem shall be introduced by the vendor into the system. The employees shall then find the ground fault and the isolation problem.
  - 5) An NFPA 72 "Record of Completion" form shall be provided and the employees shall fill out the forms which shall be checked by the vendor for proper use of the form.
  - 6) The written testing for how to perform services on a panel shall be given during the last 4 hour session with the employees.
  - 7) The vendors shall witness the owner's "trained" employees, train other employees and correct any mistakes made during the training session. This is expected to occur during the 2nd four hour session.

### 3.12 SYSTEM TESTING AND CERTIFICATION

- A. Upon completion of the installation the Contractor and the Manufacturer's authorized installer together shall conduct a 100% performance test of each and every alarm initiating device for proper response. The system shall operate for 48 hours prior to start of test. The Contractor shall be present for the full 100% test.

- B. The A/E and owner shall be given 7 days advance notice of the tests. All Audio Visual Device Testing shall be scheduled with the owner.
- C. 100% Test: The manufacturer or authorized distributor (by definition, "installer") shall 100% test all site-specific software functions for the system and then provide a detailed report or check list showing the system's operational matrix. This documentation shall be part of the "System Status and Programming Report".
1. Upon completion of the installation and its programming, the installer's technician shall test every alarm initiating device for proper response and indication, and all alarm notification appliances for effectiveness. Also, in coordination with the other building system contractors, all other system functions shall be verified, including (where applicable) elevator capture and the control of HVAC systems, door locks, pressurization fans, fire or smoke doors/dampers/shutters, etc. The Architect/Engineer shall be notified in advance of these 100% tests, to permit witnessing them if desired.
  2. If AHU shutdown occurs for any alarm, then the matrix would indicate the specific control relay(s) for that function being commanded to operate for alarm from any initiating device. If a rolling steel fire door is to drop only upon water-flow alarm from its sprinkler zone, or upon any two spot smoke detectors in adjacent spaces being simultaneously in alarm, the matrix would show the door's control relay activating upon alarm from the applicable water-flow switch(es), or from any two smoke detectors in the selected spaces (AND gate)
  3. The Digital communicator shall be on-line tested for proper communication to the receiving station.
  4. All supervised circuits shall also be tested to verify proper supervision. (Control circuits and remote annunciation lines are among those required to be supervised.)
  5. All testing described above shall be repeated in the event that subsequent software or wiring modifications are determined necessary to meet the requirements of the contract documents. Such re-testing shall be included as part of the base bid and provided at no additional cost to the Owner.
  6. Test Documentation: The installer shall fill out and submit the following documentation to the owner, through the Architect/Engineer, prior to the AHJ's system acceptance inspection:
    - a. Written verification that this 100% system test was done with copy of print out generated during test.
    - b. The NFPA 72, "Record of Completion" Form. Use this form (no substitutes) to detail the system installation and also to certify that: (a.) It was done per Code, and (b.) The Code-required 100% test was performed. The fire alarm installer (manufacturer or authorized distributor's technician) shall sign this form. If a representative of the AHJ, owner, or Architect/Engineer witnesses the tests, in whole or in part, they shall also sign the form to signify that fact only (annotating the form as needed to clarify their limited role).
    - c. For buildings with a smoke control or smoke purge system, an HVAC balance report, in the smoke control / smoke purge mode.
    - d. The System Status and Programming Report described in NFPA 72. This shall be generated on the day of the system acceptance inspection and shall include the measured sensitivity of each smoke detector.
    - e. The purpose of doing Item (d) on the day of the inspection is to assure detector sensitivity has not been affected by construction dust. Prudent contractors shall have taken measures to prevent detector contamination during construction, and shall also have had the system do a detector sensitivity test and printout prior to the

day of the inspection, to make certain all devices are properly programmed and operating within their limits.

7. After completion of the 100% system test and submission of documentation as described above the installer is to request the Architect/Engineer to set up an inspection. The system shall operate for at least two days prior to this inspection. The responding Fire Department shall be notified of this, for pre-fire planning purposes. On local government projects, local fire authorities may also want to participate in system acceptance inspections. However, for State-owned property they have no inspection jurisdiction and, if present, are only to observe.

### 3.13 PRE-FINAL AND FINAL INSPECTION

- A. Pre-Final Inspection: At the Owner's request and after passing the Designer's pre-final inspection, the Contractor and Manufacturer's authorized installer shall conduct system test in the presence of the Owner and the Designer.
- B. Final Inspection: The fire alarm system shall be inspected, with portions of it functionally tested. This shall normally include the use of appropriate means to simulate smoke for testing detectors, as well as functionally testing the system interface with building controls, fire extinguishing systems and any off-premises supervising station. Operation of any smoke removal system shall be checked as instructed by the AHJ. This statistical (sampling) inspection is intended to assure that the contractor has properly installed the system and performed the 100% operational test as required by NFPA 72. The electrical contractor shall provide two-way radios, ladders, and any other materials needed for testing the system, including a suitable smoke source.
- C. The test shall be conducted entirely by the Contractor. A copy of the final database software shall be presented to the Owner before this test. The software shall be loaded from these disks into the system in the presence of the Owner. The review shall then be conducted using this software. Any deficiencies shall be recorded and corrected. After the items have been corrected, the system shall be tested again.
  1. In the event of malfunctions or excessive nuisance alarms, the Contractor shall take prompt corrective action. The Owner may require a repeat of the Contractor's 100% system test, or other inspections.
  2. Test Report: Upon successful completion of the Inspection and after the correction of all efficiencies, the manufacturer's authorized representative shall issue a test report to the Architect/Engineer and Owner, detailing and certifying the test.
  3. System Acceptance: After successful completion of the Final Inspection and recommendation of the Architect/Engineer, the system shall be accepted by the Owner. At this time the warranty period begins.

END OF SECTION 283211