

PROJECT MANUAL FOR
THE CONSTRUCTION OF

**Macon Bibb County,
Macon Bibb County UDA,
And The Tubman African American
Museum, Inc.**

**The Buildout of the Multi-Use Assembly Space at the
Tubman Museum
310 Cherry St
Macon, GA 31201**

ARCHITECT'S PROJECT NUMBER # 2022-241

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**SECTION 01 0410
PROJECT COORDINATION**

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section shall generally cover Project Coordination and Subcontractor Coordination as it may apply to the project.

PART 2 PROJECT COORDINATION

- 2.01 The Contractor shall afford Subcontractors reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work, and shall see that all work is properly connected and coordinated.
- 2.02 The Contractor shall cooperate with the representative and employees of the Architect, with subcontractors and with any other contractors on the premises who may be employed by the Owner to expedite the construction of the entire facility.
- 2.03 If any part of the work depends, for its proper execution or completion, upon the work of others, the Contractor shall report promptly in writing to the Architect and Owner any defects in the work of others or other causes that interfere with the proper execution or completion of the work. Failure to do so would constitute a waiver of claim against the Owner except for latent defects not reasonably noticeable at the time the Contractor commenced that part of the work.
- 2.04 Whenever work being done by the Owner's forces, or by other contractors, is contiguous to work covered by this contract, the various rights of the various interests involved shall be established by the Architect.

PART 3 MAJOR SUBCONTRACTORS' COOPERATION

- 3.01 It shall be the responsibility of the General Contractor to coordinate the project as a whole, but it will also be the subcontractor's responsibility to closely coordinate their work with each other so that when material is delivered to the site, it may be installed without delay.
- 3.02 If any subcontractor should fail to introduce his portion of the work according to the schedules, and this failure would interfere with the proper execution or completion of the work, he should report such deficiencies to the General Contractor, in writing, and he in turn shall be guided by the directions as stated in Paragraph 2.03 herein.

END OF SECTION

**SECTION 01-0600
INSPECTIONS**

PART 1 GENERAL

1.01 DESCRIPTION

- A. The General Contractor, subcontractors, and separate contractors shall request inspections from applicable governmental agencies in accordance with prevailing laws and ordinances governing their respective trades. At completion of the Project, the Contractor shall secure and submit, to the Owner, a certificate executed by the various inspection agencies stating that the construction has been inspected and is acceptable.
- B. Agencies applicable to the inspection process are:
 - 1. Building Inspection Department
 - 2. State and Local Fire Marshal
 - 3. Plumbing Inspector
 - 4. Electrical Inspector
 - 5. Heating and Ventilation Inspector
 - 6. Others, as required by Local Authorities
- C. Upon Substantial Completion of the Project, the General Contractor shall secure and submit to the Owner, a Certificate of Occupancy executed by Local Building Inspector and Fire Marshal.

1.02 NOTIFICATION

- A. Contractor shall give adequate advance notice of request for inspections in accordance with the requirements-of the various agencies.
- B. Prior to commencing work, the Contractor shall contact a representative of each of the Agencies and determine the required intervals for inspection and the required advance notice for the various inspections.

END OF SECTION

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Project Description:

This project is a build-out of a multi-purpose existing 6,323 square foot interior space. The scope of work shall include minor demolition of walls and ceilings construction. In addition, this work includes new construction of walls, ceilings, flooring, painting, movable partitions, retractable stage, mechanical, electrical, and plumbing systems.

The doors, frames, hardware, and ceiling will match the existing

Contractor to provide a separate price for additional movable partition and associated ceiling, mechanical and electrical. These changes are identified on the Alternate # 1 drawings.

This work will include cutting and patching

- 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

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.
- C. 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.

Warranty

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

Materials

- 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.

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 primer.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

Preparation

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protective: 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 to occupied areas if building is occupied.

Performance

- A. General: Employ qualified 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, similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots 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/or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 5. Proceed with patching after construction operations requiring cutting are complete.
- 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 Enclosure: Patch components in a manner that restores enclosure to a weather tight 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

**SECTION 01 7400
WARRANTIES AND COMPLETION CERTIFICATES**

PART 1 GENERAL

1.01 DESCRIPTION

- A. Categories of Specific Warranties: It is recognized that warranties on the work are in several categories, including those of the General Conditions, and including (but not necessarily limited to) the following specific categories related to the individual units of work specified in the section of Division 2 thru 16 of these specifications.
1. Special Project Warranty: (Guaranty): A warranty specifically written and signed by the General Contractor for a defined portion of the work; and where required, countersigned by the subcontractor, installer, manufacturer or other entity engaged by the Contractor; formerly generally recognized as (and sometimes specified in the Contract Documents as) a "guaranty".
 2. Specified Product Warranty: A warranty which is required by the Contract Documents, to be provided for a manufactured product which is incorporated into the work; regardless of whether the manufacturer has published the warranty without regard for specific incorporation of the product into the work, or has written and executed the warranty as a direct result of the Contract Document requirements.
 3. Coincidental Product Warranty: A warranty which is not specifically required by the Contract Documents (other than as specified in this Section); but which is available on a product incorporated into the work, by virtue of the fact that the manufacturer of the product has published the warranty in connection with purchases and uses of the product without regard for specific applications except as otherwise limited by the terms of the warranty.
- B. Definition- Manufactured Product: A physical item for incorporation into the work, which has been produced from raw or natural materials by a manufacturing process, and which is purchased from a manufacturer either specifically for the work or the General Contractor's/Subcontractor's/ Fabricator's/Installer's stock from which it is drawn for incorporation into the work.
- C. Explanation: This section specifies general requirements for special project warranties, specified product warranties, and coincidental product warranties. It is recognized that certain required "certifications" and other commitments and agreements for continuing services to the Owner, flowing out of the Contract, are similar to the requirements of this Section, and are specified elsewhere in the Contract Documents.
- D. Refer to individual sections of Division 2 through 16 for the determination of units of work that are required to be specifically or individually warranted, and for the specific requirements and terms of those warranties (or guarantees).
- E. Refer to the General Conditions for terms of the General Contractor's general warranties.
- F. General Limitations: It is recognized that specific warranties are intended primarily to protect the Owner against failure of the work to perform as required, and against deficient, defective and faulty materials and workmanship, regardless of sources. Except as otherwise indicated specific warranties do not cover failures in the work which result from: 1. Unusual and abnormal phenomena of the elements, 2. The Owner's misuse, maltreatment or improper maintenance of the work, 3. Vandalism after the time of Substantial Completion, or 4. Insurrection or acts of aggression including war. Although the manufacturer's commitments in product warranties on products used in the work are generally written to exclude the substrate supporting the product, such limitations in product warranties do not relieve the General Contractor of the more general warranties on work which incorporates the use of such products. Except as otherwise indicated, this same relationship applies to units of work performed by other entities (other than

- manufacturers), such as fabricators, installers and subcontractors who are required to countersign special project warranties (and guaranties) with the General Contractor for such units of work.
- G. Related Damages and Losses: In connection with General Contractor's correction of warranted work which has failed, remove and replace other work of the project which has been damaged as a result of such failure, or must be removed and replaced to provide access for correction of such warranted work.
- H. Replacement cost, Obligations: Upon determination within the warranty period that a unit of work covered by a special project warranty or a product covered by a specified product warranty has failed, proceed promptly to replace or restore the unit or product to acceptable condition complying with the requirements of the Contract Documents. Except as otherwise indicated, the cost of replacing or restoring such failing unit or product is the General Contractor's obligation, without regard for whether the Owner has already benefited from use of the failing unit or product through a portion of its anticipated useful service life.
- I. Owner's Resources: Except as otherwise indicated, specific warranties do not diminish implied warranties, and shall not deprive the Owner of actions, rights, and remedies otherwise available to him for the General Contractor's failure to fulfill requirements of the Contract Documents, nor shall the periods of warranties be interpreted as limitations on the time in which the Owner can pursue such actions, rights or remedies.
1. Rejection of Warranties: Owner reserves the right, at the time of Substantial Completion or thereafter, to reject coincidental product warranties submitted by the General Contractor, which in the opinion of the Owner, tend to detract from or confuse the interpretation of requirements of Contract Documents. Refer to instances of uncertainty to the Architect or Engineer prior to purchase of products, where coincidental product warranties may be in conflict with the requirements of the Contract Documents
- J. General Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or sub-subcontract for materials or units of work for the project where a special project warranty, specified product warranty, certification or similar commitment is required by the Specifications, without the provider being willing to sign such commitments. Refer seemingly irresolvable instances to the Architect for administrative or procedural consultation before proceeding.
- 1.02 QUALITY ASSURANCE- SPECIFIC WARRANTY FORMS
- A. General: Where a special project warranty (guaranty) or specified product warranty is required, prepare a written document to contain the terms and appropriate identification, ready for execution by required parties. Submit draft to Owner (through Architect or Engineer) for approval prior to final execution.
- B. Submit specific warranties along with requests for certification at Substantial Completion. Date(s) will be inserted to correspond with certification as established by the Architect and accepted by the Owner.

END OF SECTION

SECTION 02 4120

SELECTIVE BUILDING DEMOLITION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Selective demolition of building elements for alteration purposes.

1.03 REFERENCES

- A. Definitions:
 - 1. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.
 - 2. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.
 - 3. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
 - 4. Remove and Repair: Detach items from existing construction, prepare for reuse by repairing defects and returning to like new condition, and reinstall where indicated.
 - 5. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
 - 6. Replace: Remove items of existing construction, dispose of materials off- site, unless otherwise indicated and install new material as indicated.
- B. Reference Standards:
 - 1. 29 CFR 1926 - Safety and Health Regulations for Construction.
 - 2. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.04 MATERIALS OWNERSHIP

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

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

1.05 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be demolished.
 - 2. Review structural load limitations of existing structures.
 - 3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review and finalize protection requirements.
 - 5. Review procedures for noise control and dust control.
 - 6. Review procedures for protection of adjacent buildings.
 - 7. Review procedures for protection of adjacent spaces.
 - 8. Review items to be salvaged and returned to Owner.
 - 9. Review procedures for affected utilities.

1.06 SUBMITTALS

- A. Site Plan: Showing:
 - 1. Vegetation to be protected.
 - 2. Areas for temporary construction and field offices.
 - 3. Areas for temporary and permanent placement of removed materials.
 - 4. Indicate proposed locations and construction of barriers.
- B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities including the following:
 - 1. Extent of demolition.
 - 2. Removal sequence.
 - 3. Bracing and shoring.
 - 4. Location and construction of barricades and fences.
 - 5. Identify demolition firm and submit qualifications.

6. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.
- C. Qualification Data: Submit the following:
 1. Demolition firm qualification data.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations.

1.07 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.08 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
 1. Minimum of five years of documented experience.

1.09 FIELD CONDITIONS

- A. Spaces immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied spaces will not be disrupted.
 1. Provide not less than 4 business days notice of activities that will affect operations of adjacent occupied spaces.
 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent spaces.
 - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent spaces without written permission from authorities having jurisdiction.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
- D. On-site storage or on-site sale of removed items or materials is not permitted.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

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

PART 3 EXECUTION

3.01 SCOPE

- A. Remove portions of existing building as indicated on Drawings.
- B. Remove items indicated, for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Use of explosives is not permitted.
 - 3. Provide, erect, and maintain temporary barriers and security devices.
 - 4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 6. Do not close or obstruct roadways or sidewalks without permit.
 - 7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.

2. Prevent movement or settlement of adjacent structures.
 3. Stop work immediately if adjacent structures appear to be in danger.
- E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- F. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.

3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without minimum 14 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without minimum 7 days prior written notification to Owner.
- F. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 DEMOLITION BY MECHANICAL MEANS

- A. Unless directed otherwise by Owner, remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- B. Salvage: Items to be removed and salvaged are indicated on Drawings.

3.05 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
1. Verify that construction and utility arrangements are as indicated.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- D. Remove existing work as indicated and as required to accomplish new work.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
- F. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 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.
- B. Do not burn demolished materials.

3.07 CLEANING

- A. Clean adjacent areas and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
 - 1. Clean roadways of debris caused by debris transport.

2. Leave site and work areas in clean condition, ready for subsequent work.

END OF SECTION

SECTION 04 8100 UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1. Concrete masonry units (CMUs).
 - 2. Mortar and grout.
 - 3. Reinforcing steel.
 - 4. Masonry joint reinforcement.
 - 5. Ties and anchors.
 - 6. Miscellaneous masonry accessories.
 - B. Related Sections include the following:
 - 1. Division 7 Section for damp proofing applied to face of masonry walls as indicated on Drawings.
 - 2. Division 7 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
 - 3. Division 7 Section "Penetration Firestopping" for firestopping at openings in masonry walls.
 - 4. Division 7 Section "Fire-Resistive Joint Systems" for fire-resistive joint systems at heads of masonry walls.
 - 5. Division 7 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.
 - C. Products furnished, but not installed, under this Section include the following:
 - 1. Dovetail slots for masonry anchors, installed under Division 03 Section "Cast-in- Place Concrete".
 - D. Products installed, but not furnished, under this Section include the following:
 - 1. Steel lintels and shelf angles for unit masonry, furnished under Division 5 Section "Metal Fabrications".
2. Manufactured reglets in masonry joints for metal flashing, furnished under Division 7 Section "Sheet Metal Flashing and Trim".

1.03 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.
- B. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated.
- C. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes. Show control joints and expansion joints, indicating locations and details.

2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement". Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications. Show profiles, material thicknesses, and identify sealant types used at terminations and lapped joints.
- D. Samples for Verification: For each type and color of the following:
 1. Accessories embedded in masonry.
- E. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.
 1. Cementitious materials. Include brand, type, and name of manufacturer.
 2. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 3. Grout mixes. Include description of type and proportions of ingredients.
 4. Reinforcing bars.
 5. Joint reinforcement.
 6. Anchors, ties, and metal accessories.
- F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
- G. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- H. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.
- I. Meeting Records: Minutes of pre-installation conference.

1.06 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- C. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
- D. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
 1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 48 inches high.
 2. Clean one-half of exposed faces of panels with masonry cleaner indicated.
 3. Protect approved sample panels from the elements with weather-resistant membrane.
 4. 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 Design Consultant 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 Design Consultant in writing.

- E. Pre-Installation Conference: Conduct conference at Project site.

1.07 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 designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

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

1.08 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such 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.
- D. 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 ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.01 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of

units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.02 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners, unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent for units exposed to the weather, unless otherwise indicated.
 - 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 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
 - 2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Addiment Incorporated; Block Plus W-10.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.
 - c. Master Builders, Inc.; Rheopel.
- C. Concrete Masonry Units: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
 - 2. Weight Classification: Lightweight
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions, as indicated on Drawings.
 - 4. Exposed Faces: Provide manufacturer's standard color and texture, unless otherwise indicated.

2.03 CONCRETE AND MASONRY LINTELS

- A. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.
- B. Concrete Lintels: Precast units made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated. Cure precast lintels by same method used for concrete masonry units.
- C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.04 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, 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.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207,

Type S.

- D. Aggregate for Mortar: ASTM C 144.
 - 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.
- E. Aggregate for Grout: ASTM C 404.
- F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Addiment Incorporated; Mortar Kick.
 - b. Euclid Chemical Company (The); Accelguard 80.
 - c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
 - d. Sonneborn, Div. of ChemRex; Trimix-NCA.
- G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Addiment Incorporated; Mortar Tite.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
 - c. Master Builders, Inc.; Color Cure Mortar Admix or Rheomix Rheopel.
- H. Water: Potable.

2.05 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951.
 - 1. Interior Walls: Mill-galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size for Side Rods: W2.8 or 0.188-inch diameter.
 - 4. Wire Size for Cross Rods: W2.8 or 0.188-inch diameter.
 - 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.06 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
 - 2. Galvanized Steel Sheet: ASTM A 653, Commercial Steel, G60 zinc coating.
 - 3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153.
- B. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel wire.
 2. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch- diameter, hot-dip galvanized steel wire
 3. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.097-inch- thick, steel sheet, galvanized after fabrication
 4. Tie Section for Concrete: Corrugated metal ties with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch of masonry face.
- C. Partition Top Anchors: 0.097-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- 2.07 MISCELLANEOUS ANCHORS
- A. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.
- 2.08 EMBEDDED FLASHING MATERIALS
- A. Metal Flashing: Provide metal flashing complying with Division 7 Section "Sheet Metal Flashing and Trim".
 - B. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section "Sheet Metal Flashing and Trim".
 - C. 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.
- 2.09 MISCELLANEOUS MASONRY ACCESSORIES
- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.
 - B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.

- b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
- c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
- d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.10 MASONRY CLEANERS

A. Proprietary Acidic 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.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.11 MORTAR AND GROUT 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. Limit cementitious materials in mortar to portland cement and lime.
 3. 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.
 4. Add water-repellent admixture to mortar used in joints of concrete masonry units with integral water repellent.
- 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. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
1. For masonry below grade or in contact with earth, use Type M.
 2. For reinforced masonry, use Type S or N.
 3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Thickness: Build composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. 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.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- F. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
 - 1. 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 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 4. For exposed 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. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 5. 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.
 - 6. 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.
 - 7. 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.

3.03 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 running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
 - C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
 - D. Stopping and Resuming Work: Stop work by racking 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.
 - E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
 - F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
 - G. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
 - H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.
 - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 7 Section "Fire-Resistive Joint Systems."
- 3.04 MORTAR BEDDING AND JOINTING
- A. Lay hollow concrete masonry units as follows:

- 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
 - C. Joints in exterior masonry shall be tight and free of any voids or separations. Penetrations in exterior walls shall be completely sealed with mortar or specified

sealant, as indicated. Refer to Division 7 "Joint Sealants" for joint sealants.

3.073.05 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c, unless otherwise indicated.

2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls, unless otherwise indicated.

3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings, unless otherwise indicated.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.06 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.

2. Space anchors as indicated, but not more than 16 inches o.c. vertically and 36 inches o.c. horizontally.

3.07 CONTROL AND EXPANSION JOINTS

A. General:

1. Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

2. Install control and expansion joints at locations indicated on Drawings. In the event control joints are not indicated on the Drawings, space control joints at 20'-0" on center, maximum.

B. Form control joints in concrete masonry as follows:

1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants", but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.08 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete or masonry lintels where shown and where openings of more than 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.09 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry

as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches.
- 3.10 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 Design Consultant'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 masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
- 3.11 MASONRY WASTE DISPOSAL
- A. 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 Division 2 Sections.
 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's

property.

END OF SECTION 04810

SECTION 05 4000

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Formed steel stud interior wall framing.
 - 2. Load-bearing wall framing.

1.03 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation.
 - 1. Coordinate with work of other Sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.
- B. Attendees shall include contractor, cold formed metal framing installer, and installers of adjacent materials and systems.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Provide data on standard framing members; describe materials and finish, product criteria, limitations.
 - 2. Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
- B. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
 - 1. Indicate stud and soffit framing layout.
 - 2. Describe method for securing studs to tracks and for bolted framing connections.
 - 3. Calculations for loadings and stresses of framing, signed and sealed by a professional structural engineer.

4. Details and calculations for factory-made framing connectors, signed and sealed by a professional structural engineer.
- C. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.
- D. Designer's Qualification Statement: Written statement of designer qualifications.
- E. Manufacturer's Qualification Statement: Written statement of designer qualifications.

1.05 CLOSEOUT SUBMITTALS

- A. Special Installer Warranty: Executed warranty meeting specified requirements.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
 1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 2. Protect steel members and packaged materials from corrosion and deterioration.
 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
- B. Repair or replace damaged materials or structures as directed.

1.08 WARRANTY

- A. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing:
 1. CEMCO: www.cemcosteel.com.

2. ClarkDietrich Building Systems: www.clarkdietrich.com.
3. Jaimes Industries: www.jaimesind.com.
4. Marino: www.marinoware.com.
5. Nuconsteel, A Nucor Company.
6. R-stud, LLC: <https://www.rstud.com>.
7. SCAFCO Corporation: www.scafco.com.
8. Steel Construction Systems: www.steelconsystems.com.
9. The Steel Network, Inc: www.SteelNetwork.com.
10. United Steel Deck, Inc.

B. Framing Connectors and Accessories:

1. Same manufacturer as metal framing.

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, licensed in the State of Georgia to design cold-formed steel framing system to meet the project requirements.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 1. Design Loads: As indicated on Drawings and as required by applicable code.
 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
 - b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
 - c. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.
- C. 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.
- D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Refer to fire rated assembly requirements indicated on Drawings.
 2. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.03 COLD-FORMED STEEL FRAMING

- A. Steel Sheet Materials: 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 (Z180 or G90 (Z275).
- B. 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: 18 gage minimum, as indicated by delegated design requirements.
 2. Flange Width: As indicated on drawings or as indicated by delegated design requirements.
- C. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
1. Minimum Base-Metal Thickness: 18 gage minimum, or as indicated by delegated design requirements.
 2. Flange Width: 1-1/4 inches or as indicated by delegated design requirements.
- D. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- E. 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, and as follows:
1. Minimum Base-Metal Thickness: 18 gage minimum, as indicated by delegated design requirements.

2. Flange Width: As indicated on drawings or as indicated by delegated design requirements.
- F. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 18 gage minimum, as indicated by delegated design requirements.
 2. Flange Width: As indicated on drawings or as indicated by delegated design requirements.
 - a. Inner Track: Of web depth indicated, and as follows:
 - b. Minimum Base-Metal Thickness: 18 gage minimum, as indicated by delegated design requirements.
 - c. Flange Width: As indicated on drawings or as indicated by delegated design requirements.
- G. 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.
- H. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, unpunched, and continuous without splicing, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 18 gage minimum, or as indicated by delegated design requirements.
 2. Flange Width: As indicated on drawings or as indicated by delegated design requirements.

2.04 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, as follows:
 1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.

5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.05 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.
- 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, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.
 1. Uses: Securing cold-formed steel framing to structure.
- 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.
- F. Welding Electrodes: Comply with AWS standards.

2.06 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 1. Fabricate framing assemblies using jigs or templates.
 2. Cut framing members by sawing or shearing; do not torch cut.

3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

2.07 WALL SHEATHING

- A. Refer to Section 09 2116 - Gypsum Board Assemblies.

2.08 ACCESSORY MATERIALS

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Galvanizing Repair Paint: ASTM A780/A780M.
- C. 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.
- D. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- E. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- F. Grommets: Provide protective grommets recommended by metal framing manufacturer for electrical wire and plumbing pipe passage through metal framing members.

- G. Track Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing 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. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 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 (6 mm) 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.

3.03 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 shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. 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.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 07 2100 - 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.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Shear walls: Where indicated as "shear walls" for frame stability and lateral load resistance, position additional studs to resist vertical loads as indicated by delegated design.
- K. Cutting:
 1. Cutting for utilities: Do not remove, notch, cut or relocate load-bearing studs or other structural members for utility installation or other cause without prior approval of Architect.
 2. Cut-outs: Minimize cut-outs for utilities and bridging. Locate cut-outs near bottom, but not less than 12 inches from bottom track. No cut-outs allowed at mid-points or tie points.
 3. Perform cutting with a power-driven saw with an abrasive blade. No hand cutting will be permitted. Cuts shall be clean, accurate and true to line.
- L. Attachment: Secure abutting and intersecting members using methods indicated by delegated design. Where not indicated, the following shall apply:
 1. Secure 18 gage and lighter members using screws. Secure 16 gage and heavier by welding.
 2. Screws:

- a. Comply with screw manufacturer's product data and ASTM C954 for minimum spacing and edge distance requirements and for torque requirements.
 - b. Screw penetration through joined materials shall be minimum of three exposed screw threads.
3. Welding:
- a. Welds shall develop 1,000 psi minimum strength to structural framing, 500 psi minimum strength to other cold-formed metal framing components; comply with AWS methods and requirements.
 - b. Weld only 16 gauge and heavier members directly to structural framing; weld 18 gauge and lighter members to 16 gauge or heavier clips, then weld clips to structural framing.
 - c. Weld to adjacent steel construction whenever possible.
 - d. Screw or bolt to dissimilar construction and where welding is not possible or feasible.

3.04 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 (3 mm) 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: 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. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
- E. 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.

- F. 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.
- G. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. 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 (150 mm) 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.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- H. 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.
- I. 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.

3.05 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: As indicated on Drawings.
- 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 on Shop Drawings but not more than 48 inches (1220 mm) 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 (305 mm) 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.

3.06 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings].
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.
- C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:
 1. Joist Spacing: As indicated on Drawings.
- D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.
 1. Install web stiffeners to transfer axial loads of walls above.

- F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
 - 1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
 - 2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated, and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.07 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 (1:960) and as follows.
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.08 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.

3.09 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.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

3.10 INSTALLATION OF WALL SHEATHING

- A. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
- B. Install sheathing in accordance with manufacturer instructions and delegated design requirements.
 - 1. Comply with applicable provisions of GA-253, and ASTM C1280.
 - 2. Use maximum lengths possible to minimize number of joints.
 - 3. Refer to Section 09 2116 - Gypsum Board Assemblies.

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes: Fabricated metal items as indicated.
 - 1. Steel framing and supports for the following:
 - a. Operable and movable partitions.
 - b. Overhead hung, ceiling-hung or overhead supported items.
 - c. Countertops.
 - d. Partitions.
 - e. Low partitions.
 - f. Equipment.
 - g. Concealed steel supports for restroom items and other support locations.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- B. Products Furnished But Not Installed Under This Section:
 - 1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
 - 2. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are

to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Preinstallation Conference:

1. Preinstallation Conference: Conduct meeting minimum two weeks prior to starting work of this section, requiring attendance of all trades affected by the Work of this section.

1.04 SUBMITTALS

A. Product Data: For all shop fabricated items and as follows.

1. Metal components and fabrications of this Section.
2. Fasteners.
3. Shop primers.
4. Shrinkage-resisting grout.
5. Other fabrications required for support or installation of specified items.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Provide plan drawings indicating location of each item.
2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Delegated-Design Submittal: Analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Provide submittal for the following items:

1. Indication of compliance with specified Design Requirements article, signed and sealed by a professional structural engineer including calculations.
2. Metal support and framing for:
 - a. Overhead supported doors and/or grilles.
 - b. Equipment.
 - c. Overhead or ceiling supported items.

D. Delegated-Designer Qualification Data: For professional engineer's experience with providing Delegated-Design engineering services of the kind indicated, including documentation that engineer is licensed in the State of Georgia.

E. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

- F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.
- G. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.05 QUALITY ASSURANCE

- A. Delegated-Design: Design indicated metal fabrications under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Georgia.
 - 1. Fabricated items shall comply with requirements of applicable codes.
 - 2. Include complete design of each item or assembly including materials, securement and anchorage, substrate requirements, and finishing requirements.
- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.
- C. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
 - 1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 - 2. Protect steel members and packaged materials from corrosion and deterioration.
 - 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
- B. Repair or replace damaged materials or structures as directed.

1.07 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 PRODUCTS

2.01 METAL JOINTING AND FINISH QUALITY LEVEL DESCRIPTIONS

- A. General: All items of this section are to be Architectural level, unless noted otherwise.
- B. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
 - 1. Welded Joints: Continuously welded and ground smooth and flush.

2. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
 3. Exposed Edges and Corners: Eased to small uniform radius. Exposed joints tight with face surfaces aligned.
 4. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.
- C. Service: Exposed joints tight with face surfaces aligned.
1. Welded Joints: Welded on back side wherever possible.
 2. Welds Exposed to View: Ground smooth; not required to be flush.
 3. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts or screw threads.
 4. Metal Surfaces to be Painted: Sanded smooth, suitable for satin or matte finish.

2.02 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- H. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- I. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- J. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- K. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
 1. 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.

- L. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.03 FABRICATION, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. 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.
1. 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.
 2. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 3. Form exposed work with accurate angles and surfaces and straight edges.
 4. Continuously seal joined members by continuous welds.
 5. Weld corners and seams continuously to comply with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. 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.
 6. 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.
 7. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 8. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

9. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 10. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.
 11. Fabricate items with joints tightly fitted and secured.
- C. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- D. Finish and joint quality shall be as indicated for each item.

2.04 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
1. Fabricate units from slotted channel framing where indicated.
 2. Furnish inserts for units installed after concrete is placed.
- C. Jointing and Finish Quality Level: Service, as described in this Section.
- D. Provide metal support strapping for flashing/termination bar fastening.
- E. Finish: As specified and in accordance with Section 09 9000 - Painting and Coating.
1. Exposed Items: Prepare and prime as specified in Section 09 9000 - Painting and Coating. Field finish in color selected by Architect.
 2. Concealed Items: Prepare and prime. No additional finish required.

2.05 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting. Coordinate with project Structural design requirements.
- B. Jointing and Finish Quality Level: Service, as described in this Section.
- C. Finish: As specified and in accordance with Section 09 9000 - Painting and Coating.

1. Exposed Items: Prepare and prime as specified in Section 09 9000 - Painting and Coating. Field finish in color selected by Architect.
2. Concealed Items: Prepare and prime. No additional finish required.

2.06 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.
 1. Coordinate with project Structural design requirements.
- B. Jointing and Finish Quality Level: Service, as described in this Section.
- C. Finish: As specified and in accordance with Section 09 9000 - Painting and Coating.
 1. Exposed Items: Prepare and prime as specified in Section 09 9000 - Painting and Coating. Field finish in color selected by Architect.
 2. Concealed Items: Prepare and prime. No additional finish required.

2.07 FINISHES - STEEL

- A. Galvanizing: Hot dip galvanize items as follows.
 1. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft (530 g/sq m) galvanized coating.
 2. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.
- B. Prime paint steel items.
 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry. Coat with bituminous coating after galvanizing.
 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- C. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
 1. Prepare surfaces to be primed in accordance with SSPC-SP2.
- D. Shop prime iron and 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 primers specified in Section 09 9000 - Painting and Coating, unless zinc-rich primer is indicated.

2. Prime Painting: Two coats, minimum.
- E. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
1. Indicated to Receive Primers Specified in Section 09 9000 - Painting and Coating: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
 - a. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- F. 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.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
- G. Field Painting: Where indicated, field paint items in accordance with Section 09 9000 - Painting and Coating.

2.08 MISCELLANEOUS MATERIALS

- A. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. 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.
- F. Concrete: Comply with requirements in Section 03 3000 - Cast-in-Place Concrete, for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).
- G. Separator Sheet, Self Adhered SBS Underlayment:
1. For use as follows:
 - a. Where indicated on drawings.
 - b. In lieu of bituminous paint, for protection between dissimilar materials, and for protection between dissimilar metals to prevent galvanic corrosive action.

2. Approved products:
 - a. Mid-States "Quick-Stick" HT.
 - b. W R Grace "Ice & Water Shield HT.
 - c. Henry "Blueskin PE 200 HT".
 - d. Carlisle Coatings and Waterproofing, Inc., "WIP 300HT".

H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

1. For use as a separator between dissimilar metals.
2. Apply to achieve 30 dry mil thickness.

2.09 FABRICATION TOLERANCES

- A. Squareness: 1/16 inch (1.5 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 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.
 - 1. Do not weld, cut, or abrade surfaces of 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.
 - 5. Perform field welding in accordance with AWS D1.1/D1.1M.
- 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.
- F. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- G. Utilize bituminous paint to separate dissimilar metals and metals permanent contact with concrete. Install paint with minimum two coat application with installed 30 dry mil finished thickness.
- H. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor shelf angles securely to construction with expansion anchors and anchor bolts.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

- D. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.05 REPAIRS

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

3.06 FIELD FINISHING

- A. Field Finishing: As indicated in this section. Where field finishing is required, refer to Section 09 9000.

END OF SECTION

SECTION 06 1053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Non-structural dimension wood materials.
 - 2. Preservative treated wood materials.
 - 3. Fire retardant treated wood materials.
 - 4. Equipment mounting boards.
 - 5. Concealed wood blocking, nailers, and supports.
 - 6. Structural dimension lumber framing and sheathing not included in this section.
 - a. Refer to structural drawings and specifications.

1.03 REFERENCE DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) size or greater but less than 5 inches nominal (114 mm actual) size in least dimension.
 - 1. Blocking.
 - 2. Nailers.
- C. Exposed Framing: Framing not concealed by other construction.
- D. OSB: Oriented strand board.
- E. Timber: Lumber of 5 inches nominal (114 mm actual) size or greater in least dimension.
- F. S4S: Surfaced four sides.
- G. KDAT: Kiln Dried Wood After Treatment. Identifies preservative treated wood that is kiln dried after treatment from post-treatment moisture contents of 35 to 75 percent to a kiln dried maximum moisture content of 19 percent for lumber and 15 percent for plywood. KDAT wood provides moisture contents within acceptable ranges of many materials to be installed over treated wood substrates.

1.04 REFERENCE STANDARDS

- A. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. AWWA U1 - Use Category System: User Specification for Treated Wood.
- D. PS 1 - Structural Plywood.
- E. PS 20 - American Softwood Lumber Standard.
- F. SPIB (GR) - Grading Rules.

1.05 SUBMITTALS

- A. Product Data: Provide technical data on wood preservative materials and application instructions.
 - 1. Indicate that all submitted wood materials are fire retardant treated. Wood materials that are not fire retardant treated will not be accepted.
- B. Exterior Plywood Sheathing: Where used, submit the following.
 - 1. Product data for the following materials:
 - a. Indicate that all submitted wood materials are fire retardant treated. Wood materials that are not fire retardant treated will not be accepted.
 - b. Plywood Sheathing.
 - c. Securement products including fasteners and adhesives.
 - 2. Shop drawings as follows:
 - a. Plan drawings indicating locations where sheathing to be used. Minimum drawing scale is 1/16 inch equals one foot.
 - b. Drawings showing sections and details of specific assembly using sheathing to be installed. Minimum drawing scale is 3/4 inch equals one foot.
 - c. Include complete assembly to be installed over exterior plywood sheathing. Reference the project specification section(s) containing materials and systems to be installed over sheathing.
 - d. Indicate coordination with requirements of other systems including written statement from other system manufacturer that proposed plywood sheathing is acceptable for use as a substrate for proposed system.
- C. Manufacturer's Certificate: Certify that wood products supplied meet or exceed specified requirements.

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

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- C. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Fire Retardant Project Requirement: All wood materials shall be fire retardant treated. Wood materials that are not fire retardant treated will not be accepted by Architect.
- B. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 1. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- C. Lumber fabricated from old growth timber is not permitted.
- D. All wood used for interior applications, whether concealed or exposed, shall be fire retardant treated. Coordinate with fire rated assembly requirements on drawings.
- E. Products shall contain no urea formaldehyde

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

- A. All wood materials shall be fire retardant treated. Wood materials that are not fire retardant treated will not be accepted by Architect. Preservative treated wood materials shall comply with fire retardant treated wood requirements.
- B. Kiln-dry lumber after treatment (KDAT) to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

- D. Preservative Chemicals: Acceptable to code officials and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood sills, blocking, and similar concealed members in contact with masonry or concrete.
 - 2. Plywood or other dimension lumber installed in areas subject to moisture exposure including interior areas such as kitchens, bathrooms, janitor closets, and other maintenance related areas.

2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to code officials, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM 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 (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment (KDAT) to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Concealed blocking.
 - 2. Plywood backing panels.

2.04 EXPOSED DIMENSION LUMBER

- A. Sizes: Nominal sizes as indicated on drawings.
- B. Surfacing: S4S.
- C. Moisture Content: S-dry or MC19.

2.05 EQUIPMENT MOUNTING BOARDS

- A. Use PS 1 A-D plywood, 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.06 OTHER APPLICATIONS

- A. General: Provide fire retardant wood materials in all locations.
- B. Water Resistant Interior or Exterior Plywood:
 - 1. Marine Grade: A-B Grade exterior structural panel, sanded on both sides.
 - a. Minimum five layers/plies, knothole free, with water resistant finish.
 - b. All plies shall be voidless or no void greater than 1/8 inch.
 - c. Plies adhered with waterproof structural glue. A or B grade face and back veneers.
 - d. Western Larch or Douglas Fir wood only.
 - e. A-B Grade: 3/4 inch thickness.
 - f. Paintable and stainable.
 - g. Refer to Drawings for additional requirements.
- C. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior Exposure 1 grade.
- D. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
- E. Other Locations: PS 1, C-D Plugged or better.

2.07 FASTENERS AND ANCHORS

- A. General: Provide nails, bolts, nuts, washers, screws, expansion bolts, clips, fasteners and accessories necessary for complete installation of rough carpentry items.
- B. Metal and Finish: Comply with treated wood manufacturer recommendations for specific wood treatment utilized. Requirements indicated in this Section are minimum requirements.
 - 1. Exterior: Stainless steel, or hot-dipped galvanized steel complying with ASTM A153/A153M.

2. Interior Dry Areas: Stainless steel, or hot-dipped galvanized steel complying with ASTM A153/A153M, or zinc plated steel complying with ASTM B633.
 3. Interior Wet or High Humidity Areas: Stainless steel, or hot-dipped galvanized steel complying with ASTM A153/A153M.
- C. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.
- D. Nails, Brads, and Staples: ASTM F1667.
- E. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to code officials, based on ICC-ES AC70.
- F. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to code officials, based on ICC-ES report appropriate for substrate.

2.08 ACCESSORIES

- A. Self Adhered Membrane Barrier for Dissimilar Materials:
1. For separation of treated wood products and structural steel, steel, aluminum, or other materials which cause corrosive action.
 2. Self-adhesive, polyethylene film-backed barrier with release sheet.
 3. Thickness: 40 mils minimum.
 4. Water Vapor Permeance: 0.035 perm, maximum, when tested in accordance with ASTM E96/E96M.
- B. Prefabricated supports and connectors:
1. Acceptable manufacturers:
 - a. Cleveland Steel Specialty Co.
 - b. Harlan Metal Products, Inc.
 - c. USP Lumber connectors.
 - d. Simpson Strong-Tie Co.
 2. Prefabricated supports and connectors shall comply with ASTM D1761, as applicable for specific application.
 3. Material: Minimum 18 gage steel.
 4. Nails shall be annular ring type and of sizes recommended by prefabricated connector manufacturer's product data.
 5. Finish: Finish of supports and connectors shall be compatible with fasteners and with each other.

- a. Finish for use with non-pressure treated wood products shall be G90 hot-dip galvanized.
 - b. Finish for use with pressure-treated wood products shall be G185 hot-dip galvanized or Type 316L stainless steel.
- C. Adhesive:
1. Provide adhesive designed for adhering rough carpentry items to concrete or masonry.
 2. Product shall comply with ASTM D3498 and be approved for proposed application by adhesive manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate installation of rough carpentry members specified in other sections.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- E. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

- I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing membrane separator between wood and metal decking.
- K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Applicable requirements of ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.

3.03 INSTALLATION OF WOOD BLOCKING AND NAILERS

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

3.04 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. Provide the non-structural framing and blocking at locations indicated and on Drawings, including but not limited to the following:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Joints of rigid wall coverings that occur between studs.

3.05 EQUIPMENT MOUNTING BOARDS

- A. Provide plywood equipment mounting boards in accordance with engineering drawing and specification requirements for size, dimension, location, and finishes.

- B. 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.
- C. Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.
 - 4. Coordinate locations with utilities requiring backing panels.
 - 5. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
 - 6. Size and Location: As indicated on drawings.

3.06 TOLERANCES

- A. Framing Members: 1/8 inch from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.
- C. Variation from Plumb: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.07 CLEANING

- A. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 4115

ARCHITECTURAL CABINETS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Specially fabricated cabinet units.
 - 2. Hardware.

1.03 REFERENCES

- A. Definitions:
 - 1. Cabinets, Casework, Cabinetry: Refers to items specified in this Section.
- B. Reference Standards:
 - 1. ANSI/AWI 0641.
 - 2. BHMA A156.9 - American National Standard for Cabinet Hardware.

1.04 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation.
- B. Attendees shall include contractor, cabinetry installer, manufacturer technical representative, and installers of adjacent materials and systems.

1.05 SUBMITTALS

- A. Product Data:
 - 1. Provide data for prefabricated items.
 - 2. Provide data for hardware accessories.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Elevations: 3/4 inch equals 1 foot, minimum.
 - 2. Scale of Sections: 1-1/2 inches equals 1 foot, minimum.

3. Scale of Details: 3 inches equals 1 foot, minimum.
 4. Provide the information required by AWI/AWMAC/WI (AWS).
 5. Include written documentation of manufacturer compliance with AWI/AWMAC/WI (AWS) certification program and product label.
 6. Indicate compliance with Aesthetic and Structural grade indicated.
 7. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 8. Show locations and sizes of cutouts and holes for items installed in architectural cabinets.
- C. Samples for Verification:
1. Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
 2. Submit actual sample items of proposed pulls, hinges, shelf supports including standards and support pins, and locksets, demonstrating hardware design, quality, and finish.
 3. Submit actual samples of laminate finishes as indicated. Minimum 3 by 5 inches in size.
- D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.06 CLOSEOUT SUBMITTALS

- A. Special Installer Warranty: Executed warranty meeting specified requirements.
- B. Special Manufacturer Warranty: Executed warranty meeting specified requirements.
- C. Special Manufacturer Finish Warranty: Executed warranty meeting specified requirements.
- D. Maintenance Data: Provide manufacturer parts lists, operation, and maintenance instructions for the materials of this Section.

1.07 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 1. Company with at least five projects in the past 5 years with value of cabinetry within 20 percent of cost of cabinetry for this Project.
 2. Company with at least five projects in the past 5 years with value of cabinetry exceeding the cost of cabinetry for this Project.
 3. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:

1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) requirements for grade or grades specified.
2. Provide designated labels on shop drawings as required by certification program.
3. Provide designated labels on installed products as required by certification program.
4. Submit certifications upon completion of installation that verifies the work is in compliance with specified requirements.
5. Replace, repair, or rework all work for which certification is refused.

1.08 MOCKUPS

A. Mockup: Provide a mockup for evaluation of installation, finishes, and workmanship.

1. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.
2. Locate as directed by Architect.
3. Size: Minimum one fabricated unit in configuration directed by Architect.
4. Do not proceed with installation beyond mockup until the mockup installation is approved by Architect. Correct deficiencies and refinish mock-up area as required to produce acceptable work.

B. Subject to compliance with requirements, approved mockups may become part of the completed Work if accepted to remain by Architect and if undisturbed at time of Substantial Completion. Remove mockup when directed by Architect.

C. Approval of mockups does not constitute approval of deviations from the Contract Documents unless Architect specifically approves such deviations in writing.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

B. Deliver materials only when the project is ready for installation and the general contractor has provided a clean storage area.

C. Maintain indoor temperature and humidity within the range recommended by the manufacturer or North American Architectural Woodwork Standards for the location of the project.

D. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: 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. 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.

1.11 WARRANTY

- A. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer Warranty: Provide manufacturer's warranty covering manufacturing and material defects, where items fail to perform as designed and manufactured.
 - 1. Warranty Period: Ten years from date of Substantial Completion.
- C. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace cabinetry materials that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 CABINETS, CUSTOM FABRICATED UNITS

- A. Final cabinetry finishes and configurations are to be determined. Refer to Drawings for additional requirements.
- B. Quality Standard: Complying with ANSI/AWI 0641 - Current Edition, except where noted otherwise.
 - 1. Aesthetic - Laminate Finished: Premium Grade.
 - a. Structural: Performance Grade Duty Level 4.
- C. Exterior Surfaces:
 - 1. Laminate Finish:

- a. Exposed Surfaces: High Pressure Decorative Laminate (HPDL) or High Pressure Laminate (HPL).
- b. Concealed Surfaces: Match exposed surfaces, except where indicated otherwise.
2. Toe Kick: As indicated on Drawings.
- D. Interior Surfaces:
 1. Interior Permanently Exposed Surfaces at Laminate Surfaced Cabinetry: High Pressure Decorative Laminate (HPDL) or High Pressure Laminate (HPL) or Melamine as indicated on Drawings. ---
- E. Cabinet Design: As indicated on drawings.
- F. Adjustable Shelf Loading: 40 lbs. per sq. ft. minimum.
- G. Cabinet Style: As indicated for each location.

2.02 MATERIALS, CUSTOM FABRICATED UNITS

- A. General: Performance and technical requirements shall be in accordance with basis of design product selections. Requirements of this Section establish minimum requirements.
- B. Cabinetry shall be constructed with solid wood or plywood boxes, stiles, rails, doors and drawer fronts; full overlay.
- C. Sustainability:
 1. Wood fabricated from old growth timber is not permitted.
- D. Cabinet Materials:
 1. Doors and Drawer Faces - Laminate Finish: Water resistant MDF finished with thermally fused, HPL or HPDL laminate finish on all exposed surfaces.
 - a. For use where indicated on Drawings.
 - b. Thickness: 3/4 inch.
 2. For top, bottom, sides and drawers: Minimum 3/4 inch thick 9-ply closed grain plywood. Refer to Countertops specification sections for countertop substrates.
 3. Cabinet Backs: Minimum 1/4 inch thick closed grain plywood.
 4. Base Cabinets: Provide minimum 3/4 inch 9-ply closed grain plywood top. Provide pressure treated, or marine grade, water resistant tops. Comply with additional requirements indicated on Drawings; where conflict exists, the more stringent requirement shall apply.
 5. Melamine Shelving: Exterior grade plywood 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. Melamine finish on all exposed surfaces. ---

- a. For use only where indicated on Drawings.
 - b. Provide melamine finish on all six sides of shelving.
 - c. Thickness: 3/4 inch.
6. MDF: Minimum ANSI A208.2, Grade 130, and as required to meet performance duty level specified.
- E. Glue: All glue shall be Type-II water resistant glue.
- F. Products shall contain no urea-formaldehyde.

2.03 LAMINATE MATERIALS

- A. General: Laminate materials for use where indicated on Drawings.
1. Product Basis of Design Selections: As indicated on Drawings. Where not indicated, as selected by Architect. Coordinate with project Interior Design requirements.
 2. Performance and Technical Requirements: As indicated by basis of design product selections.
- B. High Pressure Laminate (HPL) or High Pressure Decorative Laminate (HPDL) Cladding for Exposed Surfaces: Coordinate with product selections.
1. Horizontal Surfaces: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
 2. Postformed Surfaces: NEMA LD 3, Grade HGP, 0.039 (1.0 mm) nominal thickness.
 3. Vertical Surfaces: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
- C. Melamine Laminate: Melamine impregnated, decorative paper thermally fused directly to rigid board complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10. Minimum 0.020 inch (0.5 mm) nominal thickness. ---
- D. Color, Sheen and Texture: As indicated on Drawings. Where not indicated, as selected by Architect.

2.04 COUNTERTOPS

- A. Countertops: As indicated on Drawings.
1. Refer to Section 12 3600 - Countertops.

2.05 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Fasteners: Size and type to suit application.

- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- D. Grommets: Where indicated provide standard plastic or painted metal grommets for cut-outs, in color to match adjacent surface.
 - 1. Final color selection by Architect from manufacturer full range.
- E. Wood Blocking: Refer to the requirements of project rough carpentry specification section.

2.06 HARDWARE

- A. Final requirements are to be determined.
- B. General: Provide anti-ligature and tamper resistant hardware in all Patient areas. Refer to Drawings for additional requirements.
- C. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
 - 1. Specified products indicate minimum standards. Refer to Drawings for final selections.
- D. Shelf Supports: Provide type indicated on Drawings in accordance with the following. Where not indicated, as selected by Architect from one of the following. Final requirement to be determined.
 - 1. Adjustable Shelf Supports - Standards: Standard side-mounted system using recessed metal shelf standards and coordinated shelf rests, satin chrome finish, for nominal 1 inch (25 mm) spacing adjustments. Heavy Duty Grade.
 - 2. Adjustable Shelf Supports - Pins: Standard side-mounted system using multiple holes for pin supports and coordinated shelf rests, satin chrome finish, for nominal 1 inch (25 mm) spacing adjustments. Heavy Duty Grade.
 - a. Vinyl coated.
 - b. Basis of Design: 348 Series by Knape and Vogt Manufacturing Co.
www.knapeandvogt.com
- E. Drawer and Door Pulls:
 - 1. Final selections are to be determined.
 - 2. Finish: As indicated on Drawings. Where not indicated, as selected by Architect.
- F. Cabinet Locks: Keyed cylinder, three keys per lock, master keyed, steel with satin finish. Meeting ANSI/BHMA A156.11, E07121.
- G. Drawer Locks: Keyed cylinder, three keys per lock, master keyed, steel with satin finish. Meeting ANSI/BHMA A156.11, E07041.

- H. Access Panel Locks: Keyed cylinder, three keys per lock, master keyed, steel with satin finish. Meeting ANSI/BHMA A156.11, E07121.
- I. Door and Drawer Silencers: BHMA A156.16, L03011.
- J. Catches: Push-in magnetic catches, BHMA A156.9, B03131.
- K. Drawer Slides: BHMA A156.9.
 - 1. Type: Full extension.
 - 2. Type: Extension types as indicated.
 - 3. Static Load Capacity: Heavy Duty grade. Minimum 75 lb capacity.
 - 4. Mounting: Side mounted.
 - 5. Stops: Integral type. Designed for silenced stops; in and out.
 - 6. Features: Provide self closing/stay closed type.
- L. Hinges, Non-Continuous: Heavy-duty institutional type five knuckle, hospital tip, .095 gauge, 170-degree swing. Hinge wings shall overlap interior cabinet side and back of door. Self closing, frameless concealed hinge. Shall exceed ANSI/BHMA 156.9, B01602.
 - 1. Designed for silenced open and close.
 - 2. Color and style selected by Architect.
- M. Hinges, Continuous: Heavy-duty continuous hinge to exceed ANSI/BHMA A156.26 standard for Continuous Hinges.
 - 1. Includes "piano" style hinges.
 - 2. Rating: Heavy Duty.
 - 3. Material: Stainless Steel.
 - 4. Mounting Configuration: As indicated on Drawings.
- N. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. As indicated on Drawings. Coordinate with project Interior Design requirements.
- O. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.07 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Seal cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.
- C. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.
- D. Field Measurements: Check actual project field dimensions before manufacturing cabinetry and coordinate with shop drawings.
- E. Verify locations of necessary concealed framing and supports with respective trades.
- F. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.
- E. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
- F. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- G. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with cabinet surface.

1. Mechanical fasteners used at exposed and semi-exposed surfaces, excluding installation attachment screws and those securing cabinets end to end, shall be countersunk.
- H. Install cabinets level, plumb, and true in line 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. Maintain veneer sequence matching of cabinets with transparent finish. -td
 4. 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 or toggle bolts through CMU backing walls.

3.03 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 semiexposed surfaces. Touch up finishes to restore damaged or soiled areas.
- D. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to the material finishes. Thoroughly rinse surfaces and dry
- E. Restore components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Architect, remove damaged materials and replace with new materials

3.04 PROTECTION

- A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION

SECTION 07 8100

SPRAY APPLIED FIREPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Spray applied fireproofing of interior structural steel.
- B. Spray applied fireproofing of interior structural concrete.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. UL (FRD) - Fire Resistance Directory.

1.03 DEFINITIONS

- A. SFRM: Sprayed fire-resistive materials.

1.04 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation to discuss conformance with project requirements, manufacturer installation requirements, affected adjacent materials and system, and site conditions.
 - 1. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.
- B. Attendees shall include contractor, sprayed fireproofing installer, manufacturer technical representative, and installers of adjacent materials and systems.
- C. Conduct meeting in accordance with Section 01 3100 - Project Management and Coordination.

1.05 SUBMITTALS

- A. Refer to Section 01 3300 - Submittal Procedures, for submittal procedure requirements.
- B. Product Data: Indicate complete application instructions along with UL report or approved independent testing laboratory report on tested assembly or construction. Indicate material thickness for all locations and conditions. Include printed statement of material VOC content.
- C. Shop Drawings:
 - 1. Schedule indicating minimum SFRM thickness, test assembly ID, and hourly rating for each SFRM product type to be used.

2. Installation plan indicating structural members to receive each detail in the SFRM schedule. Coordinate with steel subcontractor's erection drawings.
- D. Samples: Submit 12 by 12 inch samples of each type of fireproofing on minimum 1/2 inch thick gypsum board, applied in required density and at 1 inch thickness.
- E. Manufacturer's Certificate: Certify that applied fireproofing products meet or exceed requirements of contract documents.
- F. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, as follows:
 1. Bond strength.
 2. Bond impact.
 3. Compressive strength.
 4. Fire tests using substrate materials similar those on project.
 5. Evaluation reports from ICC-ES.
- G. Manufacturer's Installation Instructions.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.

1.06 CLOSEOUT SUBMITTALS

- A. Special Installer Warranty: Executed warranty meeting specified requirements.
- B. Special Manufacturer Warranty: Executed warranty meeting specified requirements. Warranty shall be completed in Owner's name and registered with manufacturer.
- C. Manufacturer Reports: Indicate environmental and conditions that applied fireproofing materials were installed. Provide copies of any other field inspection reports.
- D. Maintenance Data: Provide manufacturer maintenance instructions for the materials of this Section.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience and approved by manufacturer.

- C. Manufacturer Testing: Fireproofing material shall have been tested by UL in accordance with procedures of ASTM E119 and shall be listed in the UL "Fire Resistance Directory", current edition, for spray applied cementitious fireproofing material.
- D. Manufacturer Inspection: Manufacturer shall make an initial inspection of substrates where materials will be applied and project specific application for materials to verify compliance with manufacturer product data.
- E. Fireproofing materials shall be installed in thickness and density required to achieve fire rating classifications indicated. Refer to drawings for locations.

1.08 FIELD CONDITIONS

- A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F (4 degrees C) or when temperature is predicted to be below said temperature for 24 hours after application.
- B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.
- C. Provide temporary enclosure to prevent spray from contaminating air.
- D. Schedule fireproofing work to begin after installation of roofing , roof mounted mechanical equipment, and after placement of concrete on metal decking where fireproofing will be installed.
- E. Prohibit traffic on roof areas during and after fireproofing application until material is cured and dried.

1.09 WARRANTY

- A. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 - 1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer Warranty: Provide manufacturer's warranty covering manufacturing and material defects, where items fail to perform as designed and manufactured.
 - 1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- B. Source limitations: Obtain fireproofing for each fire-resistance design from single source.
- C. Asbestos: Provide products containing no detectable asbestos.

2.02 SPRAY APPLIED FIREPROOFING MATERIALS FOR INTERIOR CONCEALED APPLICATIONS

- A. Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.
- B. Manufacturers:
 - 1. Basis of Design: GCP Applied Technologies, Monokote Z-106G: www.gcpat.com
- C. Acceptable Manufacturers: Subject to compliance with specified requirements:
 - 1. Carboline Company; a subsidiary of RPM International: www.carboline.com
 - 2. GCP Applied Technologies: www.gcpat.com
 - 3. Isolatek International, Inc.: www.isolatek.com
- D. Properties:
 - 1. Bond Strength: Minimum 430-lbf/sq. ft. (20.59-kPa) cohesive and adhesive strength based on field testing according to ASTM E736 and complying with project building code requirements.
 - 2. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E605, whichever is thicker, but not less than 0.375 inch (9 mm).
 - 3. Combustion Characteristics: ASTM E136.
 - 4. Surface-Burning Characteristics: Comply with ASTM E84.
 - 5. Flame-Spread Index: 0.
 - 6. Smoke-Developed Index: 0.

7. Compressive Strength: Minimum 50 psi (340 kPa) according to ASTM E761.
8. Corrosion Resistance: No evidence of corrosion according to ASTM E937.
9. Deflection: No cracking, spalling, or delamination according to ASTM E759.
10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E760.
11. Air Erosion: Maximum weight loss of 0.000 g/sq. ft. (0.000 g/sq. m)] in 24 hours according to ASTM E859.
12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G21.

2.03 FIREPROOFING ASSEMBLIES

- A. Provide assemblies as indicated on drawings. Thickness shown on Drawings are for graphic clarity only. Provide thickness and density indicated by rated assembly requirement.

2.04 AUXILIARY MATERIALS

- A. Provide auxiliary materials that are compatible with sprayed fire-resistive material and substrates and are approved by UL or another testing and inspecting agency acceptable to code officials for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by sprayed fire-resistive material manufacturer for the required fire-resistance design.
- C. Bonding Agent: Product approved by sprayed fire-resistive material manufacturer.
- D. Topcoat: Suitable for application over sprayed fire-resistive material; of type recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive fireproofing.
- B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.
- C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.
- D. Verify that voids and cracks in substrate have been filled.
- E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

- F. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.
- G. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 PREPARATION

- A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.
- B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.
- C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.
- D. Protect surfaces not scheduled for fireproofing from damage by overspray, fall-out, and dusting by fire protection materials during application.
- E. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

- A. Prime substrates where included in fire-resistance design and where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.
- B. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.
- C. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fire protection Work.
- D. Comply with sprayed fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- E. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer. In exposed locations, trowel surface smooth and form square edges, using tools and procedures recommended by fireproofing manufacturer.

- F. Do not install enclosing or concealing construction until after sprayed fire-resistive material has been applied, inspected, and tested and corrections have been made to deficient applications.
- G. Install to provide smooth finish with "orange peel" surface texture.

3.04 FIELD QUALITY CONTROL

- A. Special Inspections: Contractor shall engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC, Subsection 1705.13, "Sprayed Fire-Resistant Materials." and in accordance with requirements where indicated on Schedule of Special Inspections.
- B. Prepare test and inspection reports and provide to Architect.
- C. Fire protection will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fire protection that does not pass tests and inspections, and retest.
 - 2. Apply additional fire protection, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

3.05 CLEANING

- A. Remove excess material, overspray, droppings, and debris.
- B. Remove fireproofing from materials and surfaces not required to be fireproofed.
- C. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

3.06 REPAIRS

- A. Repair fire protection damaged by other work before concealing it with other construction.
- B. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

SECTION 07 8400

FIRESTOPPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Firestopping systems.
 - 2. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- F. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies.
- G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- H. ITS (DIR) - Directory of Listed Products.
- I. FM 4991 - Approval Standard for Firestop Contractors.
- J. FM (AG) - FM Approval Guide.
- K. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.
- L. UL (DIR) - Online Certifications Directory..
- M. UL (FRD) - Fire Resistance Directory.

1.04 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation to discuss conformance with project requirements, manufacturer installation requirements, affected adjacent materials and system, and site conditions.
- B. Attendees shall include contractor, firestopping installer(s), and installers of adjacent materials and systems.
- C. Conduct meeting in accordance with Section 01 3100 - Project Management and Coordination.

1.05 SUBMITTALS

- A. Refer to Section 01 3300 - Submittal Procedures, for submittal procedure requirements.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- C. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Installer Qualification: Submit qualification statements for installing mechanics.

1.06 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and as follows.
 - 1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:

- a. Verification of minimum three years documented experience installing work of this type.
 - b. Verification of at least five satisfactorily completed projects of comparable size and type.
 - c. Licensed by local code officials (AHJ).
- D. Single source responsibility: Obtain firestop systems for each kind of penetration and construction condition indicated from a single primary firestop systems manufacturer.
1. Materials from different manufacturer than allowed by tested and listed system shall not be intermixed in the same firestop system or opening.
 2. Install tested and listed firestop systems before installing an Engineering Judgement or Equivalent Fire Resistance Rated Assembly (EFFRA).

1.07 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

1.08 WARRANTY

- A. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 1. Warranty Period: One year from date of Substantial Completion.
- B. Special Manufacturer Warranty: Provide manufacturer's warranty covering manufacturing and material defects, where items fail to perform as designed and manufactured.
 1. Warranty Period: Provide manufacturer standard warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 1. 3M Fire Protection Products: www.3m.com/firestop.
 2. Everkem Diversified Products, Inc; Intumescent Fire-Rated Putty Pads: www.everkemproducts.com.
 3. Hilti, Inc: www.us.hilti.com.
 4. Nelson FireStop Products: www.nelsonfirestop.com.

5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.

2.02 MATERIALS

- A. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- C. Intumescent Putty:
 1. General - Fire-Rated Intumescent Putty Pads: Designed to seal around electrical boxes to maintain the hourly integrity of fire rated walls restricting the passage of flame, smoke, and toxic gases. UL Classified for 1 & 2 hour gypsum fire rated wall systems.
 2. Characteristics:
 - a. ASTM-E90.
 - b. UL classified.
 - c. 2 Hour fire rating.
 - d. Maintains 60 STC rating.
 - e. Non-curing, repositionable.
 - f. Red color.
 - g. No asbestos fillers.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Refer to drawings for firestopping assembly configurations.
- B. Perimeter Firestop: Provide perimeter firestop materials complying with requirements indicated on Drawings and in accordance with applicable codes.
 1. Firestop materials shall meet or exceed the requirements of ASTM E2307, ASTM E 84, ASTM E90.
- C. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
 1. Movement: Provide systems that have been tested to show movement capability as indicated.

- D. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
 - 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 - 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
 - 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

- E. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
 - 1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
 - 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 - 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
 - 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by code officials.

- C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Contractor shall engage a testing agency to examine penetration firestopping in accordance with ASTM E2174, and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 08 1113

HOLLOW METAL FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Hollow metal frames for wood doors.
- B. Related Requirements:
 - 1. Section 09 9000 - Painting and Coating.

1.03 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. ANSI: American National Standards Institute.
 - 2. ASCE: American Society of Civil Engineers.
 - 3. HMMA: Hollow Metal Manufacturers Association.
 - 4. NAAMM: National Association of Architectural Metal Manufacturers.
 - 5. NFPA: National Fire Protection Association.
 - 6. SDI: Steel Door Institute.
 - 7. UL: Underwriters Laboratories.
- B. Definitions:
 - 1. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.
- C. Reference Standards:
 - 1. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames.
 - 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.
 - 3. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).

4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
6. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
7. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
8. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames.
9. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.
10. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames.
11. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.
12. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.
13. UL (DIR) - Online Certifications Directory.
14. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
15. ICC A117.1 - Accessible and Usable Buildings and Facilities.
16. ITS (DIR) - Directory of Listed Products.
17. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

1.04 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation to discuss conformance with project requirements, manufacturer installation requirements, affected adjacent materials and system, and site conditions.
 1. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors.
 2. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.
- B. Attendees shall include contractor, hollow metal door and frame installer, manufacturer technical representative, and installers of adjacent materials and systems.

1.05 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each frame type.
 - 2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 3. Include construction details, material descriptions, core descriptions, ratings, and finishes.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. When applicable, provide details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 7. Details of moldings, removable stops, and glazing.
- C. Product Schedule: For hollow-metal frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.
- D. Qualification Data: For door inspector.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 - 2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
 - 3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.
- E. Product Test Reports: For each type of fire-rated hollow-metal frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.
- F. Field quality control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, provide list of door numbers and applicable room name where door is located.
- B. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101. Indicate all doors and frames are labeled as required by applicable code.
- C. Special Installer Warranty: Executed warranty meeting specified requirements.

- D. Special Manufacturer Warranty: Executed warranty meeting specified requirements. Warranty shall be completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years documented experience.
- B. Manufacturer Qualifications: Provide hollow metal items from SDI Certified manufacturer: www.steeldoor.org/sdicertified.php.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.
- D. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
- E. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.
- C. Deliver hollow-metal items palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- D. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- E. Store hollow-metal items vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Frames:

1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
3. Republic Doors, an Allegion brand: www.republicdoor.com.
4. Steelcraft, an Allegion brand: www.allegion.com.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Frames for Wood Doors:

1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on Drawings.
4. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
5. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal frames.
6. Sound Transmission: Provide hollow metal door frame assemblies meeting indicated STC ratings including double rabbeted perimeter seals.
 - a. Final requirements to be determined.

- #### B. Combined Requirements: If a particular unit is indicated to comply with more than one type of requirement, comply with the most stringent.

2.03 HOLLOW METAL FRAMES

- #### A. Doors, frames, frame anchors, and hardware reinforcements shall be provided to meet the requirements of the performance levels indicated for doors. The more stringent requirement shall apply.
- #### B. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.

1. Frame Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
 2. Frame Finish: Factory primed and field finished.
- C. Door Frames, Fire-Rated: Full profile/continuously welded type.
1. Fire Rating: Same as door, labeled.
 2. Frame Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
 3. Frame Finish: Factory primed and field finished.
- D. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- E. Mullions for Pairs of Doors: Removable type, with profile similar to jambs. Provide lockable mullions.

2.04 FINISHES

- A. General: Field or factory finish as indicated on Drawings.
- B. Factory Primer Finish: Factory primed complying with ANSI/SDI A250.3 for field finishing.
1. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10.
- C. Field Finishing: Field painted finish in accordance with Section 09 9000 - Painting and Coating.
- D. Field Applied Bituminous Coating for Frame Interior Surfaces: Asphalt emulsion or bituminous coating paint.
1. Complying with ASTM D1187/D1187M.
 2. For use as a separator between dissimilar metals.
 3. Apply to achieve 30 dry mil thickness.

2.05 ACCESSORIES

- A. Fasteners: Provide tamper proof fasteners in all locations.
- B. Removable Stops: Rolled steel bar, mitered corners; prepared for countersink style tamper proof screws.
- C. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.
- E. Door Hardware: As specified in Section 08 7100.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 PREPARATION FOR HARDWARE AND ANCHORS

- A. Reinforcement: Factory reinforce door and frame components for hardware installation in accord with ANSI/SDI A250.8 and ANSI/SDI A250.6.
- B. Install hardware reinforcement and anchors without distortions or blemishes on exposed surfaces.
- C. Coordinate preparation with door hardware and access control requirements.

3.03 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Floor Anchors: Secure with post installed expansion anchors. Floor anchors may be set with power-actuated fasteners instead of post installed expansion anchors if so indicated and approved on Shop Drawings.
- E. Install door hardware in accordance with manufacturer instructions.
 - 1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
- F. Coordinate installation of electrical connections to electrical hardware items.
- G. Touch up damaged factory finishes prior to field finishing.
- H. Field finish in accordance with Section 09 9000 - Painting and Coating.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Hollow Metal Frame Minimum Installation Tolerances:
 - 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for compliance with ADA accessibility requirements.
- B. Adjust for smooth and balanced door movement.
- C. 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.

3.06 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

3.07 FIELD QUALITY CONTROL

- A. Inspection Agency: Contractor shall engage a qualified inspector to perform inspections and to furnish reports to Architect.

- B. Fire-Rated Door Inspections: Inspect each fire-rated door and frames in accordance with applicable project codes including NFPA 80, Section 5.2.
 - 1. Prepare and submit separate inspection report for each fire rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.
- C. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with applicable project codes including NFPA 101, Section 7.2.1.15.
 - 1. Prepare and submit separate inspection report for each egress door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.
- D. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- E. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

END OF SECTION

SECTION 08 1416

FLUSH WOOD DOORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Flush wood doors.

1.03 REFERENCES

- A. Reference Standards
 - 1. ANSI A208.1 - American National Standard for Particleboard.
 - 2. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights.
 - 3. AWI (QCP) - Quality Certification Program.
 - 4. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.
 - 5. AWMAC (GIS) - Guarantee and Inspection Services Program.
 - 6. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.
 - 7. NEMA LD 3 - High-Pressure Decorative Laminates.
 - 8. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
 - 9. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.
 - 10. UL (DIR) - Online Certifications Directory.
 - 11. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
 - 12. WDMA I.S. 1A - Interior Architectural Wood Flush Doors.
 - 13. WI (CCP) - Certified Compliance Program.

1.04 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation to discuss conformance with project requirements, manufacturer installation requirements, affected adjacent materials and system, and site conditions.

1. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems. Coordinate with adjacent and affected materials and systems.
- B. Attendees shall include contractor, door installer, and installers of adjacent materials and systems.

1.05 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 veneer species.
 5. Door louvers.
 6. Door trim for openings.
 7. Door frame construction.
 8. Factory-machining criteria.
 9. 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 and frame location, type, size, and swing.
 2. Door elevations, dimension and locations of hardware, cutouts for glazing and louvers as applicable, 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. Dimensions and locations of mortises and holes for hardware.
 7. Clearances and undercuts.
 8. Requirements for veneer matching.
 9. Requirements for doors to be factory finished.
 10. Indicate that doors meet specified requirements including fire ratings

- C. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- D. Samples:
 - 1. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
 - 2. Submit a minimum of 3 samples of each face veneer, minimum 12 by 12 inches in size, representative of proposed species, cut, color and grain, with proposed factory finish.
 - 3. Accepted samples shall establish references for extremes of color, graining, defects and general quality of proposed veneers.
- E. Qualification Data: For door inspector.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 - 2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
 - 3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.
- F. Sample Warranty: For special warranty.
 - 1. Manufacturer Intent to Warranty Letter: Submit an Intent to Warrant executed by authorized warranty representative of door manufacturer, indicating that;
 - a. Manufacturer has reviewed project drawings, specifications, shop drawings, and conditions affecting the work and the relationship of doors with related work.
 - b. Manufacturer agrees to warrant proposed project upon successful completion as referenced herein without additional requirements.

1.06 CLOSEOUT SUBMITTALS

- A. Special Installer Warranty: Executed warranty meeting specified requirements.
- B. Special Manufacturer Warranty: Executed warranty meeting specified requirements. Warranty shall be completed in Owner's name and registered with manufacturer.
- C. Field quality-control reports.
- D. Provide executed copy of specified warranty for project.
- E. Quality Standard Compliance Certificates: Provide program compliance certificates.
- F. Maintenance Data: Provide manufacturer parts lists, operation, and maintenance instructions for the materials of this Section.

1.07 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than ten years of documented experience.
 - 1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
 - 2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience.
- D. Allowable color and grain variation of natural finished doors: Color and grain shall be uniform and within range established by accepted veneer samples as specified herein. Joints in face veneers shall be inconspicuous. Adjacent doors and doors viewed together shall have similar color and grain.
- E. Fire door assemblies:
 - 1. Door assemblies in rated walls shall have been tested in accord with NFPA 252 or UL 10C.
 - 2. Door assemblies in corridors and smoke barriers shall have a minimum fire rating of 20 minutes and shall have been tested in accord with NFPA 252 or UL 10C without hose stream test. Assemblies shall comply with UL 1784 for draft and smoke control test; leakage may not exceed 3.0 CFM per foot of door at 0.10" of water column.
 - 3. Fire-rated doors shall provide rating without use of salt-treated wood, or manufacturer shall provide certification that treated wood is nonhygroscopic and shall warrant door against failure or discoloration of face veneer and door finish.
- F. Labeling requirements:
 - 1. On top edge, provide each door with a label which identifies manufacturer, trade association of which he is a member, grade and type of door or industry standard with which it complies.
 - 2. Fire-rated components shall bear factory-applied labels showing manufacturer's name, name of third-party inspection agency, fire protection rating, and where required for doors in exit enclosures, maximum transmitted temperature end point. Permanently attach label to hinge stile of each fire-rated door.
 - 3. Smoke and draft doors complying only with UL 1784 shall show the letter 'S' on the manufacturer's labeling.

- G. Face veneers shall be domestically assembled veneer facing using no rainforest produced crossbands or backs.
- H. Source Requirements: All doors shall be provided by the same manufacturer.
- I. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org.
 - 2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) requirements for grade or grades specified.
 - 3. Provide designated labels on shop drawings as required by certification program.
 - 4. Provide designated labels on installed products as required by certification program.
 - 5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
- J. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 - 1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.
- K. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 - 1. DHI's Egress Door Assembly Inspector (FDAI) certification.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week. Break seal on site to permit ventilation.
- D. Comply with requirements of referenced standard and manufacturer's written instructions.
- E. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.09 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and

maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.10 WARRANTY

- A. Special Manufacturer Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch section.
 - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.
- B. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL

- A. Design intent is to match existing. Specified requirements establish minimum requirements. Refer to Drawings for additional requirements. Contractor to field verify existing. Final selections are by Architect.

2.02 MANUFACTURERS

- A. Wood Veneer Faced Door Manufacturers: Subject to compliance with requirements.
 - 1. Masonite/Marshfield DoorSystems, Inc. www.marshfielddoors.com.
 - 2. Oregon Door. www.oregondoor.com.
 - 3. Lambton Doors. www.lambtondoors.com
 - 4. TruStile Doors. www.trustile.com
 - 5. Oshkosh Door Company. www.oshkoshdoor.com
 - 6. VT Industries. www.vtindustries.com.

2.03 DOORS AND PANELS

- A. Doors: Refer to drawings for locations and additional requirements.
 - 1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Wood Veneer Faced Doors: Flush construction.
 - 1. Thickness: As indicated on Drawings. Where not indicated, as selected by Architect.
 - 2. Provide solid core doors at each location.
 - 3. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled.
 - a. Provide visible labels on hinge edge when door is open.
 - 4. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft (0.01524 cu m/s/sq m) of door opening at 0.10 inch wg (24.9 Pa) pressure at both ambient and elevated temperatures for "S" label; if necessary, provide additional gasketing or edge sealing.
 - 5. Sound Transmission: Provide wood door assemblies meeting indicated STC ratings including double rabbeted perimeter seals.
 - a. Minimum STC rating of 32 in accordance with ASTM E413. Refer to Drawings and project Door Hardware specification for additional requirements.

2.04 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.
- C. Sound-Rated Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating specified; plies and faces as indicated above.
 - 1. Final requirements to be determined.

2.05 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Species as selected by Architect, veneer grade in accordance with quality standard indicated, cut as selected by Architect, with book match

between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

1. Design intent is to match existing.
 2. Vertical Edges: Same species as face veneer.
 3. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet (3 m) of each other when doors are closed.
- B. Facing Adhesive: Type I or Type II, as required to comply with door rating, and door finish quality.

2.06 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
 2. Provide solid blocking for other throughbolted hardware.
- C. Blocking: Top and bottom rail and lock stile blocking shall accommodate specified hardware, without through-bolting hardware.
- D. Top rail for Doors with Closers: Provide 12" high top rail for doors scheduled to receive closers. Top rail shall accommodate specified hardware without through-bolting hardware.
- E. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on Drawings.
- F. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- G. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- H. Provide edge clearances in accordance with the quality standard specified.

2.07 FACTORY FINISHING - WOOD VENEER DOORS

- A. Design intent is to match Owner standards. Final requirements to be determined.
- B. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified.
1. Transparent:
 - a. System - 11, Polyurethane, Catalyzed.
 - b. Stain: As selected by Architect.

- c. Sheen: As selected by Architect.
- C. Factory finish doors in accordance with approved sample.
- D. Seal door top edge with color sealer to match door facing.
- E. Finish all door edges to match door facing.

2.08 ACCESSORIES

- A. Fasteners: Provide tamper proof fasteners in all locations.
- B. Hollow Metal Door Frames: As specified in Section 08 1113.
- C. Door Hardware: Refer to door hardware specifications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.
- D. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- E. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 INSTALLATION

- A. Allow doors to become acclimated to finished space conditions a minimum of 72 hours before hanging. Coordinate with manufacturer instructions.
- B. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements. Comply with applicable code requirements.
 - 2. Install smoke and draft control doors in accordance with NFPA 105 requirements. Comply with applicable code requirements.
 - 3. Install exterior doors in accordance with ASTM E2112.

- C. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- D. Use machine tools to cut or drill for hardware.
- E. Coordinate installation of doors with installation of frames and hardware.
- F. Coordinate installation of glazing.
- G. Install door louvers plumb and level.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.
- C. Maximum Erection tolerances:
 - 1. Variation from specified clearances: 1/32 inch.
 - 2. Maximum variation in edge alignment, pairs of doors: 1/16 inch.

3.04 ADJUSTING

- A. Adjust for compliance with ADA accessibility requirements.
- B. Adjust doors for smooth and balanced door movement.
- C. Adjust closers for full closure.
- D. Adjust sound control doors so that seals are fully engaged when door is closed.
- E. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.
- F. 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.

3.05 FIELD QUALITY CONTROL

- A. Inspection Agency: Contractor shall engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 - 1. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

- C. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
 - 1. Prepare and submit separate inspection report for each egress door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.
- D. Wood Door Inspections: Provide inspection of installed Work through AWT's Quality Certification Program, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
- E. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- F. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

END OF SECTION

SECTION 08 7100

DOOR HARDWARE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Application: The requirements of this section establish basis of design product and system performance standards. The design intent is for the products of this section to meet current Owner requirements and match existing products while meeting the requirements of this Section.
- B. Hardware for doors.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- B. BHMA (CPD) - Certified Products Directory.
- C. BHMA A156.16 - American National Standard for Auxiliary Hardware.
- D. BHMA A156.20 - American National Standard for Strap and Tee Hinges, and Hasps.
- E. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames.
- F. ICC A117.1 - Accessible and Usable Buildings and Facilities.
- G. ITS (DIR) - Directory of Listed Products; current edition.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- C. Preinstallation Meeting: Convene a preinstallation meeting minimum 14 business days prior to commencing work of this section; attendance is required by affected installers including, but not limited to, the following as applicable:
 - 1. Installer's Architectural Hardware Consultant (AHC).
 - 2. Hardware Installer.
 - 3. Owner's Security Consultant.
- D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- E. Keying Requirements Meeting:
 - 1. Schedule meeting at project site prior to Contractor occupancy.
 - 2. Attendance Required:
 - a. Contractor.
 - b. Owner.
 - c. Installer's Architectural Hardware Consultant (AHC).
 - d. Hardware Installer.
 - e. Owner's Security Consultant.
 - 3. Agenda:
 - a. Establish keying requirements.
 - b. Verify locksets and locking hardware are functionally correct for project requirements.
 - c. Verify that keying and programming complies with project requirements.
 - d. Establish keying submittal schedule and update requirements.
 - 4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
 - a. Access control requirements.
 - b. Key control system requirements.
 - c. Schematic diagram of preliminary key system.
 - 5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

6. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

- A. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- B. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
 2. Provide complete description for each door listed.
 3. Provide manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
 4. Include account of abbreviations and symbols used in schedule.
- C. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
 2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
 3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 1. Submit manufacturer's parts lists and templates.
- F. Keying Schedule:
 1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.

- I. Supplier's Qualification Statement.
- J. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- K. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- L. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
 - 1. Lock Cylinders: One for each master keyed group.
 - 2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least five years of documented experience.
- C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.
 - 1. Certifications shall be by the Door Hardware Institute (DHI), 2025 M Street NW, Suite 800, Washington, DC 20036: www.dhi.org

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

- A. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
 - 1. Closers: Five years, minimum.
 - 2. Exit Devices: Three years, minimum.
 - 3. Locksets and Cylinders: Three years, minimum.
 - 4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide all door hardware by a single manufacturer, unless indicated otherwise.
- D. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Listed and certified compliant with specified standards by BHMA.
 - 3. Auxiliary Hardware: BHMA A156.16.
 - 4. Preparation for Steel Doors and Steel Frames: BHMA A156.115.
 - 5. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
- E. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
- F. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. Refer to Shop Drawing submittal of Door Hardware Schedule.
- G. Fasteners:
 - 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
 - 2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
 - a. Self-drilling (Tek) type screws are not permitted.
 - 3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
 - 4. Provide wall grip inserts for hollow wall construction.
 - 5. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.

6. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

2.02 DOOR HARDWARE

- A. General: Provide products by a single sole source manufacturer.
- B. Refer to Drawings for additional requirements.
- C. Primary Manufacturers: Provide door hardware designed for extra heavy duty use in accordance with current Owner requirements by one of the following manufacturers
 1. Assa Abloy. www.assaabloy.com.
 2. Allegion. www.us.allegion.com
- D. Additional Manufacturers: Subject to compliance with specified requirements.
 1. Products by wholly owned subsidiaries or business units of primary door hardware manufacturers indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that electric power is available to power operated devices and of correct characteristics.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Do not install surface mounted items until application of finishes to substrate are fully completed.
- D. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. Mounting height as indicated on Drawings and in compliance with applicable codes and regulations.

3.03 FIELD QUALITY CONTROL

- A. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.
- B. Comply with field quality control requirements of each door.

3.04 ADJUSTING

- A. Adjust hardware for smooth operation.
- B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.06 PROTECTION

- A. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

SECTION 09 0561

MOISTURE VAPOR CONTROL FLOOR PREPARATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section for use in conjunction with all project flooring material installations.
 - 1. For use where floor flatness and moisture levels are not within allowable ranges at the time of flooring installation.
 - 2. For use in conjunction with flooring manufacturer recommendations and requirements.
- B. For additional requirements refer to Drawings and project flooring and floor finish specification sections
- C. Section Includes:
 - 1. Floor leveling materials.
 - 2. Fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete in preparation for floor covering installation.
 - 3. Preparation of concrete floor slabs for installation of floor coverings.
 - 4. Testing of concrete floor slabs for moisture and alkalinity (pH).
 - 5. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.

1.03 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens).
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.04 DEFINITIONS

- A. MVE: Moisture vapor emission.
- B. MVER: Moisture vapor emission rate.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.
 - 2. Coordinate with the finishing and curing requirements of concrete floor slabs in Division 03.
 - 3. Coordinate and comply with the requirements of individual floor coverings specified for use on this project.
- B. Preinstallation Conference: Conduct preinstallation conference at project site with Contractor, Installers, Architect and Owner Representative to review all floor system requirements for installation and compatibility.

1.06 SUBMITTALS

- A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- B. Testing Agency's Report:
 - 1. Description of areas tested; include floor plans and room designations matching those used on project architectural drawings.
 - 2. Summary of conditions encountered.
 - 3. Moisture and alkalinity (pH) test reports (results).
 - 4. Copies of specified test methods.
 - 5. Recommendations for remediation of unsatisfactory surfaces.
 - 6. Submit report directly to Owner.
 - 7. Submit report not more than two business days after conclusion of testing.
- C. Adhesive Bond and Compatibility Test Report.

- D. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
 - 1. Manufacturer's qualification statement.
 - 2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
 - 3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
 - 4. Manufacturer's installation instructions for each type of product.
 - 5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer meeting the requirements of this project.
- E. Qualification Data: For Installer.
- F. Field quality-control reports.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.

1.09 FIELD CONDITIONS

- A. Environmental Limitations: Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.
 - 1. Store system components in a temperature-controlled environment and protected from weather and at ambient temperature as recommended by manufacturer but not less than 65 deg F (18 deg C) and not more than 85 deg F (29.4 deg C) at least 48 hours before use.
 - 2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg F (18 deg C) or more than 85 deg F (29.4 deg C) and not less than 40 or more than 60

percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

3. Install MVE-control systems where concrete surface temperatures will remain within manufacturer recommendations but at a minimum of 5 deg F (3 deg C) higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

1.10 WARRANTY

- A. Special Project Warranty: MVE-control system manufacturer's standard form in which manufacturer agrees to repair or replace systems that deteriorate during the specified warranty period.
 1. Terms: 10-years, non-prorated, covering materials and labor.
- B. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:
 1. MVER: In compliance with ASTM F1869 and as required or recommended by flooring system manufacturer for system to be installed.
- B. Water-Vapor Transmission: Through MVE-control system, in compliance with ASTM E96/E96M and as required by floor covering manufacturer for system to be installed.
- C. Tensile Bond Strength: For MVE-control system, greater than 200 psi with failure in the concrete according to ASTM D7234.

2.02 MVE-CONTROL SYSTEM

- A. MVE-Control System: ASTM F3010-qualified, fluid-applied, two-component, epoxy-resin, membrane-forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives.
 1. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
 2. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.

B. Moisture Vapor Emission Control Products:

1. Moisture Barrier/Vapor Retarder Membrane : Single coat, high density, moisture and alkali resistant, two-component, solvent free, rapid cure 100% solids epoxy coating specifically formulated to control concrete moisture vapor emission and alkalinity beneath finished flooring installations.
 - a. Water Vapor Transmission (10 mil film): ASTM E-96 0.085 net perms
 - b. Alkaline Resistance, pH 14, 10 days ASTM D1308: No effects
 - c. Tensile Pull on damp concrete ASTM D7234: Failure in concrete substrate (>400 psi)
 - d. VOC, g/l per ASTM D2369 SCAQMD Rule 1113: 24
 - e. Prior to installation, coordinate with specific flooring system manufacturer recommendations and provide moisture vapor control material that is acceptable to flooring manufacturer for use on this project.
2. Basis of Design: is CustomTech TechMVC Moisture Vapor and Alkalinity Barrier by Custom Building Products, Inc.
3. Acceptable Manufacturers:
 - a. Any product and manufacturer recommended by flooring manufacturer.
 - b. Ardex Americas, Inc. www.ardexamericas.com
 - c. Custom Building Products, Inc. www.custombuildingproducts.com
 - d. Laticrete, Inc. www.laticrete.com

2.03 ACCESSORIES

- A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product with minimum of 3000-psi 20.68-MPa compressive strength after 28 days when tested according to ASTM C109/C109M.
 1. Product as provided by, or as recommended in writing by MVE-control system manufacturer for project specific application.
- B. Crack-Filling Material: Resin-based material for sealing concrete substrate crack repair.
 1. Product as provided by, or as recommended in writing by MVE-control system manufacturer for project specific application.
- C. Cementitious Underlayment: If required to maintain manufacturer's warranty, provide MVE-control system manufacturer's hydraulic cement-based underlayment.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of system indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Preinstallation Testing:
 - 1. Testing Agency: Contractor to engage a qualified testing agency to perform tests.
 - 2. Alkalinity Testing: Perform pH testing according to ASTM F710. Install MVE-control system in areas where pH readings are not within floor covering manufacturer range.
 - 3. Moisture Testing: Perform tests so that each test area does not exceed flooring manufacturer recommendations. Maximum test area shall be 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - 4. Anhydrous Calcium Chloride Test: ASTM F1869. Install MVE-control system in locations where concrete substrate MVER exceeds flooring manufacturer recommendation. Maximum allowable rate is 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - 5. Internal Relative Humidity Test: Using in situ probes, ASTM F2170. Install MVE-control system in locations where concrete substrates exhibit relative humidity level greater than flooring manufacturer recommendation.
 - 6. Tensile-Bond-Strength Testing: For typical locations indicated to receive installation of MVE-control system, install minimum 100-sq. ft. (9.29-sq. m) area of MVE-control system to prepared concrete substrate and test according to ASTM D7234.
 - a. Proceed with installation only where tensile bond strength is greater than 200 psi (1.38 MPa) with failure in the concrete.
- B. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.
 - 1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents.
 - 2. Provide concrete surface profile complying with system manufacturer written instructions.

3. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
 4. Fill surface depressions and irregularities with patching and leveling material.
 5. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.
 6. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
 7. Before installing MVE-control systems, broom sweep and vacuum prepared concrete. Clean as recommended by system manufacturer.
- C. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

3.03 INSTALLATION

- A. Install MVE-control system according to ASTM F3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.
1. Install primers as required to comply with manufacturer's written instructions.
- B. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.
- C. Apply system, including component coats if any, in thickness recommended in writing by MVE-control system manufacturer for MVER indicated by preinstallation testing.
- D. Cure MVE-control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.
- E. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor to engage a qualified testing agency to perform installation inspections.
- B. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE-control system is installed without deficiencies.
1. Verify that surface preparation meets requirements.
 2. Verify that component coats and complete MVE-control-system film thicknesses comply with manufacturer's written instructions.

3. Verify that MVE-control-system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.

C. MVE-control system will be considered defective if it does not pass inspections.

3.05 PROTECTION

- A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.
- B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.

END OF SECTION

SECTION 09 2116

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Performance criteria for interior gypsum board assemblies.
 - 2. Gypsum wallboard.
 - 3. Miscellaneous metal framing.
 - 4. Joint treatment and accessories.

1.03 REFERENCES

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
- D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
- F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
- H. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- J. GA-216 - Application and Finishing of Gypsum Panel Products.

- K. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation.
- B. Attendees shall include contractor, gypsum board assemblies installer, manufacturer technical representative, and installers of adjacent materials and systems.

1.05 SUBMITTALS

- A. Shop Drawings: Indicate special details associated with acoustic seals.
 - 1. Provide dimensioned plans indicating location and configuration of penetrations at rated wall and ceiling assemblies. Indicate compliance with rating requirements.
- B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- C. Test Reports: For metal framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, and proposed for use, with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- B. Store materials in weather protected environment, clear of ground and moisture.
- C. Comply with recommendations and requirements of material manufacturer.

1.08 WARRANTY

- A. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.

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

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Fire Rated Assemblies: Provide completed assemblies as indicated on drawings.
 1. ICC-IBC/CBC Item Numbers: Comply with requirements of applicable code for the particular assembly.
- C. Sound-rated assemblies:
 1. Provide materials and construction identical to those tested in assemblies indicated, tested in accord with ASTM E90 and classified in accord with ASTM E413 by an independent Testing Agency.
 2. Construct designated partitions in accord with manufacturer's product data, as submitted, for obtaining Sound Transmission Class (STC) ratings as indicated on the drawings, in accord with ASTM E90.
- D. Seismic performance: Comply with code requirements.

2.02 BOARD MATERIALS

- A. Gypsum Board:
 1. Mold and moisture resistant board: Treated paper-faced gypsum board.
 2. Acceptable products:
 - a. American Gypsum, M-Bloc Type X Gypsum Board.
 - 1) Continental Building Products, Mold Defense Type X.
 - 2) CertainTeed, M2Tech Moisture & Mold Resistant Gypsum Board.
 - 3) Georgia-Pacific, ToughRock Fireguard X Mold-Guard Gypsum Board.
 - 4) National Gypsum, GoldBond XP Fire-Shield Gypsum Board.
 - 5) USG Corporation, USG Sheetrock Brand Mold Tough.
 - b. Thickness: 5/8" thickness Type C or Type X Grade fire-rated board, tapered edges.
 - c. Description: Mold and moisture resistant gypsum core encased in mold and moisture resistant facers, with tapered long edges. Panels shall comply with ASTM C1396.
 - d. Mold resistance: Resistant to mold growth when tested in accord with ASTM D3273, score of 10.

- e. Water absorption: Less than 5% of board weight when tested in accord with ASTM C473.
 - f. Joint tape: As recommended by gypsum board manufacturer.
 - g. Limitations: Do not use as a tile backer board.
 3. Regular board: Meeting ASTM C1396 , 5/8" thickness, tapered edges.
 4. Fire-retardant board: Meeting ASTM C1396, Type C or Type X as scheduled on the drawings, 5/8" thickness, tapered edges.
 5. Interior ceiling board: Meeting ASTM C1396, 1/2" thickness, Regular Grade, tapered edges.
 6. Flexible Gypsum Board: ASTM C1396/C1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - a. Thickness: 1/4 inch.
 - b. Long Edges: Tapered.
- B. Abuse-Resistant, Impact Resistant Board:
1. For use in the following locations: Refer to Drawings for additional requirements.
 - a. Mechanical, electrical, plumbing, and IT rooms.
 - b. Storage rooms.
 2. Acceptable products:
 - a. American Gypsum, M-Bloc Impact Resistant Type X Gypsum Board.
 - b. CertainTeed, AirRenew Extreme Impact Resistant Gypsum board.
 - c. Continental Building Products, Protecta HIR 300 Type X with Mold Defense.
 - d. Georgia-Pacific: ToughRock Fireguard X Mold-Guard Abuse-Resistant Gypsum Board.
 - e. National Gypsum Co., Gold Bond Hi-Impact XP Gypsum Board.
 - f. USG Corporation, USG Sheetrock Board Mold Tough VHI.
 3. Characteristics:
 - a. Limitations: Do not use as a base for wall tile installation. Do not use in wet areas.
 - b. Description: Fiber-reinforced or glass mesh enhanced core gypsum board meeting ASTM C1396; minimum Type C or Type X fire resistance rated.
 - c. Thickness: 5/8".

- d. Abrasion resistance: Surface abrasion depth shall be maximum 0.059" when tested in accord with ASTM D4977; or achieve minimum Level 2 abrasion resistance when tested in accord with ASTM C1629.
 - e. Surface indentation: Surface indentation shall be maximum 0.100" when tested in accord with ASTM D5420; or achieve minimum Level 2 indentation resistance when tested in accord with ASTM C1629.
 - f. Soft body impact: Minimum 300 ft.-lbs. to failure for single drop when tested in accord with ASTM E695; or achieve minimum Level 3 soft body impact resistance when tested in accord with ASTM C1629.
 - g. Hard body impact: Minimum 150 ft.-lbs. to failure and achieve minimum Level 3 hard body impact resistance when tested in accord with ASTM C1629.
 - h. Fire resistance: Noncombustible, minimum Type X, meeting UL minimum one-hour fire resistance, meeting ASTM E136 and ASTM E84; flame spread rating of 15 maximum and smoke developed rating of 0.
 - i. Mold resistance: Resistant to mold growth when tested in accord with ASTM D3273, score of 10.
- C. Tile Backer Board: Coordinate with requirements of Section 09 3000 - Tiling.
- 1. Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch (12.7 mm) thick; 2 inch (51 mm) wide coated glass fiber tape for joints and corners.
 - 2. Basis of Design: Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com.
 - 3. Acceptable Products: Subject to compliance with requirements.
 - a. Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com
 - b. USG Durock with EdgeGuard. www.usg.com
 - c. James Hardie Building Products; Hardie Backer Board. www.jameshardie.com
 - d. National Gypsum Company, Gold Bond ExP Tile Backer Board. www.goldbondbuilding.com

2.03 GYPSUM BOARD FRAMING AND SUPPORT MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
- 1. ClarkDietrich Building Systems: www.clarkdietrich.com.
 - 2. Jaimes Industries: www.jaimesind.com.
 - 3. Marino: www.marinoware.com.
 - 4. Phillips Manufacturing Co: www.phillipsmfg.com.

5. SCAFCO Corporation: www.scafco.com.
 6. Steel Construction Systems: www.steelconsystems.com.
- B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing indicated below.
1. Stud size: As indicated on drawings.
 2. Stud gauge: As required by manufacturer's product data and ASTM C754 for limiting heights, structural determinations, and conditions of use, with maximum allowable deflections as follows:
 - a. Standard gypsum board stud framing assemblies:
 - 1) Stud gauge shall comply with gypsum panel manufacturer's requirements for tested design thickness.
 - 2) Non-structural studs: Minimum L/120 at 10 psf in accord with ASTM C645.
 - 3) Structural studs: Minimum L/120 at 20 psf in accord with ASTM C955-17.
 - b. Heavy duty gypsum board stud framing assemblies.
 - 1) Stud gauge shall comply with gypsum panel manufacturer's requirements for tested design thickness.
 - 2) Non-structural studs: Minimum L/360 at 10 psf using 20 ga. or heavier studs, in accord with ASTM C645.
 - 3) Structural studs: Minimum L/360 at 20 psf using 20 ga. or heavier studs, in accord with ASTM C955.
 - c. Stairs, elevator hoistways, and other vertical shafts:
 - 1) Non-structural studs: Minimum L/240 at 10 psf in accord with ASTM C645.
 - 2) Structural studs: Minimum L/240 at 20 psf in accord with ASTM C955.
 3. Partitions to receive tile finishes:
 - a. Non-structural studs: Minimum L/360 at 10 psf using 20 ga. or heavier studs, in accord with ANSI A108.11 and ASTM C645-14.
 - b. Structural studs: Minimum L/360 at 20 psf using 20 ga. or heavier studs, in accord with ANSI A108.11 and ASTM C955-17.
 4. Partitions to receive abuse-resistant/impact-resistant wallboard: ---
 - a. Non-structural studs: Minimum L/360 at 10 psf using 20 ga. or heavier studs, in accord with ASTM C645-14.
 - b. Structural studs: Minimum L/360 at 20 psf using 20 ga. or heavier studs, in accord with ASTM C955-17.

- c. Stud gauge shall comply with gypsum panel manufacturer's requirements for tested design thickness.
 5. Other partitions: Meet code requirements.
- C. Runners: Hot dip galvanized steel, minimum 1" deep, same width as studs, 20 gauge. Runner tracks shall have slotted holes for attachment to structure and studs, for slip joints where required by manufacturer's product data.
- D. Deflection tracks: Minimum 20 gauge hot dip galvanized steel, deep leg type with slotted flange width of 2-1/2" minimum, allowing vertical movement of up to 1-1/2". Track shall be same nominal depth as studs with allowance for deflection of standard deep leg track.
- E. Preformed Top Track Firestop Seal:
 1. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
- F. Non-Loadbearing Framing Accessories:
 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
 - a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
 3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.

2.04 MISCELLANEOUS INSTALLATION ACCESSORIES

- A. Accessories shall comply with ASTM C1047.
- B. Furring channels: Minimum 25 ga. galvanized steel, 7/8 inch deep by 1-3/8 inch face width.
- C. "Z" furring channels: Minimum 25 ga. galvanized steel.
- D. Cold-rolled channels: Minimum 16 ga. steel, hot dip galvanized or black asphaltum-painted, as follows:
 1. 3/4 inch depth: 300 lbs./lf, for use as horizontal stiffeners, bracing and cross furring.
 2. 1-1/2 inch depth: 475 lbs./lf, for use as main ceiling runners.
- E. Furring channel clips: Manufacturer's standard type for attachment of furring channels to cold-rolled runner channels.
- F. Resilient channel: Galvanized steel, manufacturer's standard type.

- G. Furring brackets: Minimum 20 ga. galvanized steel, for attaching 3/4 inch furring channels to masonry walls.
- H. Ceiling hanger wire: Minimum eight ga. galvanized annealed steel wire.
- I. Tie wire: Minimum 18 ga. galvanized, annealed steel wire.
- J. Wall Mounted Deflection Beads: Flexible gasket and bead with 1-1/8 inch (29 mm) flange.
- K. Control joints: Control joint shall be designed to be applied after wall board is installed. Expanded metal or perforated flanges shall accept joint compound for a flush finish. Control joints shall provide stress relief and shall assist in controlling cracking in large areas of wallboard.
- L. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- M. Screws for Fastening of Gypsum Panel Products to Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- N. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.
- O. Expansion anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488 conducted by a qualified testing agency.
- P. Power-actuated anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
- Q. Screws for tile backer board application: Corrosion resistant sheet metal screws with head diameter providing 125 lb. fastener pull-through and pull-out resistance. Screw length shall provide 1/4" minimum thread engagement.
- R. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place in accordance with specified requirements.

2.05 GYPSUM WALLBOARD ACOUSTICAL ACCESSORIES

- A. 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.
 - 1. Minimum 1-1/2" thickness and 2-1/2 lb. density,
 - 2. Glass fiber sound attenuation batts:

- a. Acceptable Manufacturers:
 - 1) CertainTeed Corp.
 - 2) Knauf Insulation.
 - 3) Johns Manville Corp.
 - 4) Owens-Corning Corp.
 - b. Characteristics:
 - 1) Type: Unfaced fiberglass batts for friction fit between studs, complying with ASTM C665, Type 1.
 - 2) Surface burning characteristics: Maximum 25 flame spread and 50 smoke development when tested in accord with ASTM E84.
 - 3) Assembly STC: As indicated on drawings.
 - 4) Thickness: As indicated on drawings.
3. Mineral Wool Sound Attenuation Blankets:
- a. Acceptable manufacturers:
 - 1) IIG, MinWool, LLC, MinWool Sound Attenuation Fire Batts.
 - 2) Owens-Corning Corp., Sound Attenuation Fire Batt.
 - 3) USG Corporation, Thermafiber SAFB (Sound Attenuation Fire Blankets).
 - b. Characteristics:
 - 1) Type: Paperless, semi-rigid mineral wool fiber blanket complying with ASTM C665, Type 1.
 - 2) Density: Maximum 4.0 pcf for 1" thickness, and maximum
 - 3) 2.5 pcf. for greater thicknesses.
 - 4) Surface burning characteristics: Maximum 15 flame spread and 5 smoke development when tested in accord with ASTM E84.
 - 5) Assembly STC: As indicated on Drawings.
 - 6) Thickness: As indicated on Drawings.

B. Acoustical Sealants:

1. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E90.
2. Acoustical Sealant for Exposed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.

- a. Color: Colors as selected by Architect from manufacturer's full range of colors.
- b. Products: Subject to compliance with requirements.
 - 1) Accumetric LLC; BOSS 826 Acoustical Sound Sealant.
 - 2) GE Construction Sealants; RCS20 Acoustical.
 - 3) Grabber Construction Products; Acoustical Sealant GSC.
 - 4) Pecora Corporation; AIS-919.
 - 5) Tremco, Incorporated; Tremco Acoustical Sealant.
 - 6) United States Gypsum Company; SHEETROCK Acoustical Sealant.
3. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.
 - a. Products: Subject to compliance with requirements.
 - 1) Pecora Corporation; BA-98.
 - 2) Serious Energy Inc.; Quiet Seal 350.
- C. Acoustical Putty: Moldable, acoustic and intumescent putty.
 1. UL Classified
 2. UL Classified.
 3. Designed for use as sound insulation product with adhesion to typical wall system materials found on this project.
 4. Non-hardening, permanently resilient.
 5. Water resistant.
 6. Odorless.
 7. In Service Temperature: -10 deg. F to 120 deg. F
 8. STC: 62 per ASTM E90/ASTM C919
 9. Acceptable Manufacturers:
 - a. Acoustigard Sound and Vibration Control. www.acoustiguard.com
 - b. Acoustical Solutions. www.acousticalsolutions.com
 - c. Kinetics Noise Control. www.kineticsnoise.com
 - d. Soundaway Corporation. www.soundaway.com
- D. Acoustical tape: Closed cell polyvinyl chloride foam tape, minimum 1/4" thickness by 1" wide.

2.06 GYPSUM BOARD FINISHING ACCESSORIES

- A. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

2.07 MISCELLANEOUS TRIM ACCESSORIES

- A. Accessories shall comply with ASTM C1047 or ASTM D3678.
- B. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
- C. Acceptable Plastic Trim Manufacturers:
 - 1. Plastic Components, Inc.
 - 2. Trim-Tex Drywall components.
 - 3. Vinyl corp.
- D. Corner Beads:
 - 1. Inside corners: 1-1/4 inch wide expanded metal or fine perforated flanges.
 - a. For use in all locations, unless indicated otherwise.
 - 2. Square Outside Corners: Square with 1-1/4 inch wide expanded metal or fine perforated flanges.
 - a. For use in all locations, unless indicated otherwise.
 - 3. Bullnose Outside corners: 3/8 inch radius bullnose corner bead reinforcement, nail or staple-on type.
 - a. For use only where indicated or where selected by Architect.
- E. Jamb, Ceiling and Casing Trim: Manufacturer's standard "L" and "U" shaped members with expanded metal or perforated flanges; "mud-in" type for finishing with joint compound.

2.08 REVEALS

- A. For use only in locations indicated on Drawings.
- B. Architectural Reveal: Standard.
 - 1. Size: 1/2 inch wide by 1/2 inch deep, unless noted otherwise.
 - 2. Pre-fabricated reveal with pre-fabricated intersections and corners.
 - 3. Material: Extruded alloy 6063 T5, with chemical conversion coating, primed finish, clear anodized or other specified finish.

4. Finish: Factory primed for field painting. Refer to Section 09 9000 - Painting and Coating.
 5. Manufacturers:
 - a. Basis of Design: Fry Reglet Corp; "Reveal DA.1": www.fryreglet.com
 - b. Trim-Tex Architectural AS Reveal Bead: www.trim-tex.com
- C. Architectural Reveal: "Z" Reveal.
1. Reveal Size: As indicated on Drawings.
 2. Pre-fabricated reveal with pre-fabricated intersections and corners. 7/8-inch embedment leg with reveal size indicated.
 3. Material: Extruded alloy 6063 T5, with chemical conversion coating, primed finish, clear anodized or other specified finish.
 4. Finish: Factory primed for field painting. Refer to Section 09 9000 - Painting and Coating.
 5. Manufacturers:
 - a. Basis of Design: Fry Reglet Corp; "Z-Reveal": www.fryreglet.com
- D. Architectural Reveal: "F" Reveal.
1. Size: As indicated on Drawings.
 2. Pre-fabricated reveal with pre-fabricated intersections and corners.
 3. Material: Extruded alloy 6063 T5, with chemical conversion coating, primed finish, clear anodized or other specified finish.
 4. Finish: Factory primed for field painting. Refer to Section 09 9000 - Painting and Coating.
 5. Manufacturers:
 - a. Basis of Design: Fry Reglet Corp; "Reveal DA.2": www.fryreglet.com
 - b. Trim-Tex Architectural F Reveal Bead: www.trim-tex.com
- E. Other reveal sizes and configurations: Provide as indicated on Drawings. -td

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 MISCELLANEOUS METAL FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 - 1. Level ceiling system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.

3.03 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Acoustic-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
 - 1. Install joint sealants and other acoustic control materials at all sound/acoustically rated wall and ceiling assemblies as required to maintain indicated acoustical rating.
- C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

3.04 APPLYING TILE BACKING PANELS

- A. Refer to the requirements of Section 09 3000 - Tiling.
- B. Where tile backing panels abut other types of panels in same plane, shim and support surfaces to produce a uniform plane across panel surfaces.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Install gypsum wallboard accessories in accordance with manufacturer's product data and as follows:
 - 1. Corner Beads and Trim: Install at external corners, using longest practical lengths.
 - 2. Metal trim shapes: Install at exposed edge of wallboard at door and window openings, at intersections with other materials and at intersection of walls with ceilings.
 - 3. Install corner beads and metal trim shapes to framing system with mechanical anchors spaced at 16 inches on-center for vertical applications, and 16 inches on-center for horizontal applications.
- B. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners, unless otherwise indicated.
 - 2. Bullnose Bead: Use at outside corners, only where indicated or where selected by Architect.

3. LC-Bead: Use at exposed panel edges.
 4. L-Bead: Use where indicated.
 5. U-Bead: Use at exposed panel edges, where indicated.
 6. Curved-Edge Cornerbead: Use at curved openings.
 7. Other Trim including Reveals: Install in locations indicated on Drawings.
- C. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
1. Control Joints: Install control joints at locations indicated on Drawings according to ASTM C840 and in specific locations approved by Architect for visual effect.

3.06 FINISH LEVELS AND JOINT TREATMENT

- A. Finish Levels: Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 3. Level 3: Walls to receive textured wall finish.
 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 5. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.
 6. Level 0: Temporary partitions.
 7. Level 0: Surfaces indicated to be finished in later stage of project.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
- C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.07 FIRE AND SMOKE BARRIER IDENTIFICATION

- A. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other rated wall required to have protected openings shall be effectively and permanently identified with signs or stenciling in a manner acceptable to code officials.

1. Where identification is required to be provided locate as directed by code officials.
2. Provide lettering and coloring as directed by code officials.
3. Use wording nomenclature as directed by code officials.

3.08 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.09 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 3000

TILING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Tile for floor applications.
 - 2. Tile for wall applications.
 - 3. Accessories.

1.03 REFERENCES

- A. Definitions:
 - 1. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
 - 2. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
 - 3. Face Size: Actual tile size, excluding spacer lugs.
 - 4. Module Size: Actual tile size plus joint width indicated.

1.04 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation to discuss conformance with project requirements, manufacturer installation requirements, affected adjacent materials and system, and site conditions.
- B. Attendees shall include contractor, tile installer, mortar and grout manufacturer technical representative, and installers of adjacent materials and systems.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

- B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, setting details, and accessories.
 - 1. Tile Assemblies: Indicate compliance with specified TCNA assemblies. Where discrepancy exists between TCNA recommendations and specified requirements, note in submittal for Architect review and coordination.
- C. Samples for Initial Selection: Provide manufacturer standard samples for tile, grout, and accessories requiring color selection.
- D. Sample for Verification:
 - 1. Provide assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved by Initial Selection.
 - 2. Metal edge strips in 6-inch lengths.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer.

1.06 CLOSEOUT SUBMITTALS

- A. Special Installer Warranty: Executed warranty meeting specified requirements.
- B. Special Manufacturer Warranty: Executed warranty meeting specified requirements.
- C. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Tile: 5 percent of each size, color, and surface finish combination, but not less than two original cartons of each type.

1.07 QUALITY ASSURANCE

- A. Maintain one copy of ANSI A108/A118/A136 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.

1.08 MOCKUPS

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Build mockup of each type of wall tile installation.
 2. Size and location of mock-ups to be selected by Architect.
- B. Subject to compliance with requirements, approved mockups may become part of the completed Work if accepted to remain by Architect and if undisturbed at time of Substantial Completion.
- C. Approval of mockups does not constitute approval of deviations from the Contract Documents unless Architect specifically approves such deviations in writing.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.10 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.
- C. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.11 WARRANTY

- A. Special Manufacturer Warranty - Mortar Setting and Grouting System Warranty: Provide setting and grouting system manufacturer system warranty against bond failure, cracking, installation, and material defects.

1. Term: Ten (10) years, beginning at date of Substantial Completion.
- B. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 TILE

- A. Final selections are to be determined. Refer to Drawings for additional requirements.
- B. Performance and Technical Requirements: As indicated by basis of design selections.
- C. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.
- D. Fabrication:
 1. Factory blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
 2. Factory-applied temporary protective coating: Where indicated under tile type, protect exposed surfaces of tile against adhesion of mortar and grout by precoating with continuous film of release agent as recommended by mortar and grout manufacturer or a hot-applied petroleum paraffin wax. Do not coat backs or sides of tile surfaces.

2.02 METAL TRANSITIONS

- A. For use where indicated on Drawings, and where selected by Architect.
- B. Metal Transitions for Walls:
 1. Applications: As indicated on Drawings.
 2. Sizes: As dictated by materials at transitions.
 3. Profiles: As indicated on Drawings. Where not indicated, as selected by Architect.
 4. Material: As indicated on Drawings. Where not indicated, as selected by Architect.
 5. Finish: As indicated on Drawings. Where not indicated, as selected by Architect.
 6. Basis of Design: Schluter Systems, Inc. www.schluter.com
 7. Acceptable Manufacturers: Subject to compliance with requirements.
 - a. Schluter Systems, Inc. www.schluter.com
 - b. Prolifitec, SpA. www.us.profilitec.com

- c. Proline Systems, GmbH. www.proline-systems.com

C. Metal Transitions for Floors:

1. Transitions shall comply with A.D.A. requirements of Section 4.5.2 Changes of Level.
2. Applications: As indicated on Drawings.
3. Sizes: As dictated by flooring materials at transitions.
4. Profiles: As indicated on Drawings. Where not indicated, as selected by Architect.
5. Material: As indicated on Drawings. Where not indicated, as selected by Architect.
6. Finish: As indicated on Drawings. Where not indicated, as selected by Architect.
7. Basis of Design: Schluter Systems, Inc. www.schluter.com
8. Acceptable Manufacturers: Subject to compliance with requirements.
 - a. Blanke Corporation. www.blankecorp.com/blanke-usa/
 - b. Genesis Global Systems Ltd. www.genesis-gs.com
 - c. Schluter Systems, Inc. www.schluter.com
 - d. Prolifitec, SpA. www.us.profilitec.com
 - e. Proline Systems, GmbH. www.proline-systems.com

2.03 SETTING MATERIALS

A. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.

1. Applications: Use this type of bond coat where indicated at floors.
2. Products:
 - a. Basis of Design: Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com.
 - b. ARDEX Engineered Cements; ARDEX N 23 MICROTEC: www.ardexamericas.com.
 - c. Merkrete, by Parex USA, Inc; Merkrete 735 Premium Flex: www.merkrete.com.
 - d. TEC, an H.B. Fuller Construction Products Brand; TEC 3N1 Performance Mortar: www.tecspecialty.com.
 - e. Mapei Corp., UltraFlex LFT: www.mapei.com/US-EN.

B. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.

1. Applications: Use this type of bond coat where indicated at walls.

2. Properties: Non-sag, pre-sanded, polymer-modified Portland cement and additives meeting ANSI A118.4, ANSI A118.11 and ANSI A118.15, non-sag, minimum 400 psi shear strength for porcelain tile at 28 days.
3. Products:
 - a. Basis of Design: Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com.
 - b. ARDEX Engineered Cements; S 28: www.ardexamericas.com.
 - c. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com.
 - d. TEC, an H.B. Fuller Construction Products Brand; TEC 3N1 Performance Mortar: www.tecspecialty.com.
 - e. Mapei Corp., UltraFlex LFT: www.mapei.com/US-EN.

2.04 GROUTS

- A. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 1. Applications: Floors and walls in areas where chemical resistance is not required.
 2. Compatible with the following:
 - a. Vitreous, semi-vitreous or non-vitreous tile: ceramic, mosaic, quarry, cement body tile.
 - b. Impervious porcelain and glass tile.
 - c. Cement-based precast terrazzo.
 - d. Polished, natural stone groutable luxury vinyl tile.
 - e. Countertops, tub surrounds, shower walls and floors and high traffic areas.
 3. Tile Surface Release Agent: Provide grout manufacturer's recommended grout release agent for application to tile surfaces prior to grouting tile.
 4. Sealers: Not required.
 5. Efflorescence: None.
 6. Color(s): As selected by Architect from manufacturer's full line.
 7. Products:
 - a. Basis of Design: Custom Building Products; Fusion Pro Single Component Grout: www.custombuildingproducts.com.
 - b. ARDEX Engineered Cements; ARDEX FL: www.ardexamericas.com.

- c. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com.
 - d. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: www.merkrete.com.
 - e. Products by Hydroment, subject to compliance with specified requirements.
- B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
1. Applications: Floors and walls in locations indicated.
 2. Color(s): As selected by Architect from manufacturer's full line.
 3. Properties: Two- or three-component, water-cleanable, 100% solids epoxy grout meeting ANSI A118.3; standard colors selected by Architect.
 4. Tile Surface Release Agent: Provide grout manufacturer's recommended grout release agent for application to tile surfaces prior to grouting tile.
 5. Sealers: Not required.
 6. Efflorescence: None.
 7. Products:
 - a. Basis of Design: Custom Building Products; CEG-Lite 100% Solids Commercial Epoxy Grout: www.custombuildingproducts.com.
 - b. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com.
 - c. TEC, an H.B. Fuller Construction Products Brand; TEC AccuColor EFX Epoxy Special Effects Grout: www.tecspecialty.com.
 - d. Mapei Corp., Kerapoxy or Kerapoxy CQ..

2.05 ADDITIVES

- A. Provide additives as recommended by mortar and grout manufacturer. Additives shall be manufactured or approved by mortar and grout manufacturer.

2.06 SEALANTS, SEALERS, EXPANSION AND CONTROL JOINTS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
 2. Color(s): As selected by Architect from manufacturer's full line.
 3. Selection: Select product for specific application. Coordinate with adjacent finishes and painting requirements.
 4. Primer: As recommended by sealant manufacturer's product data:

5. Products:
 - a. Use sealants recommended by mortar and grout manufacturer. Sealants shall be manufactured, or approved by mortar and grout manufacturer. Refer to Section 07 9200 - Joint Sealants.
 - b. Basis of Design: Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com.

B. Expansion and Control Joints:

1. Provide as recommended by setting bed and grout manufacturer and in accordance with TCNA guidelines.
2. Materials: Use specified tile sealant and closed cell joint backing materials as recommended by sealant manufacturer.

C. Grout Release: Temporary, water-soluble pre-grout coating.

1. Products:
 - a. Basis of Design: Custom Building Products; Aqua Mix Grout Release: www.custombuildingproducts.com.

2.07 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12 and ANSI A118.10; not intended as waterproofing.

1. Fluid or Trowel Applied Type:
 - a. Designed for interior and exterior substrates, to reduce crack transmission in tile and stone floors. Acceptable for use as a slab-on-grade moisture vapor barrier.
 - b. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum.
 - c. Acceptable Substrates:
 - 1) Slab-on-grade, cast-in-place, structural, interior, concrete.
 - 2) Elevated concrete slabs over interior, fully conditioned, occupied space.
 - 3) Lightweight Concrete (min. 2000 psi compressive strength) Gypsum-Based cement topping (min. 2000 psi compressive strength).
 - d. Applicable Standards:
 - 1) American National Standards Institute (ANSI) ANSI A108.01, A108.17, A108.13, A118.10 and A118.12 American National Standards for the Installation of Ceramic Tile ASTM International (ASTM).
 - 2) Tile Council of North America (TCNA) TCNA Handbook for Ceramic Tile Installation, TCNA Method EJ171, F125 & F125A.

- e. Material: Synthetic rubber or Acrylic.
- f. Products:
 - 1) Basis of Design: Custom Building Products; Crack Buster Pro: www.custombuildingproducts.com.
 - 2) TEC, an H.B. Fuller Construction Products Brand; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com.
 - 3) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com.
- B. Tile Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch (12.7 mm) thick; 2 inch (51 mm) wide coated glass fiber tape for joints and corners.
 - 1. Coordinate with the requirements of Section 09 2116 - Gypsum Board Assemblies.
 - 2. Basis of Design: Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com.
 - 3. Acceptable Products: Subject to compliance with requirements.
 - a. Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com
 - b. USG Durock with EdgeGuard. www.usg.com
 - c. James Hardie Building Products; Hardie Backer Board. www.jameshardie.com
 - d. National Gypsum Company, Gold Bond ExP Tile Backer Board. www.goldbondbuilding.com

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- B. Verify that required utilities are in correct location.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.

- C. Seal substrate surface cracks with filler. Level substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.
- F. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

3.03 INSTALLATION - GENERAL

- A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
 - 1. Comply with specified TCNA assemblies. Where discrepancy exists between TCNA recommendations and specified requirements, do not begin installation until Architect has reviewed for coordination and resolution.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align wall joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install accessories and trim in accordance with manufacturer's instructions.
- G. Install transitions where indicated.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 CLEANING

- A. Clean installed tile and grout surfaces.

3.05 INTERIOR FLOOR TILE INSTALLATION SCHEDULE

- A. Interior slab-above-grade concrete floors, wet area, thin set:
1. Tile Installation: TCNA F122A; thin setting to full coverage waterproofing membrane.
 - a. Prepared concrete subfloor.
 - b. Waterproof membrane. Tie into all drain flanges and extend full height of tile installation up all perimeter walls and at-field interruptions such as columns, wing walls, and chases to create a fully waterproofed tile installation area.
 - c. Bond Coat: Latex-Portland Cement Mortar Bond Coat.
 - d. Tile: As indicated.
 2. Grout: To be determined. Coordinate with requirements indicated on Drawings.
 - a. High-performance polymer modified grout.
 - b. Epoxy grout.
 3. Requirements: Clean, porous, uncontaminated interior slab on grade concrete. For other substrates not meeting these requirements, refer to TCNA Handbook, current edition.

3.06 INTERIOR WALL TILE INSTALLATION SCHEDULE

- A. Walls, wet areas, over wood or metal studs, thin set:
1. Tile Installation: TCNA B412; thinset mortar on cementitious backer board or fiber-cement backer board with waterproofing membrane.
 2. Waterproof membrane. Tie into all drain flanges and extend full height of tile installation up all perimeter walls and at-field interruptions such as columns, wing walls, and chases to create a fully waterproofed tile installation area.
 3. Bond Coat: Improved Latex-Portland Cement Mortar Bond Coat.
 4. Grout: To be determined. Coordinate with requirements indicated on Drawings.
 - a. High-performance polymer modified grout.
 - b. Epoxy grout.

END OF SECTION

SECTION 09 5100

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Suspended metal grid ceiling system.
 - 2. Acoustical units.
 - 3. Specialty ceilings.
 - 4. System trim and accessories.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
 - 2. Do not install acoustical units until after interior wet work is dry.
 - 3. Schedule acoustical material installation to minimize need for removal and replacement of acoustical units to accommodate work of other trades.
- B. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation.
 - 1. Attendees shall include contractor, acoustical system installer, manufacturer technical representative, and installers of adjacent materials and systems.

1.04 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Suspension system components.
 - 2. Ceiling tiles and panels.
 - 3. Molding and trims.
 - 4. Special items.

5. Acoustical sealants.
- B. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- C. Shop Drawings: Indicate grid layout and related dimensioning.
- D. Samples: Submit two samples 12 by 12 inches in size illustrating material and finish of acoustical units.
- E. Samples: Submit two samples each, 12 inches long, of suspension system main runner.
- F. Delegated-Design Submittal: For seismic restraints for ceiling systems.
 1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 2. Include compliance with exterior cladding code requirements, including wind resistance, for exterior parking garage ceiling system installations.
- G. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Seismic System Design:
 - a. Indicate compliance with applicable codes.
 - b. Indicate compliance with recommendations CISCA Seismic Construction Handbook, current edition.
 2. Ceiling suspension-system members.
 3. Structural members to which suspension systems will be attached.
 4. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 5. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 6. Size and location of initial access modules for acoustical tile.
 7. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers.

- e. Sprinklers.
- f. Access panels.
- g. Perimeter moldings.
- 8. Location of acoustical sealants.
- 9. Show operation of hinged and sliding components adjacent to acoustical tiles.
- 10. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).
- H. Qualification Data: For testing agency.
- I. Product Test Reports: For each acoustical tile ceiling, for tests performed by a qualified testing agency.
- J. Evaluation Reports: For each acoustical tile ceiling suspension system and anchor and fastener type, from ICC-ES.
- K. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Special Installer Warranty: Executed warranty meeting specified requirements.
- B. Special Manufacturer Warranty: Executed warranty meeting specified requirements.
- C. Maintenance Data: Provide manufacturer parts lists, operation, and maintenance instructions for the materials of this Section.
- D. Maintenance Materials: 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. Acoustical Ceiling Units: Full-size tiles equal to 5 percent of quantity installed. Minimum two cartons.
 - 2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 5 percent of quantity installed.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 MOCKUPS

- A. Mockup: Provide a mockup for evaluation of installation, finishes, and workmanship.
 - 1. Locate as directed by Architect.
 - 2. Size: Minimum 25 square feet in configuration directed by Architect. Provide for each type of system, as directed by Architect.
- B. Do not proceed with installation beyond mockup until the mockup installation is approved by Architect. Correct deficiencies and refinish mock-up area as required to produce acceptable work.
- C. Subject to compliance with requirements, approved mockups may become part of the completed Work if accepted to remain by Architect and if undisturbed at time of Substantial Completion. Remove mockup when directed by Architect.
- D. Approval of mockups does not constitute approval of deviations from the Contract Documents unless Architect specifically approves such deviations in writing.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.09 FIELD CONDITIONS

- A. Maintain uniform temperature in accordance with manufacturer recommendations.
- B. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.10 WARRANTY

- A. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer Warranty: Provide manufacturer's warranty covering manufacturing and material defects, where items fail to perform as designed and manufactured.
 - 1. Warranty Period: Two years from date of Substantial Completion.

- C. Special Warranty Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace materials that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL

- A. Design intent is to match existing. Specified requirements establish minimum requirements. Refer to Drawings for additional requirements. Contractor to field verify existing. Final selections are by Architect.

2.02 MANUFACTURERS

- A. Product and Material Selections: As indicated on Drawings. Where not indicated, as selected by Architect.
- B. Performance and Technical Requirements: As indicated by basis of design product selections.

2.03 ACOUSTICAL UNITS

- A. Acoustical Units - General:
 - 1. Glass-fiber-based panels made with and containing no urea formaldehyde.
 - 2. Surface burning characteristics meeting ASTM E1264, Class A.
- B. Source limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

2.04 SUSPENSION SYSTEM

- A. Product and Material Selections: As indicated on Drawings. Where not indicated, as selected by Architect.
- B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
 - 1. Provide complete standard direct-hung metal ceiling tile suspension system meeting applicable building code required structural and seismic classifications.
- C. Exposed Steel Suspension System Type 15/16": Formed steel, commercial quality cold rolled.
 - 1. Profile: Tee; 15/16 inch (24 mm) wide face. Minimum 1-1/2" nominal height main tee.
 - 2. Grid Size: As required to match specified acoustical panel or tile size.
 - 3. Construction: Double web.

4. Edge Molding: Final selection by Architect.
 - a. Square Edge Panels: Provide hemmed edges in channel or angle shapes.
 - b. Reveal Edge Panels: Provide hemmed edges in "Shadow Line" shape.
5. Flange Widths: Shall be as required to meet applicable structural and seismic classifications. Minimum 3/4".
6. Materials: Hot dip galvanized, cold rolled steel. Metal thicknesses shall be as required to meet applicable structural and seismic classifications.
7. Finish (Exposed Components): White painted. Manufacturer standard system using chemically treated paint adhesion system with factory applied, low gloss paint.

2.05 ACCESSORIES

- A. Provide accessories as needed for a complete acoustical ceiling system installation. All accessories shall be sized to comply with applicable code requirements for structural and seismic design. Sizes listed shall be considered minimums and the most stringent requirement shall apply.
 1. Accessories exposed to view shall be finished to match adjacent ceiling grid.
 2. Provide accessories for ceiling grid system in compatible, non dissimilar, non corrosive metals.
 3. Coordinate design, configuration, and installation of systems of this Section with the requirements of Section 05 4000, as applicable.
- B. 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.
 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B633, Class SC 1 (mild) service condition.
 - b. Corrosion Protection: Stainless-steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316.
 - c. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B164 for UNS No. N04400 alloy.
 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by

testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.

- C. Support Channels: Minimum 16 ga. cold-rolled steel, 1-1/2" deep.
- D. Wire Hangers, Braces, and Ties: Provide wires as follows:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 - 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch.
- E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- G. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
- H. T-Grid support clip: Mechanical clip for attaching acoustical "T" to edge molding without exposed fasteners in grid system.
 - 1. Acceptable products:
 - a. Armstrong World Industries, Inc., Beam End Retainer Clip Item 7395.
 - b. Rockfon, 1493 Unopposed Tee Clip.
 - c. Erico Products, Inc., Caddy TGE T-Grid support clip.
 - d. USG Industries, Inc., Mac 2.
- I. Hold-Down Clips: Manufacturer's standard hold-down.
- J. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
- K. Stabilizer Clips: Provide manufacturer recommended and provided stabilizer clips where length of lateral grid supports is greater than 5 feet on-center. Provide on both (opposing) sides of field installation whenever condition occurs.
- L. Seismic Clips: Manufacturer's seismic clips designed to secure acoustical panels in place during a seismic event.
- M. Seismic Stabilizer Bars: Manufacturer's perimeter stabilizers designed to accommodate seismic forces.
- N. Seismic Struts: Manufacturer's compression struts designed to accommodate seismic forces.
- O. Perimeter Moldings: Same material and finish as grid.

1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
- P. Hangar Brackets for Gypsum Sub-Ceilings:
1. Minimum 20 ga. galvanized steel bracket designed for screw attachment through gypsum board main tees and hangar wire attachment for secondary ceiling.
 2. Acceptable Product: Armstrong World Industries, Inc., Drywall Hanger Clip (DWC).
- Q. Hangar Brackets for Panel Sub-Ceilings:
1. Minimum 25 ga. galvanized steel bracket designed to fit over ceiling grid tees for attachment of hangars for secondary ceiling.
 2. Acceptable Product: Armstrong World Industries, Inc., Direct Load Ceiling Clip (DLCC).
- R. Glass Fiber Sound Attenuation Batts:
1. Characteristics:
 - a. Designed for acoustical sound control in metal stud wall assemblies.
 - b. Type: Unfaced fiberglass batts for friction fit between studs, complying with ASTM C665, Type 1.
 - c. Fire Resistance:
 - 1) Considered non-combustible and classified 10/10 when tested in accordance with ASTM E84. Capable of achieving up to a 2 hour rating when tested according to ASTM E119.
 - 2) Surface burning characteristics: Maximum 25 flame spread and 50 smoke development when tested in accord with ASTM E84-17.
 - d. Assembly STC: As indicated on drawings.
 - e. Thickness: As indicated on drawings. Minimum 2-1/2 inch thickness and 2-1/2 lb. density,
 2. Acceptable Manufacturers:
 - a. Basis of Design: Owens-Corning Corp., Sound Attenuation Batt Insulation.
 - b. CertainTeed Corp.
 - c. Knauf Insulation.
 - d. Johns Manville Corp.
- S. Mineral Wool Sound Attenuation Blankets:
1. Designed for acoustical sound control and fire rated assemblies.

2. Designed for interior stud cavities, interior floor joints (between joists), and as ceiling overlayment.
 3. Non-combustible, moisture-resistant, non-corrosive, non-deteriorating, mildew-resistant and vermin-resistant. Resists temperatures to over 2,000 degrees F.
 4. Type: Paperless, semi-rigid mineral wool fiber blanket complying with ASTM C66, Type 1.
 5. Density: Maximum 4.0 pcf for 1 inch thickness, and maximum 2.5 pcf. for greater thicknesses.
 6. Fire Resistance:
 - a. NFPA 101: Class A rated interior finish.
 - b. ASTM C 665 ; Type I, per Federal Specification HH-I-521F.
 - c. ASTM E 136: Non-combustible as defined per NFPA Standard 220.
 - d. ASTM C 1104: Absorbs less than 1% by volume.
 - e. ASTM E 84/ CAN/ULC S102: Flame Spread 0, Smoke Developed 0.
 7. Assembly STC: As indicated on drawings.
 8. Thickness: As indicated on drawings.
 9. Acceptable manufacturers:
 - a. IIG, MinWool, LLC, MinWool Sound Attenuation Fire Batts.
 - b. Owens-Corning Corp., Sound Attenuation Fire Batt.
 - c. USG Corporation, Thermafiber SAFB (Sound Attenuation Fire Blankets).
- T. Acoustical Sealants:
1. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E90.
 2. Acoustical Sealant for Exposed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
 - a. Color: Colors as selected by Architect from manufacturer's full range of colors.
 - b. Products: Subject to compliance with requirements.
 - 1) Accumetric LLC; BOSS 826 Acoustical Sound Sealant.
 - 2) GE Construction Sealants; RCS20 Acoustical.
 - 3) Grabber Construction Products; Acoustical Sealant GSC.
 - 4) Pecora Corporation; AIS-919.

- 5) Tremco, Incorporated; Tremco Acoustical Sealant.
- 6) United States Gypsum Company; SHEETROCK Acoustical Sealant.
3. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.
 - a. Products: Subject to compliance with requirements.
 - 1) Pecora Corporation; BA-98.
 - 2) Serious Energy Inc.; Quiet Seal 350.
- U. Acoustical tape: Closed cell polyvinyl chloride foam tape, minimum 1/4 inch thickness by 1 inch wide.
- V. Touch-up Paint: Tile manufacturer provided of type and color to match acoustical tile or panel units.
- W. Custom Panel Sizes: Tile manufacturer provided custom acoustical tile panels in available sizes for use in locations where standard specified sizes do not fit. Avoid field cutting acoustical tiles.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 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, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. General: Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
1. Comply with building code for seismic requirements.
 2. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
 3. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size. Align grid members straight and perpendicular to walls.
 4. Locate accessories, control joints and expansion joints before installing grid system.
 5. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
 6. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
 7. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
 8. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.
 9. Do not eccentrically load system or induce rotation of runners.
- B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers, only where required, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Coordinate with delegated-design requirements.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger

- involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Perimeter and Edge Molding and Trim: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
1. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 2. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 3. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
 4. Use longest practical lengths.
 5. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Where grid system exists in an unrestrained condition, brace back to building structure using hanger wire, main tee or carrying channel braces.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function. Install acoustical panels to fit accurately into suspension-system runners and edge moldings.
 1. Exposed acoustical unit edges are not permitted.

- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Exposed Edges:
 - 1. Visible unfinished acoustical tile or panel edges are not permitted.
- G. Cutting Acoustical Units:
 - 1. Avoid field cutting acoustical tile wherever possible. Install tile manufacturer custom panel sizes. Where field cutting is required, install tile manufacturer provided field touch up paint as specified.
 - 2. Cut to fit irregular grid and perimeter edge trim.
 - 3. Make field cut edges of same profile as factory edges.
 - 4. Scribe and cut panels at borders and penetrations to provide precise fit.
 - 5. Where round obstructions occur, provide preformed closures to match perimeter molding.
- H. Arrange directionally patterned acoustical panels as follows:
 - 1. As indicated on reflected ceiling plans.
- I. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
- J. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
- K. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
- L. Lay acoustical insulation for a distance of 48 inches (1200 mm) either side of acoustical partitions as indicated.
- M. Install hold-down clips on each panel to retain panels tight to grid system; comply with seismic design requirements.
 - 1. Install impact and seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
 - 2. Hold-Down Clips: Space Maximum 24 inches (610 mm) on all cross runners.
- N. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.05 ERECTION TOLERANCES

- A. Deflection: Suspension system components, hangers and fastening devices supporting lighting fixtures, ceiling grilles and acoustical units shall have maximum deflection of 1/360 of the span when tested in accord with ASTM C635.
- B. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.
- C. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.
- D. Bow, camber and twist: Not exceeding tolerances established by ASTM C635.

3.06 CLEANING

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

END OF SECTION

SECTION 09 6514

RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Resilient base.
- B. Flooring transition accessories.

1.03 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation.
- B. Attendees shall include contractor, resilient system installer, manufacturer technical representative, and installers of adjacent materials and systems.

1.04 SUBMITTALS

- A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- B. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

1.05 CLOSEOUT SUBMITTALS

- A. Special Installer Warranty: Executed warranty meeting specified requirements.
- B. Special Manufacturer Warranty: Executed warranty meeting specified requirements.
- C. Maintenance Data: Provide manufacturer maintenance instructions for the materials of this Section.
- D. Maintenance Materials: 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. Quantity equal to 2 percent of quantity installed. Minimum two cartons.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified materials with minimum 20 years documented experience.
- B. Installer Qualifications: Company specializing in installing specified materials with minimum five years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.08 FIELD CONDITIONS

- A. Maintain materials in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C), in spaces to receive resilient products during the following periods:
 - 1. Minimum 48 hours before installation.
 - 2. During installation.
 - 3. Minimum 48 hours after installation.

1.09 WARRANTY

- A. Special Manufacturer Warranty: Provide manufacturer's warranty covering manufacturing and material defects, where items fail to perform as designed and manufactured.
 - 1. Warranty Period: Minimum 10 years from date of Substantial Completion.
- B. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL

- A. Design intent is to match existing. Specified requirements establish minimum requirements. Refer to Drawings for additional requirements. Contractor to field verify existing. Final selections are by Architect.

2.02 PRODUCT REQUIREMENTS

- A. Single-Source Responsibility for Products: Obtain each type and color of product specified from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- B. Provide products and accessories necessary for a complete installed system.
- C. All products shall comply with applicable code requirements for fire resistance and combustibility.

2.03 RESILIENT BASE

- A. Acceptable manufacturers subject to compliance with requirements:
 - 1. Burke Flooring: www.burkeflooring.com.
 - 2. Roppe Corporation. www.roppe.com
 - 3. Tarkett (formerly Johnsonite). www.commercial.tarkett.com
- B. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset.
 - 1. Physical Characteristics:
 - a. Manufactured from a proprietary thermoplastic rubber formulation.
 - b. Meets performance requirements for ASTM F-1861, Type TP, Group 1.
 - c. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I.
 - d. Flexibility: Does not crack, break, or show any signs of fatigue when bent around a 1/4" (6.4 mm) diameter cylinder when tested according to ASTM F 137 Standard Test Method for Flexibility of Resilient Flooring Materials protocols.
 - e. Fire Resistance: ASTM E 648 Critical Radiant Flux (NFPA 253): Class I.
 - f. Color Stability: Meets or exceeds ASTM F 1861 requirements for color stability when tested to ASTM F 1515 Standard Test Method for Measuring Light Stability of Resilient Flooring protocols.
 - g. Chemical resistance (ASTM F 925): Passes – 5% acetic acid, 70% isopropyl alcohol, mineral oil, 5% sodium hydroxide solution, 5% hydrochloric acid solution, 5%

sulfuric acid solution, 5% household ammonia solution, and 5.25% household bleach solution.

- h. Resistance to light (ASTM F 1515): < 8.
 - i. Phthalate, chlorine and halogen free
 - j. 100 percent Recyclable.
 - k. Manufacturing facilities shall be ISO 9001 and ISO 14001 Certified.
- 2. Length: Manufacturer standard; provide longest available length to minimize seams.
 - 3. Profile: Provide straight or cove base as indicated on Drawings.
 - 4. Height: 4 inch or 6 inch, as indicated on Drawings.
 - 5. Accessories: Premolded external corners and internal corners.
 - 6. Color: As indicated on Drawings. Where not indicated, as selected by Architect.

2.04 ACCESSORIES

- A. Provide all accessories items from primary base manufacturer except where not available.
- B. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by product manufacturer for applications indicated.
- C. Adhesives: Water-resistant type recommended by product and adhesive manufacturers to suit base and substrate conditions indicated.

2.05 FLOORING TRANSITIONS

- A. Moldings, Transition and Edge Strips:
 - 1. Coordinate with project Interior Design requirements.
 - 2. Sizes: As dictated by flooring materials at transitions.
 - 3. Profiles: As indicated on Drawings.
 - 4. Physical Characteristics:
 - a. Transitions shall comply with A.D.A. requirements of Section 4.5.2 Changes of Level.
 - b. Standard formulation exceeds ASTM E 648 Class 1 Flammability requirements.
 - c. Designed for interior applications only.
 - 5. Basis of Design: Tarkett Slim Line Transitions by Tarkett Company: www.johnsonite.com.
 - 6. Acceptable manufacturers subject to compliance with requirements:

- a. Burke Flooring: www.burkeflooring.com.
- b. Roppe Corp: www.roppe.com.
- c. Tarkett (formerly Johnsonite). www.commercial.tarkett.com

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- B. Verify that required utilities in the materials installation area are in correct location.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 PREPARATION

- A. Clean and prepare substrates in accordance with manufacturer's written instructions.
- B. Prepare substrates for installation of resilient materials in accordance with Section 09 0561.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of substrate conditions.
- B. Install components and accessories in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 1. Spread only enough adhesive to permit installation of materials before initial set.
 2. Fit joints and butt seams tightly.

3.04 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Provide maximum joint dimension as recommended by base manufacturer.
- C. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- D. Install base on solid backing. Bond tightly to substrates.
- E. Scribe and fit to door frames and other interruptions.

3.05 INSTALLATION - TRANSITIONS

- A. Install transitions in one piece sections. Where more than one piece is required, fit joints tightly.
- B. Provide maximum joint dimension as recommended by base manufacturer.
- C. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- D. Install transitions on solid backing. Bond tightly to substrates.
- E. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.
- C. Protect installed materials from damage or deterioration until date of Substantial Completion.

END OF SECTION

SECTION 09 6813

TILE CARPETING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Carpet tile, adhered.

1.03 RELATED WORK

- A. Section 09 0561 - Moisture Vapor Control Floor Preparation.

1.04 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- B. CRI 104 - Standard for Installation of Commercial Carpet.

1.05 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation.
- B. Attendees shall include contractor, carpeting installer, manufacturer technical representative, and installers of adjacent materials and systems.

1.06 SUBMITTALS

- A. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- B. Shop Drawings: Indicate layout of seams, direction of carpet pile, patterns, and location of edge transitions.
- C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions.
- E. Concrete Sub-floor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

1.07 CLOSEOUT SUBMITTALS

- A. Special Installer Warranty: Executed warranty meeting specified requirements.
- B. Manufacturer Warranty: Executed warranty meeting specified requirements.
- C. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum ten years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum five years documented experience and approved by carpet tile manufacturer.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.09 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.
- B. Maintain conditions in accordance with manufacturer instructions.

1.10 WARRANTY

- A. Manufacturer Warranty: Provide manufacturer standard warranty.
- B. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL

- A. Design intent is to match existing. Specified requirements establish minimum requirements. Refer to Drawings for additional requirements. Contractor to field verify existing. Final selections are by Architect.

2.02 MANUFACTURERS

- A. Product and Material Selections: As indicated on Drawings. Where not indicated, as selected by Architect.
- B. Performance and Technical Requirements: As indicated by basis of design product selections.
- C. Provide products and accessories from a single manufacturer, unless noted otherwise, necessary to provide a complete system installation in accordance with specified requirements.

2.03 FLOORING TRANSITIONS

- A. Moldings, Transition and Edge Strips:
 - 1. Coordinate with project Interior Design requirements.
 - 2. Sizes: As dictated by flooring materials at transitions.
 - 3. Profiles: As indicated on Drawings. Where not indicated, as selected by Architect.
 - 4. Physical Characteristics:
 - a. Transitions shall comply with A.D.A. requirements of Section 4.5.2 Changes of Level.
 - b. Standard formulation exceeds ASTM E 648 Class 1 Flammability requirements.
 - c. Designed for interior applications only.
 - 5. Color: As indicated on Drawings. Where not indicated, as selected by Architect.
 - 6. Basis of Design: Tarkett Slim Line Transitions by Tarkett Company: www.johnsonite.com.
 - 7. Acceptable manufacturers subject to compliance with requirements:
 - a. Burke Flooring: www.burkeflooring.com.
 - b. Roppe Corp: www.roppe.com.
 - c. Tarkett (formerly Johnsonite). www.commercial.tarkett.com
- B. Metal Transitions for Floors: Provide units of maximum available length to minimize the number of joints.
 - 1. Coordinate with project Interior Design requirements.
 - 2. Description:
 - a. Transitions shall comply with A.D.A. requirements of Section 4.5.2 Changes of Level.
 - b. Material: As indicated on Drawings. Where not indicated as selected by Architect.

- c. Applications: As indicated on Drawings. Where not indicated, as selected by Architect.
 - d. Sizes: As dictated by flooring materials at transitions.
 - e. Profiles: As indicated on Drawings. Where not indicated, as selected by Architect.
 - f. Finish/Color: As indicated on Drawings. Where not indicated, as selected by Architect.
- 3. Basis of Design: Schluter Systems, Inc. www.schluter.com
 - 4. Acceptable Manufacturers: Subject to compliance with requirements.
 - a. Genesis Global Systems Ltd. www.genesis-gs.com
 - b. Proline Systems GmbH. www.proline-systems.com
 - c. Schluter Systems, Inc. www.schluter.com
 - d. Prolifitec, SpA. www.us.profilitec.com

2.04 ACCESSORIES

- A. Provide accessories necessary for a complete system installation in accordance with specified requirements.
- B. Adhesives:
 - 1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.
- C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
- D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
 - 1. Test in accordance with Section 09 0561.

2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.
- B. Allow carpet, accessories, and installation materials to acclimate to installation area environment prior to installation in accordance with installation requirements.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install carpet and accessories in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Verify carpet match before cutting to ensure minimal variation between dye lots.
- D. Lay out 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.
- E. 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.
- F. Extend tiles into toe spaces, door reveals, closets, and similar openings. Extend tiles to center of door openings.
- G. Lay out carpet and locate seams in accordance with shop drawings.
 1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
 2. Do not locate seams perpendicular through door openings.
 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
 4. Locate change of color or pattern between rooms under door centerline.
 5. Provide monolithic color, pattern, and texture match within any one area.
- H. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.
- I. Adhere tile to substrate in accordance with manufacturer instructions.

3.04 CLEANING AND PROTECTION

- A. Remove excess adhesive from floor and wall surfaces without damage. Where surfaces are damaged, repair or replace.
- B. Clean and vacuum carpet surfaces immediately after completed installation.
- C. Protect installed carpet systems from damage and soiling until date of Substantial Completion.
- D. Remove protection, clean and vacuum carpet surfaces just prior to date of Substantial Completion.

END OF SECTION

SECTION 09 9000

PAINTING AND COATING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Scope: Finish surfaces exposed to view, unless fully factory-finished and unless otherwise indicated. Includes items indicated as field painted, field finished, and shop-primed.
2. Surface preparation.
3. Field application of paints.
4. Materials for backpriming woodwork.
5. All sides and edges of plywood backboards for electrical and telecom equipment prior to installing equipment.
6. Metal fabrications, as indicated.
7. Prime prep surfaces to receive wall coverings.
8. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
 - c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
 - d. Paint dampers exposed behind louvers, grilles, to match face panels.
9. Do Not Paint or Finish the Following Items: When present on project.
 - a. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - b. Items indicated to receive other finishes.
 - c. Items indicated to remain unfinished.

- d. Rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
- e. Floors, unless specifically indicated.
- f. Ceramic and other tiles.
- g. Glass.
- h. Acoustical materials, unless specifically indicated.
- i. Concealed pipes, ducts, and conduits.

1.03 REFERENCES

A. Definitions:

- 1. Comply with ASTM D16 for interpretation of terms used in this section
- 2. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- 3. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- 4. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- 5. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- 6. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- 7. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- 8. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

B. Reference Standards:

- 1. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- 2. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- 3. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
- 4. ASTM D4259 - Standard Practice for Abrading Concrete.
- 5. ASTM D4260 - Standard Practice for Liquid and Gelled Acid Etching of Concrete.
- 6. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.

7. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association.
8. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.
9. SCAQMD 1113 - Architectural Coatings.
10. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1.
11. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2.
12. SSPC-SP 1 - Solvent Cleaning.
13. SSPC-SP 2 - Hand Tool Cleaning.
14. SSPC-SP 3 - Power Tool Cleaning.
15. SSPC-SP 6 - Commercial Blast Cleaning.
16. SSPC-SP 13 - Surface Preparation of Concrete.

1.04 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation.
- B. Attendees shall include contractor, paint and coating systems installer, manufacturer technical representative, and installers of adjacent materials and systems.

1.05 SUBMITTALS

- A. Coordination Data:
 1. Provide written evidence of compatibility of new paints and coatings with all substrates found on project. Evidence shall include letter from specified paint manufacturer indicating compatibility.
 - a. Where conflict exists between specified primers, paints, and coatings indicate conflict and manufacturer recommended substitute products.
 - b. Provide name, office phone, mobile phone, and email address of manufacturer technical representative assigned to the project.
- B. 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.
 2. Indicate VOC content.

- C. Samples for Initial Selection: For each type of topcoat product. Manufacturer color charts are acceptable for initial selection.
- D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- E. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- F. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.06 CLOSEOUT SUBMITTALS

- A. Special Installer Warranty: Executed warranty meeting specified requirements.
- B. Special Manufacturer Warranty: Executed warranty meeting specified requirements.
- C. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. 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.
 - 2. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.
 - 3. Label each container with color in addition to the manufacturer's label.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum ten years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.08 MOCKUPS

- 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. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mock-ups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
- B. Subject to compliance with requirements, approved mockups may become part of the completed Work if accepted to remain by Architect and if undisturbed at time of Substantial Completion.
- C. Approval of mockups does not constitute approval of deviations from the Contract Documents unless Architect specifically approves such deviations in writing.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.
- D. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
- E. Maintain containers in clean condition, free of foreign materials and residue.
- F. Remove rags and waste from storage areas daily.

1.10 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.
- F. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

1.11 WARRANTY

- A. Special Manufacturer Warranty: Provide manufacturer's warranty covering manufacturing and material defects, where items fail to perform as designed and manufactured.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Basis of Design: As indicated in Part 3 Schedules.
 - 2. Other Acceptable Manufacturers: Products of the following manufacturers are acceptable for use, subject to product compliance with basis of design standard of quality:
 - a. Benjamin Moore Co. www.benjaminmoore.com/en-US
 - b. PPG Paints. www.ppgpaints.com.
 - c. Sherwin-Williams Company. www.sherwin-williams.com.
 - 3. Basis of Design Compliance: Where products other than those of the manufacturer listed as the standard of quality are specified in Painting Schedule, such products have been selected to achieve specific results and substitutions will be permitted only in accordance with Product Substitution Procedures section.

C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.

1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
5. Supply each paint material in quantity required to complete entire project's work from a single production run.
6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
7. Number of coats specified are minimum.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Architectural coatings VOC limits of the State of Georgia.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: As indicated on Drawings. Where not indicated, as selected by Architect from manufacturer full range.

E. Colors: As indicated on Drawings. Where not indicated, as selected by Architect from manufacturer full range.

1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Accessory Materials: Provide cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- C. Patching Material: Latex filler.
- D. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work in accordance with manufacturer recommendations.
- B. Test shop-applied primer for compatibility with subsequent cover materials.
- C. Measure moisture content of surfaces using an electronic moisture meter. Comply with material manufacturer requirements Do not apply finishes unless moisture content of surfaces are below the maximums allowable levels.
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Apply paint only when moisture content of surfaces is within limits recommended in product data. Apply paint materials using clean brushes, rollers or spraying equipment.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.03 APPLICATION, GENERAL

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
 - 1. Where conflict between instructions and the requirements of this section exist, coordinate with paint manufacturer to ensure the most stringent and product compatible requirement is utilized.
 - 2. Use applicators and techniques suited for paint and substrate indicated.
 - 3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 4. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Priming:
 - 1. Primer coats may be omitted for surfaces specified to receive factory-applied primer, if primer is compatible with finish coats. If primer coats are not compatible, substitute a bond coat as recommended by paint manufacturer for specified primer coat.
 - 2. Where two-coat finish is specified, prime coat shall be tinted to approximate finish color.
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Sand surfaces within normal visual range, including surfaces within 10'-0" of floor level.
- J. Install prefinished or presurfaced items following finishing or sanding of adjacent surfaces. Replace prefinished items damaged by finishing of adjacent work.

- K. Apply materials at rate not exceeding that recommended in product data for surface being painted, less ten percent for losses.
- L. Comply with product data for drying time between coats.
- M. Sand and dust between coats to remove defects visible from a distance of 5 feet.
- N. Finish coats shall be smooth, free of brush marks, streaks, laps or pile-up of paint, skipped or missed areas.
- O. Make edges of paint adjoining other materials or colors clean and sharp without overlapping.
- P. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- Q. 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.
- R. Gypsum board:
 - 1. Ensure gypsum board has been finished to the level appropriate for wall finish, in accordance with finishing requirements of interior gypsum board specification section requirements.
 - a. Refer to Section 09 2116 - Gypsum Board Assemblies.
 - 2. Fill narrow, shallow cracks and small holes with patching compound. Allow to dry and sand smooth without raising nap of gypsum board paper.
- S. Metals:
 - 1. Galvanized metals:
 - a. Test for passivator or stabilizer using copper sulfate solution (20 grams of copper sulfate in one liter of water). If passivator or stabilizer is present, remove by brush blasting, sanding or chemical etching.
 - b. Clean with manufacturer approved solvent to remove grease, oil and contaminants. Wipe dry with clean cloth.
 - 2. Aluminum:
 - a. Sand or scrape to remove oxides.
 - b. Wash with xylol to remove grease, oil and contaminants. Wipe dry with clean cloth.
 - 3. Ferrous metals:
 - a. Wire-brush or sandpaper to remove rust and mill scale.

- b. Solvent-clean with xylol to remove grease, oil and contaminants. Wipe dry with clean cloth.
4. Ferrous and galvanized metals and aluminum to receive epoxy finish:
 - a. Ferrous metals: Brush sandblast, power tool clean, or hand tool clean to remove rust and mill scale.
 - b. Ferrous and galvanized metals and aluminum:
 - 1) Remove dirt and dust with stiff bristle brush or compressed air.
 - 2) Solvent clean with xylol or mineral spirits to remove grease, oil and contaminants. Wipe dry with clean cloth.

3.04 APPLICATION, SPECIFIC ITEMS

A. Gypsum Board:

1. Where portion of finish on gypsum board partition is damaged or unacceptable, refinish entire surface of partition.

B. HVAC Components, Piping, Ductwork:

1. Paint inside of ductwork flat black for entire area visible through ceiling openings. Paint underside of ductwork and other above-ceiling items flat black for entire area visible through ceiling openings.
2. Paint exposed piping and ductwork in painted spaces same as adjacent wall surfaces.
3. Paint exposed grilles and registers in public spaces.

C. Miscellaneous:

1. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
2. Paint factory primed ground mounted mechanical, plumbing and electrical equipment. Coordinate painting requirements for items such as prefinished mechanical, electrical, and plumbing equipment.

3.05 FIELD QUALITY CONTROL

- #### A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.06 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- C. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.07 PROTECTION

- A. Protect finishes until completion of project.
- B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- C. Touch-up damaged finishes after date of Substantial Completion.

3.08 SCHEDULE - PAINT SYSTEMS – INTERIOR - SHERWIN WILLIAMS BASIS OF DESIGN

- A. Coordination Requirements:
 - 1. Test all substrates for compatibility with specified paints prior to installation. Paint manufacturer representative to be present for testing.
- B. Interior Wood at Fire Retardant Equipment Panel Painted Finish, Latex Enamel:
 - 1. Coordinate painting over factory fire rating labels with requirements of applicable codes for project.
 - 2. Color: Manufacturer standard gray, selected by Architect.
 - 3. Extents: Paint all sides, including edges.
 - 4. First coat: Flame Control 20-20 System, distributed by Sherwin-Williams.
 - 5. Second coat Flame Control 20-20 System, distributed by Sherwin-Williams.
 - 6. Third coat: Flame Control 20-20 System, distributed by Sherwin-Williams.
 - 7. Label: Provide permanent painted fire rated label indicating fire rated plywood and paint.
- C. Interior Gypsum Board, Latex Eggshell:
 - 1. First coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28 Series.

2. Second coat: SW ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-12651.
 3. Third coat: SW ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-12651.
- D. Interior Gypsum Board, Semi-Gloss Latex:
1. First coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28 Series.
 2. Second coat: SW ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600.
 3. Third coat: SW ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600.
- E. Interior Gypsum Board at Wet or High Abuse Areas, Waterborne Epoxy:
1. First coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28 Series.
 2. Second coat: SW Pro Industrial Waterbased Catalyzed Epoxy.
 3. Third coat: SW Pro Industrial Waterbased Catalyzed Epoxy.
- F. Interior Gypsum Board Ceilings, Flat Latex:
1. First coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28 Series.
 2. Second coat: SW ProMar 400 Zero VOC Interior Latex Flat, B30-4651.
 3. Third coat: : SW ProMar 400 Zero VOC Interior Latex Flat, B30-4651.
- G. Interior Ferrous and Galvanized Metals and Aluminum at Wet and High Abuse Areas, Waterborne Epoxy Semi-Gloss:
1. First coat: SW Pro Industrial Pro-Cryl Universal Metal Primer, B66-310.
 - a. Provide SW Kem Kromik primer where recommended by paint manufacturer for specific project substrate.
 2. Second coat: SW Pro Industrial Waterbased Catalyzed Epoxy.
 3. Third coat: SW Pro Industrial Waterbased Catalyzed Epoxy.
- H. Interior Ferrous and Galvanized Metals and Aluminum:
1. First coat: SW Pro Industrial Pro-Cryl Universal Metal Primer, B66-310.
 - a. Provide SW Kem Kromik primer where recommended by paint manufacturer for specific project substrate.
 2. Primer for Aluminum and Galvanized: SW Pro Industrial Pro-Cryl Universal Metal Primer, B66-310.
 3. Second coat SW ProMar 200 Zero VOC Interior Latex.
 4. Third coat: SW ProMar 200 Zero VOC Interior Latex.

END OF SECTION

SECTION 10 1401

INTERIOR SIGNAGE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Interior signage.

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.04 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation to discuss conformance with project requirements, manufacturer installation requirements, affected adjacent materials and system, and site conditions.
- B. Attendees shall include contractor, signage installer, manufacturer technical representative, and installers of adjacent materials and systems.

1.05 COORDINATION REQUIREMENTS

- A. Interior Signage: Coordinate mounting, mounting height, fastening, and securement data. Coordinate special requirements for substrate finishes and types signage is to be installed over.

1.06 SUBMITTALS

- A. Product Data: Manufacturer's printed product literature for each type of sign, sign materials, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- B. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.

2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 3. Submit for approval by Owner through Architect prior to fabrication.
- C. Shop Drawings: Provide installation drawings and details indicating sign sizes, materials, thicknesses, dimensions, textures, and other characteristics.
1. Interior Signage: Provide mounting, mounting height, fastening, and securement data. Indicate special requirements for substrate finishes and types signage is to be installed over.

1.07 CLOSEOUT SUBMITTALS

- A. Special Installer Warranty: Executed warranty meeting specified requirements.
- B. Maintenance Data: Provide manufacturer parts lists, and maintenance instructions for the materials of this Section.

1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.

1.10 WARRANTY

- A. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer Warranty: Provide manufacturer's warranty covering manufacturing and material defects, where items fail to perform as designed and manufactured.
 1. Warranty Period: Provide manufacturer standard warranty.

PART 2 PRODUCTS

2.01 GENERAL

- A. Design intent is to match existing. Specified requirements establish minimum requirements. Refer to Drawings for additional requirements. Contractor to field verify existing. Final selections are by Architect.

2.02 MANUFACTURERS

- A. General: Refer to Owner signage requirements for interior and exterior signage.
 - 1. Provide identification and way finding signage complying with requirements of Accessibility and Life Safety Codes

2.03 ACCESSORIES

- A. General: Provide accessories as recommended by signage manufacturer for a complete installation.
- B. Fasteners and Anchors: Stainless steel.
- C. Tape Adhesive for Interior Locations: Double sided tape, permanent adhesive designed for permanent interior applications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install plumb and true with level edges.
- C. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 2239

FOLDING OPERABLE PANEL PARTITIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This section includes operable panel wall partitions.
- B. Related work includes, but is not limited to, the following
 - 1. Section 05 5000 - Metal Fabrications for support framing.

1.03 DEFINITIONS

- A. NVLAP: National Voluntary Laboratory Accreditation Program
- B. NIC: Noise Isolation Class
- C. STC: Sound Transmission Class

1.04 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation.
- B. Attendees shall include contractor, partition installer, manufacturer technical representative, and installers of adjacent materials and systems.

1.05 SUBMITTALS

- A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable panel partition, component, and accessory specified. Included data on acoustical performance, surface-burning characteristics, and durability.
- B. Shop Drawings: Show location and extent of operable panel partitions. Include plans, elevations, sections, details, attachments to other construction and accessories. Indicate dimensions; weights; conditions at openings and for storage; and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, and direction of travel. Show blocking to be provided by others.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

1.06 CLOSEOUT SUBMITTALS

- A. Special Installer Warranty: Executed warranty meeting specified requirements.
- B. Special Manufacturer Warranty: Executed warranty meeting specified requirements. Warranty shall be completed in Owner's name and registered with manufacturer.
- C. Maintenance Data: Provide manufacturer parts lists, operation, and maintenance instructions for the materials of this Section.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with minimum 10 years of experience manufacturing the products of this Section in their own manufacturing facilities.
- B. Installer Qualifications: An experienced installer who is certified in writing by the operable wall manufacturer as qualified to install the manufacturer's partition system for work similar in material, design, and extent to that indicated for this project.
- C. Testing Agency Qualifications: An independent NVLAP-accredited testing laboratory with experience and capability to conduct the testing indicated, as documented according to ASTM E-548.
- D. Fire-Test-Response Characteristics: Provide operable wall partitions with the following fire-test-response characteristics
 - 1. Surface-Burning Characteristics: As follows, per ASTM E-84:
 - 2. Flame Spread: 25 or less
 - 3. Fire Growth Contribution: Textile wall coverings comply with the acceptance criteria of UBC Standard 8-2.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in protective packaging.
- B. Deliver materials in order as required by schedule for installation.
- C. Handle materials in accordance with manufacturer's instructions.

1.09 PROJECT CONDITIONS

- A. Field Measurements: Verify operable panel partition openings and storage arrangements by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1.10 WARRANTY

- A. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer Warranty:
 - 1. Track:
 - a. Provide 2-year all inclusive warranty covering defects in material and workmanship.
 - b. Covered components shall include track, trolleys, track curves, intersections, switches and control devices exclusive of wiring.
 - 2. Panels:
 - a. Provide 2-year all inclusive warranty covering defects in material and workmanship.
 - b. Warranty shall cover structural members, panel faces, panel trim, hardware and operating components.
 - c. 5-Year Panel Limited Warranty: Provide 5-year limited warranty for welded steel panels. Warranty shall cover structural members, panel faces, panel trim, hardware and operating components. In the event warranty covered items fail or have their performance materially reduced due to defects in workmanship or materials, the manufacturer shall repair or provide replacement parts FOB jobsite, not including unloading or installation. Warranty shall not exclude "normal wear and tear".
 - 3. All warranties shall commence on the date of substantial completion of the installation, when performed by manufacturer or walls' provider.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers shall have at least ten years experience in the production of acoustical operable walls.
- B. Basis of Design: Hufcor, Inc. www.hufcor.com.
 - 1. Final Product and Material Selections: To be determined. Refer to Drawings for additional requirements.
 - 2. Final Performance and Technical Requirements: To be determined. Refer to Drawings for additional requirements.
- C. Acceptable Manufacturers: Subject to compliance with specified requirements.
 - 1. Hufcor, Inc. www.hufcor.com.

2. Kwik-Wall Co. www.kwik-wall.com
3. Modernfold, Inc. www.modernfold.com/en-US

2.02 OPERATION

- A. Final selection to be determined.
- B. Partitions shall be key switch controlled, requiring constant contact to activate the motor. As a safety precaution, two key switches are required to activate the partition. Switches to be mounted on both sides of partition to provide operators a clear view of the partition path to prevent injury.
- C. Motor drive shall automatically seal the partition in the opening. For models with retractable bottom seals, the motor shall automatically sets the bottom seals.
- D. Stack/Store Panels: Panels are retracted and stored by activating the two key-switch controls.

2.03 ACOUSTICAL PERFORMANCE REQUIREMENTS

- A. Final selection to be determined.
- B. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated.
 1. STC Rating: As indicated on Drawings. Where not indicated, as selected by Architect.
 - a. Basis of Design: Minimum STC rating of 54.
- C. Sound Transmission Requirements: Operable panel partition assembly in a full-size opening, 14 by 9 feet (4267 by 2742 mm), for laboratory sound transmission loss performance according to ASTM E90, determined by ASTM E413, and rated for not less than STC indicated.
 1. Acoustical performance shall be tested at a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) and in accordance with ASTM E90 Test Standards.
 2. Complete, unaltered written test report is to be made available upon request.
- D. Provide acoustical materials required for performance of walls directly adjacent to folding panel partition.

2.04 ACCESSORIES

- A. Final selections to be determined.
- B. Storage Pocket Door: Operable walls shall have acoustical storage pocket doors. Storage pocket doors shall conceal stacked partition and have same materials, finish, construction, thickness and acoustical qualities as panels; complete with operating hardware.
 1. Refer to Drawings for storage pocket and door configuration.

2. Unless indicated otherwise, storage pocket doors shall utilize wall manufacturer's standard method for securing pocket doors in closed position.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 INSTALLATION

- A. The complete installation of the operable wall system shall be by an authorized factory-trained installer and be in strict accordance with the approved shop drawings and manufacturer's standard printed specifications, instructions, recommendations and ASTM E557.
- B. Install acoustic sealant to achieve required acoustic performance.
- C. Coordinate electrical connections.

3.03 ADJUSTING

- A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.
- B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.
- C. Adjust partition assembly to achieve lightproof seal.

3.04 CLEANING

- A. Clean finish surfaces and partition accessories.
- B. All track and panel surfaces shall be wiped clean and free of handprints, grease, and soil.

3.05 CLOSEOUT ACTIVITIES

- A. Repair or adjust to ensure full operation.
- B. Installer shall demonstrate proper operation and maintenance procedures to owner's representative.

- C. Operating devices and owners manuals shall be provided to owner's representative.

END OF SECTION

SECTION 10 2800

TOILET ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Commercial toilet accessories.
- B. Related Requirements:
 - 1. Section 05 500 Metal Fabrications: Concealed supports for accessories, including in wall framing and plates, above ceiling framing, and backing plate reinforcement.

1.03 REFERENCES

- A. Reference Standards:
 - 1. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

1.04 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation.
- B. Attendees shall include contractor, toilet accessory installer, manufacturer technical representative, and installers of adjacent materials and systems.

1.05 SUBMITTALS

- A. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- B. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.06 WARRANTY

- A. Manufacturer Warranty: Provide standard manufacturer warranty for each item, unless noted otherwise.

- B. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.

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

PART 2 PRODUCTS

2.01 GENERAL

- A. Design intent is to match existing. Specified requirements establish minimum requirements. Refer to Drawings for additional requirements. Contractor to field verify existing. Final selections are by Architect.

2.02 TOILET ACCESSORIES

- A. Basis of Design: Products manufactured by Bobrick Washroom Equipment, Inc, www.bobrick.com

- 1. Provide accessories indicated in this Section. Refer to Drawings for additional requirements.

2.03 PRODUCT SELECTIONS, COMMERCIAL STYLE

- A. Grab Bars: Concealed anchors.

- 1. Size: As indicated on Drawings.
 - 2. Finishes: Satin finish for dry areas, peened finish for wet areas.
 - 3. Basis of Design: Bobrick B-5806 Series.

2.04 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Undersink Pipe Covers:

- 1. Characteristics:
 - a. Material: Soft, resilient molded vinyl.
 - b. Nominal Wall: 1/8" constant with internal ribs.
 - c. Durometer: 70-80 - Shore A.
 - d. UV Protection: Will not fade or discolor.
 - e. Trimming (E-Z Series): Internal E-Z Tear-To-Fit trim feature.
 - f. Fasteners (E-Z Series): Internal E-Z Grip fasteners, reusable.
 - g. Compatibility: #100 Series. Fits all 1-1/4" or 1-1/2" cast brass or tubular P-trap assemblies and 3/8" or 1/2" angle stop assemblies.
 - h. Compatibility: #400 Series. Fits all 1-1/2" schedule 40 plastic P-traps.

- i. Paintability: Apply latex paint.
 - j. Burning Characteristics: Per ASTM D-635; Self extinguished 0 sec (ATB) mm (AEB).
 - k. Bacteria/Fungus Resistance: Per ASTM G21 and G22 — Result: 0 growth.
 - l. Maintenance: Cleanable with common detergents.
 - m. Color: China white, manufacturer standard.
2. Basis of Design: TruBro Lav Guard 2.
 3. Acceptable Manufacturers and Products: Subject to compliance with requirements.
 - a. American Granby, Inc., Trap Wrap.
 - b. Truebro, Inc., Truebro Lav-Guard 2.
 - c. Plumberex, Handy-Shield Maxx.

2.05 CUSTODIAL AND UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop/Broom Holder with Rag Hooks: 18 Gauge (1.2 mm) thick stainless steel, Type 304, with 1-1/2 inch (38 mm) returned edges. ---
 1. Utility shelf with mop/broom holders and rag hooks shall be type-304 stainless steel with all-welded construction; exposed surfaces shall have satin finish.
 2. Mounting Brackets and Shelf: 18-8, type-304, 18-gauge (1.2mm) stainless steel with satin finish. All-welded construction. Shelf is 8" (205mm) deep with 3/4" (19mm) return edge on all three sides. Front edge is hemmed for safety.
 3. Shelf Support Brackets: 18-8, type-304, 16-gauge (1.6mm) stainless steel with satin finish. Welded to mounting base and shelf.
 4. Mop/Broom Holders: Spring-loaded rubber cams with anti-slip coating. Plated steel retainers.
 5. Rag Hooks: 18-8, type-304, 12-gauge (2.8mm) stainless steel with satin finish. Each hook attached to mounting strip with two rivets.
 6. Drying Rod: 18-8, Type 304, 1/4" (6mm) diameter stainless steel with satin finish.
 7. Products:
 - a. Bobrick B-224 X 36.

2.06 MATERIALS

- A. Keys: For keyed items, provide three keys for each accessory to Owner; master key lockable accessories.
- B. Stainless Steel Sheet: ASTM A666, Type 304 or Type 316.

- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- E. Adhesive: Two component epoxy type, waterproof.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- G. Sealants: Pick-proof, tamper-proof; security type.
- H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.07 FABRICATION

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
 - 3. Exposed edges: Hemmed, returned or flanged; sharp edges not allowable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify exact location of accessories for installation.
- B. Verify that field measurements are as indicated on drawings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.

- C. Mounting Heights: As indicated on drawings, and as required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations through date of Substantial Completion.

END OF SECTION

SECTION 10 4400

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Fire extinguishers.
 - 2. Fire extinguisher cabinets.
 - 3. Accessories.

1.03 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
- B. NFPA 10 - Standard for Portable Fire Extinguishers.
- C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation to discuss conformance with project requirements, manufacturer installation requirements, affected adjacent materials and system, and site conditions.
- B. Attendees shall include contractor, fire extinguisher and cabinet installer, manufacturer technical representative, and installers of adjacent materials and systems.

1.05 SUBMITTALS

- A. Product Data, Fire Extinguishers: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Data, Fire Extinguisher Cabinets: For each type of product.
 - 1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- C. Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Special Installer Warranty: Executed warranty meeting specified requirements.
- B. Special Manufacturer Warranty: Executed warranty meeting specified requirements.
- C. Maintenance Data: For fire-protection cabinets to include in maintenance manuals. Include test, refill or recharge schedules and re-certification requirements.

1.07 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.08 WARRANTY

- A. Installer Special Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 - 1. Warranty Period: One year from date of Substantial Completion.
- B. Manufacturer Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PRODUCTS, GENERAL

- A. Design intent is to match existing. Specified requirements establish minimum requirements. Refer to Drawings for additional requirements. Contractor to field verify existing. Final selections are by Architect.
- B. Provide fire extinguishers, cabinets, and accessories from a single manufacturer.

2.02 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. J. L. Industries, Inc., an Activar Construction Products Group, Inc. Company.
 - 2. Larsen Manufacturing Co.: www.larsensmfg.com

3. Nystrom, Inc. www.nystrom.com.
 4. Potter Roemer - Fire Protection Equipment, a division of Morris Group International.
- B. Fire Extinguisher Cabinets and Accessories:
1. Basis of Design: Potter Roemer 7200 Series by Potter Roemer/Fire Pro a, a division of Morris Group International. www.potterroemer.com
 - a. Mounting: Recessed, Semi-Recessed, or Surface mounted configuration as selected by Architect. Refer to Drawings for additional requirements.
 - b. Box: Cold rolled steel with an electrostatically applied, thermally- fused polyester coating with recoatable white finish, and a concealed hinge.
 - c. Door and Frame: Cold rolled steel with recoatable white polyester finish.
 - d. Fire Rated: Provide fire rated or non-fire rated configuration as indicated on Drawings.
 - e. ADA compliant.
 - f. Door Style: Vertical duo with standard pull and lock. Partial approximate 1/3 glazed front with tempered safety glass and vertical nigh luminous letters in color selected by Architect.

2.03 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
1. Provide extinguishers labeled by UL (DIR) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
1. Class: A:B:C type.
 2. Size: 10 pound (4.54 kg).
 3. Rated: 4A-60B:C.
 4. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).
 5. Finish: Manufacturer standard baked polyester powder coat.
 6. Color: Manufacturer standard red.

2.04 ACCESSORIES

- A. Wall Mounted Fire Extinguisher Brackets (non-cabinet mounted): Formed steel, chrome-plated.

- B. Lettering: "FIRE EXTINGUISHER" decal, or vinyl self-adhering, pre-spaced lettering in accordance with code officials. Color as required by applicable code and as selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.
- C. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 PREPARATION

- A. Prepare recesses for recessed and semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

- A. Install extinguishers at date of Substantial Completion, indicating acceptable charge pressure and tagged to show charge date and service agent.
- B. Install wall-hung extinguishers on wall mounting bracket. Secure bracket to wall structure with not less than two anchors.
- C. Install in accordance with manufacturer's instructions.
- D. Install cabinet-mounted extinguishers in cabinets using wall mounting bracket attached to back wall of cabinet.
- E. Mounting Heights: As indicated on drawings and as follows.
 - 1. Mounting heights shall meet ADA and NFPA requirements.
- F. Unless otherwise indicated, provide recessed cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed cabinets.
- G. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- H. Install cabinets plumb and level in wall openings.
 - 1. Secure rigidly in place.
- I. Place extinguishers in cabinets.

1. Locate with name and operating instructions visible on front of extinguisher.
- J. Identification: Apply decals or vinyl lettering at locations selected by Architect.
 1. Apply decals or vinyl lettering on field-painted cabinets after painting is complete.

3.04 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.05 SCHEDULES

- A. Coordinate locations and types indicated on Drawings.

END OF SECTION

SECTION 11 6905

RETRACTABLE STAGE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Retractable platform stage system.

1.03 PREINSTALLATION CONFERENCES

- A. Preinstallation Conference: Conduct conference at Project site minimum fourteen days prior to installation.
- B. Attendees shall include contractor, stage installer, and installers of adjacent materials and systems.
- C. Conduct meeting in accordance with Section 01 3100 - Project Management and Coordination.

1.04 SUBMITTALS

- A. Refer to Section 01 3300 - Submittal Procedures, for submittal procedure requirements.
- B. Product Data: Provide manufacturer product data in the products of this Section.
- C. Shop Drawings: Indicate installation requirements.
 - 1. Indicate compliance with Performance Requirements.
- D. Manufacturer's Qualification Statement.
- E. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design retractable platform stage system under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Georgia.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum ten years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer recommendations and instructions.

1.07 WARRANTY

- A. Special Installer Warranty: Furnish a written warranty signed by the installer guaranteeing materials and workmanship for the Work of this section.
 - 1. Warranty Period: One year from date of Substantial Completion.
- B. Special Manufacturer Warranty: Provide manufacturer's warranty covering manufacturing and material defects, where items fail to perform as designed and manufactured.
 - 1. Warranty Period: Provide manufacturer standard warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Products by Sheridan Seating, Inc. www.sheridanseating.com
 - 1. Model: Madsen RS-1 Surface Mount or Madsen RS-2 Recessed.
 - a. Final selection by Architect. Refer to Drawings for additional requirements.
 - 2. Characteristics:
 - a. Surface mounted, or recessed, retractable platform stage system designed to fold into vertical position to fully conceal all of the substructure and power operation mechanisms.
 - b. The platform shall be constructed of an aluminum modular substructure to receive 5/8" thick plywood.
 - c. Platform shall be solid and free of hardware and hinge joints, providing a safe attractive surface
 - d. Stage shall be complete with heavy duty electrically operated winching mechanism controlled by a key operated safety switch and concealed limit switches.
 - e. Retractable Stage shall automatically and positively lock in the extended position without the use of floor locks.
 - f. Stage to be complete with hardwood skirt board and detachable, portable safety-tread steps with handrails.
 - 3. Operation:
 - a. Electric winch assembly with minimum 208v, 3ph, 3/4 hp instant reverse motor, magnetic starter, overload protection device, spring loaded key switch, and three limit switches.

4. Size: Size as indicated on Drawings. Where not indicated, as selected by Architect from manufacturer full range including custom sizes.
 5. Accessories: 1 set of moveable stairs with handrails on both sides. Provide additional accessories selected by Architect.
 6. Stage Shroud: As indicated on Drawings. Where not indicated, as selected by Architect from the following.
 - a. Surface of primed paint grade plywood allowing the client to finish the shroud to match surrounding decor.
 - b. Select birch plywood for stained, translucent finishing.
 - c. Select oak plywood for stained, translucent finishing.
 - d. Velcro attached fabric skirt. Fabric as selected by Architect from manufacturer full range.
- B. Performance Requirements:
1. The structures are designed to the following loads, in addition to the self weight of the assembly:
 2. A vertical live load of 100 lbs./Sq.Ft. (4.8 Kpa) over the platform area with a vertical live load of 120 lbs. per linear ft. (1.75 kN/m for each linear metre), or a concentrated load of 500 lbs. (2.2 kN).
 3. The design shall be in accordance with the building code and listed standards including the following:
 - a. International Building Code (ICC-IBC).
 - b. CAN/CSA S16.1-94 Limit States Design of Steel Structures
 - c. CAN/CSA S136-94 Cold Formed Structural Steel Members
 - d. CSA 086.1-94 Engineered Design in Wood
 - e. CAN3-S157-M83 Strength Design in Aluminum
 - f. W59-M1989 Welded Steel Construction
 - g. W59-M1991 Welded Aluminum Construction
 - h. All welding to be done by a CWB/AWB or AWS certified shop
- C. Fabrication:
1. Vertical steel columns shall be structural steel tubing.
 2. Provide 5 x 1-1/2 inch non-marking urethane wheels and non-marking adjustable rubber bumpers.

3. Provide Auto-Loc safety device. The fully automatic device will bring the stage to an immediate stop. The breaking mechanism is activated by both inertia (quick jerk) and/or centrifugal force (a faster than normal speed).
 4. Provision shall be made for stage to automatically and positively lock in the extended position without the use of floor locks.
 5. Each rolling frame will be permanently coupled to its adjacent frame which insures positive engagement and alignment of vertical frames.
 6. Provide minimum 5/8" thick G1S plywood sub floor, fastened to sub frame with countersunk screws, with hardwood nosing on exposed edges.
 7. Provide solid, premium grade, Southern Yellow Pine skirt board along front of stage.
 8. Provide paint grade plywood, primed and painted, for vertical shroud around stage, complete with support framing and hardwood corner trim. Provide removable panel at center, top for access to motor.
 9. Provide electric winch assembly - 208v, 3ph, . hp, instant reverse motor, magnetic starter, overload protection, flush-mounted key switch and three safety limit switches.
- D. Exposed Finishes: As selected by Architect from manufacturer full range.
- E. Flooring Surface: Additional flooring finish as indicated on Drawings. Where not indicated, as selected by Architect.

2.02 ACCESSORIES

- A. Installation Accessories: Provide necessary accessories as required for complete installation.
- B. Fasteners: Manufacturer's standard inserts, adhesives, anchors, bolts, rivets, and screws appropriate for project conditions; corrosion-resistant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions for compliance with requirements of backing walls, installation tolerances, and other conditions that may impact performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of materials of this section indicates acceptance of substrates and conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Set components plumb, level, and rigid.

- C. Install anchors in accordance with anchor manufacturer's installation guidelines.

3.03 PROTECTION

- A. Protect installed equipment from subsequent construction operations through date of Substantial Completion.

3.04 ADJUSTING AND CLEANING

- A. Repair damaged and defective items, where possible, to eliminate functional and visual defects. Where not possible to repair, replace with new. Adjust for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean exposed and semiexposed surfaces. Touch up finishes to restore damaged or soiled areas. Comply with manufacturer recommendations.

3.05 DEMONSTRATION AND TRAINING

- A. Demonstration: Demonstrate operation of stage to Owner's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Briefly describe function, operation, and maintenance of each component.
- B. Training: Train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
- C. Final Acceptance: Remove labels, fingerprints; clean surfaces. Repair any marred or damaged surfaces that effect appearance in manner not acceptable to Owner. Replace any parts that cannot be repaired in such a manner.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.
- B. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all systems. All work shall be accomplished by workmen skilled in the various trades involved.
- C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the Engineer shall be notified of the discrepancy.
- D. All work performed under this specification shall be accomplished in accordance with the requirements and provisions of the following sections:
 - 1. Section 22 00 00 - Plumbing General
 - 2. Section 23 00 00 - HVAC General
 - 3. Section 26 00 00 - Electrical General

1.2 STANDARDS

- A. All Plumbing systems shall conform to all ordinances and regulations of the City, County, State and/or other authorities having jurisdiction in accordance with the requirements of the following codes, standards and design guides.
 - 1. The International Plumbing Code, 2018 Edition, with most current local Amendments
 - 2. The International Building Code, 2018 Edition, with most current local Amendments
 - 3. The International Gas Code, 2018 Edition, with most current State of Georgia Amendments
 - 4. International Energy Conservation Code, 2018 Edition, with most current local Amendments
 - 5. Americans with Disabilities Act (ADA)
 - 6. ANSI/NSF 61 compliance is required for all components of the domestic water system.
 - 7. American Society of Plumbing Engineers (ASPE) Data Books
 - 8. National Fire Protection Association (NFPA) Standards:
 - 9. NFPA 54 - National Fuel Gas Code
 - 10. Plumbing Drainage Institute (PDI)
 - 11. Underwriters Laboratories Inc. (UL)
 - 12. National Sanitation Foundation (NSF)

13. Local and State Fire Marshal requirements
14. Local Building and Inspection Department requirements
15. Local Health Department requirements
16. ASHRAE 90.1-2010

- B. If code or other requirements exceed the provisions shown on the Contract Documents, the Engineer shall be notified in writing. Where requirements of the Contract Documents exceed code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor's expense.

1.3 PERMITS

- A. The Contractor shall obtain all permits and inspections required for the installation of this work and pay all charges incident thereto. He shall deliver to the Architect all certificates of said inspection.

1.4 WORK INCLUDED

- A. Systems
1. The Plumbing Systems installed and work performed under this Division of the Specifications shall include, but not necessarily be limited to, the following as noted below. The connection point for all systems from the site utilities shall be as 5'-0" from the exterior of the building unless specifically otherwise noted.
 - a. Domestic cold, hot and hot water recirculation systems
 - b. Sanitary, drainage, waste and vent systems

1.5 DRAWINGS

- A. The Drawings are diagrammatic and do not necessarily depict exact conditions. The indicated locations of equipment, ductwork, piping, etc. are approximate only. The Drawings are schematic in nature and are not to be scaled. Scales are shown for reference and approximation only. Refer to the architectural drawings for dimensional data of building components.
- B. The locations, arrangement and extent of equipment, devices, and other appurtenances related to the installation of work shown on the Drawings are approximate. The Contractor shall not scale drawings, but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy for resolution.
- C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

1.6 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall prepare a minimum of two (2) instruction manuals, one of which shall be submitted to the Architect for the Engineer's review, describing installation, operation and maintenance of all Plumbing equipment. Manuals shall include copies of control schematics, sequences of operations, indicate the function and operations of all components, as well as the Contractor's name, address, and telephone number. Manuals shall also contain one copy of all manufacturers' drawings, pamphlets, data, parts lists and instructions manual for each piece of equipment. Upon approval, one copy shall be delivered to the Owner; one copy shall be kept by the Contractor. The pamphlets and drawings are to be neatly bound in a 3-ring binder(s).
- B. The Contractor shall give detailed instructions for a period of not less than two (2) days to the responsible personnel designated by the Owner in the operation and maintenance of all equipment furnished under this Contract. A letter containing the name of the person or persons to whom the instructions were given and the dates of instruction period shall be submitted to the Engineer in the as-built submittal.
- C. Prior to final acceptance by the Owner, the Contractor shall submit a complete as-built drawing submittal for the Engineer's review, three (3) sets of operating and maintenance manuals, spare parts lists, drawings, wiring diagrams, troubleshooting data, manufacturer's bulletins, and other pertinent data on all equipment furnished under this Contract. Each set shall be enclosed in a suitable hard cover binder.
- D. A complete set of reproducible as-built drawings shall be provided indicating the location of all piping dimensionally located from a minimum of two column lines or major building structures. Drawings shall be a minimum of 1/8" scale.
- E. Provide name, address and telephone numbers of the manufacturer's representative and service company for each piece of equipment installed in the as-built submittal package.
- F. Provide all loose keys for supply valves, wall hydrants and hose bibbs installed.
- G. Provide a full repair kit set (total relief valve kit, first check and second check kits) for each reduced pressure backflow preventer installed.

1.7 AS-BUILT DRAWINGS

- A. The Contractor shall maintain a record set of drawings indicating all changes in the work from that shown in the Contract Documents. Prior to final acceptance by the Owner, the Contractor shall assemble the complete set of as-built drawings that accurately reflects all changes to indicate actual final construction. All concealed piping shall be dimensionally located from at least two (2) column lines or major building structure elements. Drawings shall be a minimum of 1/8" scale.
- B. The original set of "as-built" drawings shall be scanned and transmitted to the Architect in both full size mylar and CD format.

1.8 EQUIPMENT, MATERIAL BID BASIS

- A. Manufacturers' names, model numbers, etc. as specified on the Drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.
- B. Unless "approved equal" is specifically stated, bids shall be based on equipment named in Specifications or on Drawings as "base" products. Proposed alternate equipment and materials may be submitted along with the "base" products, provided deductive pricing is included with the alternate.
- C. Alternate "approved equal" items listed shall conform to specified base items and shall be substantially equal in quality, size, weight, construction, capacities and performance. The alternate equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. The Engineer shall consider the use of the alternate equipment based on the supportive documentation and other information available to him, and shall approve or disapprove any alternates. The decision of the Engineer shall in all cases be final.
- D. The Contractor shall coordinate the installation of all plumbing equipment proposed for use in this project with all building trades (architectural, structural, mechanical and electrical). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. Any modifications or revisions required by other trades as a result of the use of equipment other than the basis of design shall be made at no additional cost. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.9 SUBMITTALS

- A. The Contractor shall prepare, submit, and obtain Engineer's review of manufacturers' submittals on the following equipment and systems prior to ordering, purchasing, or installation of any equipment or materials. All required submittals shall be transmitted electronically (e.g. pdfs, etc.) with the associated specification section and the item submitted clearly identified. Partial submittals will be returned without review. Submittals, as a minimum, shall include:
 - 1. Plumbing fixtures, faucets and trim
 - 2. Insulation
 - 3. Floor drains and drainage accessories
 - 4. Valves
 - 5. Pipe supports
 - 6. Piping accessories
- B. All approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to equipment being submitted to the Engineer.

- C. Review of submittals by the Engineer does not relieve the Contractor from the responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements of all approved equipment with other trades and disciplines such as roof openings, wall openings, electrical characteristics, etc.
- D. All submittals shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.
- E. Submittals shall clearly indicate selection of model numbers, sizes, dimensions, electrical characteristics, etc. of the proposed equipment. Any proposed deviations from specified equipment shall be clearly indicated on the submittal.
- F. Included with submittals of plumbing equipment requiring electrical connections shall be a written statement confirming coordination of voltage requirements, bearing the names and signatures of the plumbing and electrical contractors. A photocopied reproduction of the below statement is acceptable.

VOLTAGE COORDINATION STATEMENT

This statement is to confirm that the voltages of the equipment provided under this specification have been coordinated with the Electrical Drawings, as well as with the electrical contractor.

Plumbing Contractor: _____

Project Manager Name: _____

Project Manager Signature/Date: _____

Electrical Contractor: _____

Project Manager Name: _____

Project Manager Signature/Date: _____

- G. Provide Material Safety Data Sheet (MSDS) or letter from manufacturer certifying the VOC content for each adhesive, sealant, paint and coating.

1.10 COORDINATION OF TRADES

- A. The Contractor shall give full cooperation to other trades, and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.
- B. Piping and other plumbing equipment shall not be installed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate all uncoordinated piping and other plumbing equipment installed should they interfere with the proper

installation and mounting of electrical, HVAC equipment, ceilings and other architectural or structural finishes.

- C. The Contractor shall coordinate the elevations of all piping and equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation.
- D. In areas where more than one trade is required to use common openings in beams, joists, chases, shafts and sleeves for the passage of conduits, raceways, piping, ductwork and other materials, the Contractor must coordinate the positions of all piping and equipment to be furnished under this section so that all items including the materials and equipment of other trades may be accommodated within the space available.
- E. The Contractor shall confirm that work installed under this section does not interfere with the clearances required for finished columns, pilasters, partitions, walls or other architectural or structural elements as shown on the Contract Documents.
- F. Work that is installed under this Contract which interferes with the architectural design or building structure, shall be removed and relocated as required at no additional cost to the Contract.
- G. All offsets, fittings, valves, devices and accessories which may be required are to be provided under this Contract. The Contractor shall examine the entire set of Contract Documents and carefully investigate the structural and finish conditions affecting all his work and shall arrange such work accordingly for the complete satisfactory operation of all systems, providing such fittings, traps, valves, devices and accessories as may be required to meet such conditions.

1.11 WARRANTY

- A. All equipment furnished and installed under this Contract shall be provided with the manufacturer's standard warranty unless otherwise noted.
- B. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of building acceptance by the Owner. The phrase "make good" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. All equipment, materials, accessories, etc. used shall be new and of current production unless specified otherwise. Equipment not specified in the Contract Documents shall be suitable for the intended use and shall be subject to approval by the Engineer.
- B. All equipment, products and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.

- C. All equipment shall bear the inspection label of Underwriters Laboratories Inc.
- D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.

2.2 ELECTRICAL WORK

- A. Except as otherwise specified or noted, electrical equipment used for plumbing systems shall be as specified herein.
- B. Motor controls, system controls, starters, disconnects, pilot lights, push buttons, etc. shall be furnished by the Contractor compatible with the apparatus that it operates. Electrical equipment shall be wired for the voltage, as shown on the Electrical Drawings.
- C. The Contractor shall be responsible for coordinating and furnishing equipment of voltage shown on the electrical documents.
- D. All "loose" disconnects and starters shall be installed by Division 26.
- E. Power wiring to disconnects, starters, and equipment shall be provided and installed by Division 26. All equipment requiring electrical power shall be provided with a disconnect switch at each piece of equipment. Coordinate switch type (fused or non-fused) with equipment characteristics, manufacturer's recommendations and the electrical drawings.
- F. Provide all system controls and associated control and interlock wiring for complete and operable systems. 120 volt and higher wiring shall be MC cable or in conduit in accordance with local codes and the materials and installation requirements of Division 26 - Electrical.
- G. All starters for 3-phase equipment shall have overload devices in each phase.
- H. Acceptable manufacturers shall be General Electric, Square D, Eaton, Siemens and Allen Bradley.

2.3 PIPING SYSTEMS

- A. General
 - 1. The various piping systems are classified as follows, and materials of construction shall be as specified unless otherwise noted on the Drawings.
 - 2. Piping, valves and equipment used in similar applications shall be provided from the same manufacturer unless noted otherwise.
- B. Domestic Cold Water System, Underground, 3 Inches and Larger, Suitable for Working Pressure of 125 psig to 5'-0" Outside Building
 - 1. Piping Systems
 - a. Basis of Design
 - 1) Mains where pressure is no greater than 100 psi: Polyvinyl Chloride (PVC), 160 psi water piping, ASTM D2241, SDR26

- with mechanical or push-on joints with neoprene “O” rings, ASTM D3139.
- 2) Mains where pressure is greater than 100 psi: Polyvinyl chloride (PVC), 200 psi water piping, AWWA C900, 200 psi, with mechanical or push-on joints with neoprene “O” rings, ASTM D3139.
- 2. All valves, fittings, and changes in direction or elevation shall have joints restrained in accordance with NFPA-24.
- 3. Trenching Conditions: Class B1 bedding with 4" minimum thickness of clean granular fill. Recesses shall be provided at all pipe barrels to ensure no loads are transmitted at the joint connections.
- C. Domestic Water System Branch Piping, Underground, 2 Inches and Smaller, Suitable for a Working Pressure of 125 psig
 - 1. Piping Systems
 - a. Copper Type K, soft annealed, conforming to Federal Specification WWT-799. Joints and fittings are not permitted below floor slabs with copper Type K soft annealed pipe.
 - b. Multi-layer CPVC over aluminum composite middle layer bendable piping, ASTM D2846, solvent cement joints and fittings, ASTM F493. Noveon FlowGuard Gold Bendable.
- D. Domestic Cold Water and Hot Water Systems Above Ground
 - 1. Piping Systems
 - a. Basis of Design
 - 1) Hot and Cold Water Systems: Chlorinated Polyvinyl Chloride (CPVC) CTS, ASTM F-441 and D-2846 (100 psi at 180 degrees F). Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Fittings: Schedule 40 socket type CPVC, ASTM F-439 and F-441. Joints: Solvent cement and primer for CPVC piping, ASTM F-493. All metal thread connections to fixtures and fittings (tub spout, showerhead, etc.) shall be connected with a brass transition fitting.
 - 2) All piping shall be supported per manufacturers recommendations.

Temperature		SDR 11 FlowGuard Gold CPVC Permissible working pressure (psi)	Schedule 80 Corzan (for Pipe Sizes greater 2") Permissible working pressure (psi)				
	Pipe Sizes	½"-2" (max size)	2½"	3"	4"	6"	8"

Temperature	Pipe Sizes	SDR 11 FlowGuard Gold CPVC Permissible working pressure (psi)	Schedule 80 Corzan (for Pipe Sizes greater 2") Permissible working pressure (psi)				
		½"-2" (max size)	2½"	3"	4"	6"	8"
73-80		400	420	370	320	280	250
100		325	344	303	262	229	205
120		260	273	240	208	182	162
140		200	210	185	160	140	125
160		160	168	148	128	112	100
180		100 (max. temp)	105	92	80	70	62
200			84 (max. temp)	74	64	56	50

- 3) Hot and Cold Water Systems within Living Units: Cross-linked polyethylene (PEX) plastic tubing, PEX-a grade, ASTM F-876; ASTM F-877 (100 psi at 180 degrees F). Brass, copper or engineered plastic (EP) fittings, ASTM F-1960. Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Fittings/Joints: Cold expansion fitting with PEX reinforcing rings, ASTM F-1960 or cold expansion fitting with metal compression sleeve, ASTM 2080.
- a) Acceptable PEX manufacturers/systems:
 - (1) Uponor Wirsbro Aquapex tubing with ProPEX fittings
 - (2) Rehau PEX tubing and fittings
 - b) All PEX tubing and fittings shall be from the same manufacturer.
 - c) Galvanized pipe and nipples are not acceptable for any portions of the domestic water system.
 - d) All piping shall be supported per manufacturers recommendations.

Temperature	Pipe Sizes	SDR 9 PEX piping Permissible working pressure (psi)
73-80	3/8"-4"	160
120	3/8"-4"	130
180	3/8"-4"	100

200 (max temp)	3/8"-4"	80
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E. Sanitary, Waste and Vent and Storm Drain Systems, Below Ground to 5'-0" Outside Building

1. Piping Systems

a. Basis of Design

1) Schedule 40 DWV PVC pipe, ASTM D1785. Install per ASTM D2321. Fittings: Schedule 40 DWV PVC, socket type fittings, ASTM D2665. Joints: Solvent joints for PVC, ASTM D2564. (PVC piping is not acceptable for waste piping receiving discharge higher than 130 degrees F, cast iron piping is to be installed at the central plant, mechanical rooms and at all laundry and kitchen equipment discharges.)

b. Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.

c. Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.

d. Foam core PVC piping is not acceptable for any drainage system.

F. Sanitary, Waste and Vent Systems and Storm Drainage Systems Above Ground

1. Piping Systems

a. Basis of Design

1) Polyvinyl Chloride (PVC), schedule 40 DWV PVC pipe, ASTM D1785. Fittings: Schedule 40 DWV PVC, socket type fittings, ASTM D2665. Joints: Solvent joints for PVC, ASTM D2564.

b. Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.

c. Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.

d. Foam core PVC piping is not acceptable for any drainage system.

e. All piping shall be supported per manufacturers recommendations.

2. Piping Systems

a. Hot and Cold Water Systems: Chlorinated Polyvinyl Chloride (CPVC) Schedule 40, ASTM F-441 and D-2846 (100 psi at 180 degrees F). Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Fittings: Schedule 40 socket type CPVC, ASTM F-439 and F-441. Joints: Solvent cement and primer for CPVC piping, ASTM F-493.

2.4 VALVES, FLANGES AND UNIONS

A. General

1. All systems under this section shall be provided with valves to permit complete and sectional control of the system. They shall be located to permit easy operation, replacement

and repair. They shall be installed where shown on the Drawings, or as herein specified. Valves shall be as manufactured by one of the following companies: American, Anvil International, Conbraco, FNW, Kennedy, Kitz, Milwaukee, Nibco, Powell, Stockham, Victaulic, Watts, or approved equal, and shall conform to description listed below.

2. Control valves shall be provided for the domestic hot and cold water supply to all risers and specific areas such as restrooms, fixture groups, equipment, hose bibbs and wall hydrants, food service areas and building separations. Valves shall be located in back-of-house or service areas with access panels or above lay-in ceilings. Access panels will be permitted in public spaces with gypsum ceilings. The tower riser control valves will be provided with an access panel concealed below the lowest guestroom vanity or above the ceiling in the closet in the lowest level unless specifically noted otherwise.

B. Valve Description

1. Gate Valves
2. Ball Valves
 - a. 2" and smaller, Milwaukee UPBA 100.
3. Unions and Joints
 - a. Unions on drainage pipes on fixture side of traps may be slip or flanged joints with soft rubber washers or gaskets. Unions 2" and smaller on copper pipe shall be all brass with ground joint and shall be 250# copper to copper. Unions above 2" shall be flanged with gaskets. Provide union at water and gas connection to all equipment, except plumbing fixtures.
 - b. Bathtub waste and overflow joints shall be soldered if required by local authorities to eliminate the requirement for an access panel to bathtub drain connection.

2.5 CLEANOUTS

- A. Cleanouts shall be provided where indicated on Drawings and elsewhere as required by code.
 1. Cleanouts in pipelines shall consist of Schedule 40 PVC DWV cleanout plug with square head as scheduled on the Drawings. Where piping is concealed in floors or walls cleanouts shall be installed in or near surface of floor or walls and have countersunk plugs with covers.
- B. Cleanouts shall be provided at the base of the stack on all sanitary, waste and drainage stacks. Base of stack cleanouts on piping located within walls or partitions shall be cast iron cleanout tee with countersunk plug and chromium-plated round access cover, J.R. Smith figure 4530 or approved equal.
- C. Base of stack cleanouts on hotel, condominium student housing, multi-family projects, etc. shall have the stack located behind the water closet at the lowest level to allow for concealing the base of stack cleanout behind the tank of the water closet.
- D. Brass cleanouts shall be solid nut construction.
- E. Provide Owner with three (3) wrenches for removing flush cleanout plugs.

2.6 FLOOR DRAINS

A. Setting Grades

1. The plumbing contractor shall obtain exact elevation of finished grade at the top of the drains prior to setting any drains. Drains installed in excess of 1/4" below the adjacent finished floor shall be removed and reset to the correct elevation.

B. Drain Types

1. All floor drain outlets shall be of size noted on the Drawings. All drains shall be equal to the assembly specified. Acceptable manufacturers are as follows: Josam Co., Zurn Co., J.R. Smith Co., Wade, or approved equal. Drains shall be acid-resisting where indicated.
2. Floor drains noted as FD "DD" for use in deck drainage applications shall be Jay R. Smith Figure 1412-HP, C.I. drain with 13" square heel proof grate, D.I. undergrate with nickel bronze strainer.
3. Floor drains noted as FD "G" for use in public spaces such as Restrooms, Locker Rooms, Showers, etc., shall be general purpose type. Drains shall be cast iron with 6" square nickel bronze strainer and trap primer connection. Drains shall be Jay R. Smith Figure 2005B-L-B6-P050 or approved equal.
4. Floor or hub drains located within rooms considered to be a plenum are to be provided with a deep seal trap and trap primer.
5. Unless otherwise noted, acceptable manufacturers shall be Josam, Jay R. Smith, Mifab, Watts, and Zurn.

C. Trap Primers

1. Drains not receiving a continuous discharge are to be provided with an automatic trap primer.
2. Trap primers shall be in-line type actuated by flow independent of pressure, pressure activated primers are not acceptable. Josam models 88250 and 88300.
3. Proset Trap Guards or equal can be used in lieu of trap primers where approved by local authorities having jurisdiction.

2.7 ACCESS PANELS

- ### A.
- Group valves together above suspended ceilings, walls, furred spaces to minimize the number of access panels, but with all valves freely accessible for maintenance. Locate all valves within 1'-0" of access point.

- ### B.
- Furnish access panels of proper size to service concealed valves and cleanouts. Panels shall be of the proper type for material in which they occur and are to be furnished by the Contractor, but installed by the particular trade for the material within which the access panel is installed.

- ### C.
- Panels shall have flush doors with No.14 USCG steel door and trim No. 16 USCG steel frame, metal wings for keying into construction, concealed hinges, and screwdriver operated stainless steel cam lock. Panels shall be shop coated with one coat of zinc chromate primer. Valves above removable ceilings shall have tile clips by the Contractor for identification.

2.8 PIPE SUPPORTS AND HANGERS

- A. All piping shall be supported per manufacturers recommendations.
- B. Maximum spacing between pipe hangers shall be:
 - 1. PVC/CPVC and all plastic pipe:
 - a. 1-1/4" and smaller: 3'-0"
 - b. 1-1/2" and larger: 4'-0"
- C. At least one hanger shall occur within 2'-0" from where change in direction takes place. Where pipes extend down or up to other floors, pipe clamps shall be provided on each floor to support vertical risers. Vertical piping drops shall be rigidly anchored to structure at the top and bottom offsets and at eight foot increments along the vertical drop.
- D. Special approved hangers that require less installation space are to be used where required due to ceiling space limitations.
- E. All connections to pumps and other vibrating machinery shall be provided with stainless steel braided flexible hose connections. Connections to potable water systems shall meet ANSI/NSF 61 design standards.

2.9 WATER HEATERS – ELECTRIC

- A. Provide electric storage type water heaters as specified on the Drawings.
- B. Water heater shall carry a UL certification for 150 psi working pressure, an ASME temperature and pressure relief valve (T and P) sized for the heater, vacuum relief valve, immersion thermostat, glass lined tank, temperature gauge on outlet, and manual reset high limit control.
- C. Provide a combination ball/relief valve on the domestic water supply sized as indicated on the Drawings, Watts series BRV or approved equal.
- D. The water heater shall carry a five-year minimum limited warranty for tank leakage.
- E. Electric water heaters shall be as manufactured by:
 - 1. A.O. Smith
 - 2. Bradford White
 - 3. Lochinvar
 - 4. State

2.10 FLASHING

- A. Vent pipes passing through roof shall be flashed watertight.
- B. The roof connections shall meet the approval of the manufacturer of the roofing materials and shall comply with the roof bond requirements.

- C. All vent piping shall be offset above ceilings or in attic space and as shown on the Drawings to penetrate roofs on the least visible sides of building.

2.11 FLOOR, WALL AND CEILING PLATES

- A. Furnish and install heavy gauge chromium plated steel wall and ceiling plates on all exposed pipes in finished areas where they pass through walls, ceilings, etc. Plates shall be of type that will remain permanently in position and where pipes are insulated they shall be of size necessary to cover insulated pipe.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. All equipment and materials shall be completely installed, adjusted, and fully operational with all accessories and connections.
- B. Equipment, piping, ductwork, etc. shall fit into the spaces provided in the building and shall be installed at such times and in such a manner as to avoid damage and as required by the job progress. The Contractor shall coordinate work with other trades and locate work described herein to avoid interferences with structural, electrical and architectural work. Equipment, accessories and similar items requiring normal servicing or maintenance shall be accessible.
- C. The Engineer reserves the right to direct the removal of any item which, in his opinion, does not present an orderly and reasonably neat or workmanlike appearance. Such removal and replacement shall be done when directed by the Engineer and without additional cost to the Owner.

3.2 STORAGE AND PROTECTION OF MATERIALS

- A. During construction, all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers, etc.
- B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, test plugs until final connection to system is made.
- C. All equipment and piping shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.
- D. Handle and store materials in accordance with manufacturer's and supplier's recommendations and in manner to prevent damage to materials during storage and handling. Replace damaged materials.
- E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Equipment or materials damaged or

which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

3.3 CUTTING AND PATCHING

- A. Work shall include all cutting, patching, masonry and carpentry required as part of the equipment installation when not provided by other sections of these specifications.
- B. All work shall be performed as specified under architectural specification section for cutting and patching.

3.4 CLEANING

- A. At all times, the premises shall be kept reasonably clean and free of undue amounts of waste, trash and debris by periodic cleaning and removal. After completion, all foreign material, trash and other debris shall be removed from the job site.
- B. After all equipment has been installed, but prior to start-up, all equipment, piping, etc. shall be thoroughly cleaned both inside and out.
- C. After startup of systems as specified and just prior to Owner review and acceptance, all systems shall be finally cleaned and shall be left ready for use.

3.5 EQUIPMENT SUPPORT

- A. Major equipment supports (framed structural openings, etc.) shall be furnished and installed by others as shown on the Drawings. The plumbing work shall include, the furnishings and installation of all miscellaneous equipment supports, structural members, rods, clamps and hangers required to provide adequate support of all equipment.
- B. Unless otherwise shown on the Drawings, all equipment, piping, and accessories shall be installed level, square, and plumb.
- C. All equipment, piping, etc. supported by structural joists shall be supported by the top chord only of such joists. Hangers shall not be attached to the bottom chord of any joists.

3.6 PIPE PENETRATIONS

- A. Sleeves shall be installed in all masonry or concrete walls, floors, roofs, etc. for pipe penetrations. Sleeves for pipe shall be Schedule 40 black steel. Sleeves shall be sized to provide a minimum of 1/4" clearance between the sleeve and pipe.
- B. The 1/4" minimum clearance shall be provided between the sleeve and the insulation on insulated piping systems. A gap of the insulation shall be omitted at each side of a rated wall penetration to allow for the required fire stopping.

- C. As far as possible, all pipe penetrations shall be provided for at the time of masonry or concrete construction. Where drilling is required, only core drills shall be used. Star drills shall not be used.
- D. All pipes penetrating walls or floors of any construction shall be installed with escutcheon plates on both sides of the penetration securely fastened to the wall or floor. In exposed areas, escutcheon plates shall be chrome plated. All escutcheon plates shall be sized to completely conceal the penetration.
- E. All pipe and duct penetrations of fire, smoke, or fire and smoke-rated assemblies shall be fire-stopped as required to retain the integrity of the UL rated assembly. Fire barrier products shall be as manufactured by Tremco, Hilti, 3M, Metacaulk, Nelson, or approved equal.

3.7 FLASHING

- A. All piping penetrating roofs shall be flashed in an approved manner, shall be watertight, and shall conform to the requirements detailed in other sections of these specifications.
- B. Flashing for piping shall have a base not less than 2 square feet, and shall extend up over and into the open end of the pipe. All flashing shall be properly caulked and sealed.

3.8 PIPING SYSTEMS

- A. Water Piping - General
 1. Pipe used in piping assembly must be clean of dirt and obstructions and shall have ends square and reamed before putting into the fittings.
 2. All piping must be true and.
 3. All domestic water lines serving flush valve fixtures and washing machines shall be protected from water hammer by shock absorbers. Where shock absorbers are required they shall be as manufactured by Josam Mfg. Company, J. R. Smith, Sioux Chief Ind., Precision Plumbing or Zurn Mfg. Co. and shall conform to the Plumbing and Drainage Institute published requirements.
 4. All connections to water heaters, tanks and equipment shall be made with unions or flanges. Insulated piping systems shall be installed to provide space for insulation.
- B. Sanitary Waste, Vent, Indirect Waste and Storm Drain Piping - General
 1. Pipes shall be plumb and parallel to building walls, beams and columns unless otherwise indicated. All horizontal lines are to be evenly pitched and properly secured with iron or steel hangers, unless noted otherwise. A pitch of 1/8 inch per lineal foot shall be maintained on all soil, and waste lines, wherever possible.
 2. All soil and waste pipes shall be extended out full size through the roof or connected to a common vent as shown on the Drawings.
 3. Main vent stacks shall run parallel to the soil pipe stacks and shall connect to the vent continuation of the soil stack at least three (3) feet above the rim of the highest plumbing fixtures on the stack. Vent stacks shall also be connected at the base or horizontal offset of the soil stack through a Y and 1/8 bend or an upright Y fittings. Offsets in vent pipe shall be

- made with 45 degree fittings wherever possible. Horizontal vent lines shall pitch toward the waste line.
4. Threaded joints shall have American National taper screw thread with graphite and oil compound applied to the male threads.
 5. Sanitary and vent stacks are to be run straight and plumb and all offsets shall be made at an angle of not less than 45 degrees.
 6. All existing sanitary and vent systems re-used within the buildings shall be inspected and rodded or pressure flushed to restore the piping to full flow capacity.
- C. Mounting heights, unless otherwise noted, are to the centerline of the equipment and/or device.

3.9 TESTING OF PIPING SYSTEMS

A. General

1. All piping systems shall be subjected, before being insulated or concealed, to testing with water or air as noted and shall hold tight at the pressure head stated for the time interval required without adding air or water. While any system is being tested required head or pressure shall be maintained until all joints are inspected.
2. All tests shall be witnessed by the inspector having jurisdiction and the Owner's Representative, with a minimum 48-hour notice given these authorities.
3. All equipment, material, labor and testing mediums required for testing any of the various systems or any part thereof shall be furnished by the Contractor.
4. All connected equipment, accessories, etc. shall be isolated from piping systems prior to testing.

B. Sanitary Piping Systems

1. Water test shall be applied to these drainage systems either in their entirety or in sections as required, after rough piping has been installed. If the system is tested in sections, each opening shall be tightly closed except the highest opening in the section under test. All sections shall be tested with a minimum of 10 feet of head. In testing successive sections, at least the upper 10 feet of the next section shall be tested so that no joint of piping in the building shall be submitted to a test of less than 10 feet of head. The water shall be kept in the system for at least 30 minutes before inspection starts; the system shall then be made tight at all points.
2. Any points of the drainage systems to be tested with air instead of water shall be made by attaching an air compressor testing apparatus to any suitable opening and after closing all other inlets or outlets, forcing air into the system until there is a minimum gauge pressure of 5 psi. This pressure shall be held without the introduction of additional air for a period of at least 30 minutes.
3. Exterior connections shall be tested as part of the interior systems.

C. Interior Water Piping Systems

1. Upon completion of the entire water supply system or a section of it as required, it shall be tested prior to connection of fixtures and proved tight under a water/air pressure of 150 psi. Pressure shall hold for a period of one hour without introducing additional water/air. Water used for testing shall be from a potable source of supply. Defective joints or piping shall be replaced as required and all piping shall be retested.

2.

D. Defective Work

1. If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests shall be repeated. All repairs to piping shall be made with new material. Caulking of screwed joints or holes is not acceptable.

E. Additional Tests

1. Provide all additional tests such as smoke or pressure tests as required by the regulations or as directed by authorities making the inspection.
2. Provide for any repeated test as directed by the Owner's Representative, to make all systems tight as required.
3. Visual inspections of joints, valves, etc. shall be made as directed by the Engineer.

3.10 DISINFECTION OF WATER SYSTEM – INTERIOR AND EXTERIOR

- A. Prior to project completion, all potable water piping systems shall be disinfected per local code requirements.
- B. Whenever the authority having jurisdiction does not specify disinfection procedures, the new water piping system shall be thoroughly disinfected with a solution containing not less than 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or sodium hydrochloride solution and shall be introduced into the system and drawn to all points in the system. The disinfection solution shall be allowed to remain in the system for a period of eight hours, during which period all valves and faucets shall be opened and closed several times. After disinfection, the solution shall be flushed from the system with clear water until the residual chlorine content is not greater than 0.2 parts per million.
- C. This work is to be supervised or performed by an approved chemical testing laboratory and results sent to Engineer or his representative for verification.

3.11 FIXTURE CONNECTIONS AND SUPPORTS

- A. Wall fixtures shall be hung by means of carrier type fixture supports as manufactured by J.R. Smith, Josam, Mifab, Wade or Zurn.

3.12 SLEEVES

- A. Furnish and install pipe sleeves around all piping passing through masonry walls, floors, beams, etc. Sleeves shall be of such diameter as to allow pipe to pass through easily and permit expansion and contraction of pipe. Where pipes are insulated, the sleeves shall be of such diameter as to allow the insulated pipe to pass through easily. The sleeves shall be placed before the pouring of concrete and before construction of walls. Sleeves for vertical risers shall extend a minimum of 1" above the floor slab. Sleeves to outside walls below grade shall be caulked or provided with expansion type mechanical seals as required to make them waterproof.

3.13 INSTALLATION OF UNIONS

- A. Unions shall be located as shown on plans and as required by equipment so piping and equipment can be easily dismantled. Unions shall not be installed in any location where they are not readily accessible.

3.14 TRAPS

- A. All fixtures, drains, etc. shall be provided with traps, unless specifically shown or specified otherwise. Traps shall be set in an upright position, level and true, and shall be vented as shown and required. All exposed traps shall be provided with cleanout plugs.

3.15 CLEANOUT INSTALLATION

- A. Furnish and install cleanouts in soil and waste lines as required by Code and/or job conditions, as shown on the Drawings and as follows: At or near the end of each branch and main drainage line, horizontal lines at intervals as required by code. All cleanouts shall be readily accessible, with plugs easily removable for cleanout lines. Cleanouts at the base of vertical piping shall be held within 2'-0" from finished floor unless otherwise indicated.

3.16 FLASHING INSTALLATION

- A. All pipes passing through roofs shall be flashed in an approved manner. Flashing shall be watertight.
- B. Roof connections shall meet the approval of the manufacturer of roofing material and shall comply with roof bond requirements.

3.17 EQUIPMENT AND MATERIAL PROTECTION

- A. During construction all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers.
- B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, test plugs until connection to system is made.

3.18 SPACE REQUIREMENTS

- A. Piping, apparatus and equipment shall fit into the space provided in the building or within the property and shall be installed at such time and in such manner as to avoid damage to the building structure or property as required by the job progress. Equipment, apparatus and accessories requiring normal servicing or maintenance shall be made easily accessible.

END OF SECTION 220000

SECTION 230000
HVAC GENERAL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Refer to Division 1 - General Requirements and any and all Supplementary or Special Requirements, all of which apply to work described in Division 23 - HVAC as if written in full herein.
- B. The scope of work described in these Specifications and/or indicated on the Drawings shall include the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all HVAC systems. All HVAC work shall be accomplished by workmen skilled in the various trades involved.
- C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawings and Specifications, the higher implied cost shall be included in the bid, and the Architect shall be notified of the discrepancy in writing.

1.2 CODES AND STANDARDS

- A. All HVAC work shall conform to all ordinances and regulations of the City, County and State where the work will take place, including the requirements of all authorities having jurisdiction. The following codes, standards and references shall be observed as a minimum:
 - 1. The 2012 International Codes
 - 2. The 2012 Uniform Mechanical Code
 - 3. State Amendments to the Code
 - 4. National Fire Protection Association (NFPA) Standards and Guidelines
 - 5. Local and State Fire Marshal requirements
 - 6. Local Building and Inspection Department requirements
 - 7. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE)
 - a. Standard 90.1-2010 – Energy Standard for Buildings Except Low-Rise Residential Buildings
 - b. Standard 62.1-2010 – Ventilation for Acceptable Indoor Air Quality

- c. Standard 55-2010 – Thermal Environmental Conditions for Human Occupancy
 - d. Other Standards and Guidelines as applicable
 8. Sheet Metal and Air Conditioning Contractors’ National Association, Inc. (SMACNA) Manuals
 9. Underwriters Laboratories Inc. (UL)
 10. Americans with Disabilities Act (ADA)
- B. If Code or other requirements exceed the provisions shown on the Contract Documents, the Engineer shall be notified in writing. Where requirements of the Contract Documents exceed Code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor’s expense.

1.3 MISCELLANEOUS DEFINITIONS

- A. Terms: The following definitions of terms supplement those of the Division 01- General Requirements and are applicable to Division 23 – Heating, Ventilation, and Air Conditioning (HVAC):
1. Contractor: As used herein the term shall mean “the person or entity referred to throughout the Contract Documents as if singular in number. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term “Contractor” means the Contractor or the Contractor’s authorized representative.”
 2. Furnish: As used herein shall mean “supply and deliver to Project site, unload and inspect for damage.”
 3. Install: As used herein the term shall mean “to place in position for service, temporarily store, unpack, assemble, erect, apply, place, protect, clean, start up, and make ready for use.”
 4. Owner: As used herein the term shall mean “the person or entity identified as such and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner’s approval or authorization. The term “Owner” means the Owner or the Owner’s authorized representative.”
 5. Product: As used herein shall include materials, systems, and/or equipment, machinery, components, and fixtures forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

6. Provide: As used herein shall mean “furnish and install, complete and ready for the intended use.”
7. The Work: As used herein the term shall mean “the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor’s obligations. The Work may constitute the whole or a part of the Project.

1.4 WORK INCLUDED

The HVAC Systems installed and work performed under this Division of the Specifications shall include, but not necessarily be limited to:

A. Airside Systems

1. Equipment: including fans, unitary air conditioners, air handling units, fan-coil units, make-up air units, dedicated outdoor air units, furnaces, split systems, etc.
2. Ductwork and Accessories: including sheet metal, duct-board, flexible ductwork, fire and smoke dampers, access doors, etc.
3. Air Distribution Devices: including louvers, registers, grilles, diffusers, etc.

B. Refrigerant Systems

1. Piping, Tubing and Accessories: including pipe, refrigerant tubing, valves, solenoids, thermal expansion valves, strainers, air vents, pipe and equipment drains, condensate drains, expansion devices, etc.

C. Equipment, Ductwork and Piping Supports

1. Equipment Mounts: including roof curbs, concrete housekeeping pads, equipment rails, miscellaneous steel, etc.
2. Hangers and Support Devices: including inserts, hanger rods, strut channel, cross-bracing, anchor bolts, pipe anchors, restraints, etc.

D. Insulation

1. Ductwork Insulation: including exterior duct wrap, internal duct liner, fire wrap, etc.
2. Piping and Equipment Insulation: including preformed, board and wrap.

E. Miscellaneous HVAC Equipment: Unit heaters, wall heaters, roof hoods, heat tracing, etc.

F. Automatic Temperature Controls

1. Decentralized: including all thermostats, control dampers, line and low-voltage wiring, smoke detectors, pressure sensors, gas sensors, control logic, etc.
- G. Labor and Equipment: including project management, supervision, tradesmen, lifts, fork-trucks, cranes, scaffolding, saws, wrenches, etc.
- H. Demonstration and Owner Training

1.5 ENGINEER'S DRAWINGS

- A. The locations, arrangement and extent of equipment, devices, ductwork, piping, and other appurtenances related to the installation of the HVAC work shown on the Drawings are approximate and define the intent of the design. The Contractor shall not scale Engineer's Drawings, but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy.
- B. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

1.6 EQUIPMENT, MATERIALS AND BID BASIS

- A. Manufacturers' names, model numbers, etc. cited on the Drawings and in the Specifications are for the purpose of describing type, capacity, function and quality of equipment and materials required. All project design and coordination between disciplines has been performed as if the named manufacturer and specific piece of equipment will be provided to the project by the Contractor.
- B. Alternate equipment and/or materials other than that named on the Drawings and in the Specifications may be proposed for use, but all equipment and materials shall conform entirely to the specified base items. Proposed alternate equipment shall be substantially equal in size, weight, construction and capacity. Alternate equipment and materials shall be submitted only as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. Requests for prior approval of alternate products shall be made at least ten (10) days prior to the bid date and as required by Division 1 - General Requirements. The Engineer shall consider the use of the alternate equipment based on the supportive documentation made available to him, and shall approve or disapprove any proposed alternates. The decision of the Engineer shall, in all cases, be final.
- C. The Contractor shall coordinate the installation of all HVAC equipment proposed for use in this project with all building trades (architectural, structural, electrical, etc.). Coordination shall be accomplished prior to, and shall be reflected in, the equipment submittals for approval. When the Contractor requests substitution of alternate equipment, it is with the knowledge that he shall be responsible for any and all costs required by the substitution, including necessary

engineering and construction revisions in his or any other contract or trade to satisfy the design intent shown on the Plans and described in the Specifications.

- D. All materials exposed within HVAC plenums shall have a flame-spread index of not more than 25 and a smoke-developed rating index of not more than 50 unless otherwise allowed by code.

1.7 SUBMITTALS

- A. The Contractor shall prepare, submit and obtain Engineer's review of all manufacturers' data on the HVAC equipment and systems prior to ordering, purchasing or installing any equipment or materials. Six (6) hard copies of the complete submittal are required, five of which will be reviewed and returned by the engineer. Electronic submittals (e.g. pdfs, etc.) may be acceptable, if approved by the architect and described in Division 01 - General Requirements. All submittals shall be transmitted simultaneously in hard ring binders (or in a single .zip file), with the associated specification sections cited and the items submitted clearly identified. Partial submittals will be returned without review. Submittals, as a minimum, shall include:

1. All HVAC items scheduled on the Drawings
2. Equipment arrangement, ductwork and piping drawings. Contractor drawings shall be prepared at a minimum scale of 1/8" = 1'-0". A scale of 1/4" = 1'-0" scale is preferred. Drawings shall be indicative of actual equipment purchased and shall show all offsets, transitions, fittings, dampers, valves, hanger locations, etc. Sections are required in spatially tight areas (e.g. kitchens, laundries, central plants, mechanical rooms, etc.) The following will guide the Contractor as to minimum drawing detail required:
 - a. Clearly indicate top and bottom of duct and pipe elevations. All elevations shall be coordinated as to not conflict with structural, plumbing, electrical and architectural trades.
 - b. Indicate all offsets (both vertical and horizontal).
 - c. Indicate graphically all duct and pipe joints and their lengths.
 - d. Submit duct and pipe-work fabrication schedule indicating duct size range with minimum duct material gauges, pipe schedule being used, duct and pipe connection joint types, section lengths, duct reinforcement type and spacing, etc.
 - e. Indicate graphically all ductwork to be fabricated with internal duct liner.
 - f. Indicate all insulation for ductwork and piping.
 - g. Indicate all dampers and valves as shown on design documents and called for in the specifications.
 - h. Indicate all flexible connectors where required by specifications and notes.
3. Flexible ductwork, duct-board, insulation and linings
4. Dampers, louvers, air distribution devices, wall terminations (wall caps), roof terminations (roof caps, hoods, jacks, etc.)
5. Manufacturer's cut sheets of all piping and tubing materials

6. Where split systems are used in a “long line application,” submit manufacturer’s refrigerant line set routing drawings and engineered calculations supporting the recommended suction and liquid line sizes. Identify and provide cut sheets of any and all accessories required to make the system complete, functional and reliable. Also, refer to the EQUIPMENT INSTALLATION - COMMON REQUIREMENTS paragraph below.
 7. Refrigerant type and charge (lbs.) for each item of equipment utilizing refrigerant.
- B. All submittal approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to being submitted to the Engineer.
 - C. Review of submittals by the Engineer does not relieve the Contractor from responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements (roof penetrations, wall penetrations, floor penetrations, curbs, electrical, etc.) of all approved equipment with the other trades and disciplines.
 - D. All submittals shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.
 - E. The Contractor shall provide a written statement confirming coordination of voltage requirements for all HVAC equipment requiring an electrical connection. Statement shall bear the names and signatures of the HVAC and electrical contractors. A photocopied reproduction of the below statement is acceptable.

VOLTAGE COORDINATION STATEMENT

This statement is to confirm that the voltages of the equipment provided under this specification have been coordinated with the Electrical Drawings, as well as with the Electrical Contractor.

HVAC Contractor: _____

Project Manager Name: _____

Project Manager Signature/Date: _____

Electrical Contractor: _____

Project Manager Name: _____

Project Manager Signature/Date: _____

1.8 PERMITS

- A. The Contractor shall obtain all permits and inspections required for the installation of the HVAC work and pay all charges incident thereto. He shall deliver copies of all certificates of permit and inspection to the Architect.

1.9 COORDINATION OF TRADES

- A. The Contractor shall give full cooperation to other trades, and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.
- B. Piping and other HVAC equipment shall not be installed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate all uncoordinated ductwork, piping and other HVAC equipment installed should they interfere with the proper installation and mounting of electrical, plumbing equipment, ceilings and other architectural or structural finishes.
- C. The Contractor shall coordinate the elevations of all ductwork, piping and equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation.
- D. In areas where more than one trade is required to use common openings in beams, joists, chases, shafts and sleeves for the passage of conduits, raceways, piping, ductwork and other materials, the Contractor must coordinate the positions of all piping and equipment to be furnished under this section so that all items including the materials and equipment of other trades may be accommodated within the space available.
- E. The HVAC Contractor shall confirm that his work does not interfere with the clearances required for finished columns, pilasters, partitions, walls or other architectural or structural elements as shown on the Contract Documents.
- F. Work that is installed under this Contract which interferes with the architectural design or building structure shall be removed and relocated as required at no additional cost to the Contract.
- G. Coordinate power and fire alarm requirements of all combination fire/smoke dampers and smoke dampers with the electrical contractor.

1.10 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall prepare a minimum of two (2) instruction manuals, one of which shall be submitted to the Architect for the Engineer's review. Manuals shall describe installation, operation and maintenance of all HVAC equipment and shall include copies of control schematics, sequences of operation, function and operations of all components, as well as the Contractor's name, address, and telephone number. Manuals shall also contain one copy of all manufacturers' drawings, pamphlets, data, parts lists, and instruction manual for each piece of equipment. Upon approval, one copy shall be delivered to the Owner; one copy shall be kept by the Contractor. The pamphlets and drawings are to be neatly bound in (a) 3-ring binder(s).

1.11 AS-BUILT DRAWINGS

- A. The Contractor shall maintain a record of all changes in the work from that shown in the Contract Documents. The record shall be by red-line mark-up on the most current set of

Engineer's Drawings kept in the field office. After all work is completed, the Contractor shall prepare a set of "as-built" reproducible drawings of similar type and quality as the Engineer's Drawings. As-built drawings shall accurately depict actual final arrangement of all HVAC items. As-built drawings shall be delivered to the Architect.

1.12 WARRANTY

- A. All equipment furnished and installed under this Contract shall be provided with the manufacturer's standard warranty unless otherwise noted.
- B. All reciprocating and scroll air conditioning compressors shall be provided with an extended 5-year parts warranty.
- C. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of building acceptance by the Owner. The phrase "make good" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All equipment, materials, accessories, etc. used shall be new and of current production unless specified otherwise. Equipment not specified in the Engineer's Drawings shall be suitable for the intended use and shall be subject to approval by the Engineer.
- B. All equipment, products and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.
- C. All equipment shall bear the inspection Label of Underwriters Laboratories Inc.
- D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.

2.2 ELECTRICAL WORK

- A. Except as otherwise specified or noted, electrical equipment used for HVAC systems shall be as specified herein.
- B. Motor controls, system controls, starters, disconnects, pilot lights, push buttons, etc. shall be furnished by the HVAC Contractor compatible with the apparatus that it operates. Electrical equipment shall be wired for the voltage shown on the Electrical Drawings.
- C. The Contractor shall be responsible for coordinating and furnishing equipment of voltage shown on the electrical documents.

- D. Electric motors shall be NEMA Premium Efficiency open drip proof type. Motors shall meet NEMA MG1 Table 12-12 of EISA, 2010. Motors shall be selected with a minimum of 15% safety factor greater than the fan brake/horsepower (e.g. 4.75 BHP would require a nominal 7½ HP motor). The motor service factor shall not be used as part of the safety factor. All motors shall have thermal overload protection. Motors shall be capable of operating at $\pm 10\%$ of the design voltage without voiding the manufacturer's warranty. Motors that drive equipment that will run continuously shall be IEC 60034-1 continuous duty rated.
- E. All "loose" disconnects and starters shall be installed by Division 26.
- F. Power wiring to disconnects, starters, and equipment shall be provided and installed by Division 26. All equipment requiring electrical power shall be provided with a disconnect switch at each piece of equipment. Coordinate switch type (fused or non-fused) with equipment characteristics, manufacturer's recommendations and the electrical drawings.
- G. Provide all system controls and associated control and interlock wiring for complete and operable systems. 120 volt and higher wiring shall be MC cable or in conduit in accordance with local codes and the materials and installation requirements of Division 26 - Electrical.
- H. Coordinate power and fire alarm requirements of all combination fire/smoke dampers and smoke dampers with the electrical contractor.
- I. All disconnects shall be labeled on the face of the device with a semi-rigid plastic laminate nameplate with 1" high white letters on a black background securely affixed to the equipment. The label shall indicate equipment served (equipment tag used on the Drawings). Labels shall be furnished and installed by the Contractor.
- J. Acceptable manufacturers shall be General Electric, Square D, Eaton, Siemens and Allen Bradley.

2.3 AIR FILTERS

- A. All filters shall be U.L. 900 classified.
- B. Filters shall be pleated disposable type (MERV 6 minimum) unless specified otherwise.
- C. Install one set of new filters in air handling equipment during construction and install a new set prior to turning system over to the owner.
- D. Temporary roll filter media shall be provided at the inlets to all air handling equipment operated during construction. Remove temporary filter media prior to turning system over to the owner.

PART 3 - EXECUTION

3.1 GENERAL

- A. All equipment and materials shall be completely installed, adjusted, and fully operational with all accessories and connections.

- B. Equipment, piping, ductwork, etc. shall fit into the spaces provided in the building and shall be installed at such time and in such a manner as to avoid damage and as required by the job progress. The Contractor shall coordinate work with other trades and locate work described herein to avoid interferences with structural, electrical and architectural work. Equipment, accessories and similar items requiring normal servicing or maintenance shall be accessible.
- C. The Engineer reserves the right to direct the removal of any item which, in his opinion, does not present an orderly and reasonably neat or workmanlike appearance. Such removal and replacement shall be done when directed by the Engineer and without additional cost to the Owner.
- D. Listed mounting heights are to the finished bottom of the device unless otherwise noted.
- E. All work shall be designed and installed to comply with the requirements for the seismic design category and use group for the area in which the building is constructed.

3.2 STORAGE AND PROTECTION OF MATERIALS

- A. During construction, all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers, etc.
- B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, and test plugs until final connection to system is made.
- C. All equipment, piping and ductwork shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.
- D. Handle and store materials in accordance with manufacturer's and supplier's recommendations and in a manner to prevent damage to materials during storage and handling. Replace damaged materials.
- E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

3.3 CUTTING AND PATCHING

- A. The work shall include all cutting and patching required as part of the HVAC installation. Refer to Division 1 - General Requirements.

3.4 CONCRETE WORK

- A. Construct curbs, pads and similar supports for equipment where required.

- B. Perform concrete work in accordance with applicable portions of Division 3 - Concrete. Minimum compressive strength of concrete shall be same as specified for slabs on grade.
- C. Mix and install grout for HVAC equipment base bearing surfaces and anchors. Provide forms as necessary and place grout to completely fill equipment bases.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right-of-way for piping to be installed with the required slope.
- E. For roof and attic mounted equipment requiring routine maintenance, allow for an unobstructed path from the roof/attic service entry point to the equipment. The path area shall be a minimum of 6'-0" high by 3'-0" wide.
- F. Split system outdoor unit equipment has been shown indicating matched systems of the indoor unit with its associated outdoor unit. While the location of the outdoor units are approximate, the importance of unit locations relative to the refrigerant line set penetration through a wall or roof is critical for the project. Prior to ordering equipment, the contractor shall carefully coordinate the line set routing and requirements with the split system manufacturer to insure installation guidelines, especially for long line applications, are being followed. Refrigerant line sets shall be routed to reduce the system total equivalent length and minimize system capacity losses due to elbows, fittings, valves, etc. After the coordinated routing drawings have been approved and certified by the split system manufacturer, they shall be submitted for review along with the equipment and any required accessories. During installation, the contractor is responsible for keeping as-built refrigerant piping installation drawings noting any deviations to the proposed routing. Deviations that may affect proper system operation or performance shall be reviewed by the manufacturer immediately and corrective action implemented as required.

3.6 EQUIPMENT SUPPORTS

- A. Major equipment supports (structural steel frames, framed structural slab and wall openings, etc.) shall be furnished and installed by others; however, the HVAC work shall include furnishing and installation of all miscellaneous equipment supports, structural members, rods, clamps and hangers required to provide adequate support of all HVAC equipment.
- B. Unless otherwise shown on the Drawings, all HVAC equipment, piping, and accessories shall be installed level, square, and plumb.

- C. All equipment, piping, etc. supported by structural bar joists shall be supported only by the top chord of the joists. Hangers shall not be attached to the bottom chord of any joists.

3.7 PIPE AND DUCTWORK PENETRATIONS

- A. Sleeves shall be installed in all masonry or concrete walls, floors, roofs, etc. for pipe and ductwork penetrations. Sleeves for pipe shall be schedule 40 black steel pipe. Refer to Section 23 21 13 – Piping and Accessories for additional information. Sleeves for ductwork shall be 20-gauge galvanized steel. Ductwork sleeves shall be sized to provide a minimum of ¼" clearance between the sleeve and duct. For insulated ducts, the clearance shall be between the sleeve and the insulation.
- B. As far as possible, all pipe and ductwork penetrations shall be provided for at the time of masonry or concrete construction. Where drilling is required, only core drills shall be used. Star drills shall not be used.
- C. All pipes penetrating walls or floors of any construction shall be installed with escutcheon plates on both sides of the penetration securely fastened to the wall or floor. In exposed areas, escutcheon plates shall be chrome plated. All escutcheon plates shall be sized to completely conceal the penetration.
- D. Ductwork penetrating walls or floors of any material shall be installed with closure plates on both sides of the penetration.
- E. Pipe penetrations through exterior walls shall be sealed weather-tight with a factory fabricated mechanical type rubber seal. Refer to Section 23 21 13 – Piping for additional information.
- F. All pipe and duct penetrations of fire, smoke, or fire and smoke-rated assemblies shall be fire-stopped as required to retain the integrity of the UL-rated assembly. Fire barrier products shall be as manufactured by Tremco, Hilti, 3M, Metacaulk, Nelson, STI or approved equal. Refer to Division 7 - Thermal and Moisture Protection.

3.8 FLASHING

- A. All piping and ductwork penetrating roofs shall be flashed in an approved manner, shall be watertight, and shall conform to the requirements detailed in Division 7 - Thermal and Moisture Protection.

3.9 EQUIPMENT LABELING

- A. All HVAC equipment shall be labeled. This shall include all central plant, air handling or air conditioning equipment, air terminals, and other similar and miscellaneous equipment.
- B. Labels for air terminals or other devices shall be located for optimum visibility through access panel or removed ceiling tiles.

- C. Equipment labeling shall be one of the following, unless noted or specified otherwise:
 - 1. Permanently attached plastic laminated signs with 1" high lettering
 - 2. Stencil painted identification, 2" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel

3.10 CLEANING

- A. At all times, the premises shall be kept reasonably clean and free of undue amounts of waste, trash and debris by periodic cleaning and removal. After completion, all foreign material, trash and other debris shall be removed from the job site.
- B. After all equipment has been installed, but prior to testing and balancing, all equipment, piping, ductwork, etc. shall be thoroughly cleaned both inside and out.
- C. After cleaning, filters shall be installed where required and all systems shall be tested and balanced.

3.11 PAINTING

- A. Painting will be done under Division 9 - Painting except as otherwise noted, but the HVAC Contractor shall leave all surfaces of work free of rust, dirt and grease.
- B. The HVAC Contractor shall touch-up any equipment scratched in shipment or during installation to match original finish. Touch-up painting of HVAC equipment shall be part of the HVAC work.
- C. Any visible ductwork through grilles, registers and diffusers shall be painted flat black.
- D. All painting and coating shall match the original finish and shall conform to the requirements detailed in Division 9 - Finishes.
- E. Do not paint over equipment nameplates, nonferrous hardware, accessories or trim.

3.12 PRESSURE TESTING

- A. Unless otherwise specified herein, all HVAC piping shall be tested as required by Code to 1½ times the rated system pressure or 100 psig, whichever is greater. Care shall be taken to isolate all equipment not suitable for this test pressure by installing pipe caps or blank flanges at the equipment connections. All valves and fittings shall be tested under pressure.

3.13 PERFORMANCE AND DEMONSTRATION TESTS

- A. All testing and demonstration of any and all HVAC systems required for acceptance by any authorities having jurisdiction shall be included as part of the HVAC work. This shall include the furnishing of any and all testing equipment, smoke generation devices, and any other required equipment or accessories, and all necessary labor required to perform any required tests or demonstrations. The Contractor shall coordinate and verify all devices, equipment and sequence of testing and/or events with such authorities having jurisdiction. The Contractor shall perform a minimum of two (2) satisfactory preliminary tests or demonstrations prior to any formal tests and/or demonstrations for any code authorities, and shall give a minimum of five (5) days advance notice to the Engineer of any and all preliminary tests and/or demonstrations, indicating the date and time of such tests.

3.14 TRAINING

- A. Upon completion of the work, the Contractor shall conduct operation and training session(s) for the Owner's key operating personnel. These sessions shall be of sufficient length and duration to adequately explain the design intent and proper operating and maintenance techniques for all HVAC equipment and systems. After these sessions are completed, the Contractor shall provide a copy of a signed statement by the Owner that his personnel are thoroughly familiar with and capable of operating all HVAC equipment and systems.

END OF SECTION 230000

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 23 00 00 - HVAC General.
- B. The insulation shall be installed in a neat and workmanlike manner by trained personnel regularly engaged in the installation of insulation and approved by the insulation manufacturer. Insulation, adhesives, coverings and coatings shall be applied in strict accordance with its respective manufacturer's recommendations. Installer has been in business for no less than 5 years and has completed at least 10 installations of similar size projects.
- C. The contractor shall verify that test and inspection of the work to be insulated have been completed and approved before the insulation is applied.
- D. All insulation must meet applicable codes for Flame Spread and Smoke Developed ratings when tested in accordance with ASTM 84 and UL 723.

1.2 WORK INCLUDED

- A. The work done under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install all insulation, complete, as indicated on the Drawings and as specified herein.

1.3 QUALITY ASSURANCE

- A. Materials shall be the standard products of manufacturers regularly engaged in the production of insulation products. Insulation materials shall be products that have been in use in commercial buildings for at least 2 years prior to bid opening.
- B. Surface Burning Characteristics:
 - 1. Insulation shall have a composite insulation, jacket, binders, and adhesive Flame-Spread rating of 25 or less and a Smoke-Developed rating of 50 or less and shall be so listed by UL.
 - 2. Insulation and related materials shall have surface burning characteristics determined by test performed on identical products per ASTM E 84, NFPA 255, and UL 723, mounted and installed as per ASTM E 2231.
 - 3. Adhesives, mastics, tapes, and other accessories shall have the same component ratings.

4. Materials shall be labeled indicating compliance with the above requirements.
5. All testing shall be performed by a testing and inspecting agency acceptable to authorities having jurisdiction. Insulation, jacket materials, adhesives, mastics, tapes and cement material containers shall be labeled with appropriate markings of applicable testing and inspecting agency.

1.4 RELATED WORK

- A. Where ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be protected and sealed with fire-stopping materials as specified in Section 23 00 00 - HVAC General.
- B. Adequate provisions shall be made to protect the premises, equipment, and the work of other trades against droppings, adhesives and coatings used in the installation.

1.5 SUBMITTALS

- A. Submit product information for insulation materials to the Architect in accordance with Division 1 and Section 23 00 00 - HVAC General.
- B. Submit shop drawings and data to prove complete compliance with these specifications on products and methods of installation. Include materials used, thickness for each application, flame and smoke ratings, thermal conductivity, permeance, density for each product, and jackets (both factory and field applied). Indicate methods of applications.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to purchase. Insulation shall be CFC and HCFC free.
- B. Provide insulation that meets or exceed the requirements of ASHRAE 90.1.
- C. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state.

2.3 BLANKET TYPE INSULATION (DUCTWRAP)

A. Description:

1. Flexible, limited combustible, blanket type insulation composed of mineral or inorganic glass fibers bonded together with a thermosetting resin, meeting ASTM C 553, Type 1 and ASTM C 1290.
2. Vapor retarder jacket: Provide one of the following types of vapor retarder jackets:
 - a. Foil-scrim-kraft (FSK), foil reinforced kraft (FRK), or polypropylene-scrim-kraft (PSK) with a 2" (50mm) (min.) stapling and taping flange on one edge.
 - b. Conforming to ASTM C 1136 Type II.
3. Surface Temperature Application Limits: Insulation shall be rated for use on surfaces operating at temperatures up to 250°F.
4. Ratings:

Insulation Type:	Type 1:	Type 2:
Minimum R-Value, out of package*: hr•ft ² •°F/Btu (m ² •°C/W) at 75°F (24°C) mean temperature	R-7.4 (1.30)	R-10.3 (1.81)
Minimum R-Value, installed: hr•ft ² •°F/Btu (m ² •°C/W) at 75°F (24°C) mean temperature	R-6.0 (1.06)	R-8.0 (1.46)
Minimum Density: lb/ft ³ (kg/m ³)	1.0 (16)	0.75 (12)
Thickness: Inches (mm)	2 (51)	3 (76)
Maximum Labeled K-value at 75°F (24°C) mean temperature: Btu. •in./hr. •ft ² •°F (W/m. •°C)	0.27 (0.039)	0.29 (0.042)

*Value may vary by manufacturer; minimum installed value must be met

B. Insulate the following with Type 1 blanket insulation:

1. All galvanized steel ductwork containing heated and/or cooled supply air, except:
 - a. Exposed ductwork in finished conditioned spaces.
 - b. Ductwork indicated to be internally lined or insulated with external insulation.
2. Concealed surfaces of ceiling diffusers exposed to non-return air plenums.

3. Return air ductwork exposed to attics or non-return air plenums.
 4. Return air, toilet exhaust, and general exhaust ductwork exhausting conditioned air and routed through interior spaces that are ventilated with outside air or exposed to outside air conditions.
 5. Concealed outside air ductwork located within indirectly conditioned spaces (e.g. indoor soffits, furr-downs, vertical chases, etc.).
 6. Ductwork and plenums located inside of the building (i.e. located within the exterior boundary or skin of the building thermal envelope) when containing or flowing, makeup air, or exhaust air ducts and plenums, when not indicated to be insulated with rigid fiberglass insulation. This applies to ducts and plenums whether exposed or concealed within chases when located on the interior side of the exterior skin of heated or cooled space.
- C. Insulate the following with Type 2 blanket insulation:
1. Ductwork and plenums located outside of the exterior boundary or skin of the building thermal envelope when containing or flowing heated and/or cooled air when not indicated to be insulated with rigid fiberglass insulation.
 2. Supply air ductwork located in unconditioned attic spaces and in indoor spaces that are ventilated with outside air or exposed to outside air conditions.
 3. Concealed surfaces of ceiling diffusers exposed to attics.
- D. Subject to compliance with requirements, insulation shall be manufactured by: CertainTeed, Johns Manville, Knauf, Owens Corning, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Shop drawing submittals shall include a complete package of materials and methods intended for use as described in this section.
- B. All work shall be in strict accordance with applicable codes, ordinances and the manufacturer's recommendations.
- C. All work shall be performed in a professional workmanlike manner and standard trade practice. It shall be smooth in appearance and suitable for finish painting.
- D. All exterior piping shall be installed with a corrugated aluminum jacket with bands 3'-0" on center.

- E. Provide insulating tape over all piping specialties to prevent condensation such as drain valves, drain plugs, combination temperature/pressure test plugs, etc.
- F. Fiberglass pipe insulation shall be applied to clean (free of rust) dry pipe prior to leak testing.

END OF SECTION 230700

PART 1 - GENERAL

1.1 DESCRIPTION

- A. All work in this section shall be subject to the provisions of Section 23 00 00 - HVAC General.
- B. Furnish and install all material, labor, accessories, etc. shown on the drawings and as specified herein to completely install all ductwork systems.
- C. Ductwork systems shall be classified as follows:
 - 1. Static pressure class +2 in. wg - from constant volume air handling unit, and terminal unit to supply diffusers; all return, outside air and exhaust ductwork.
- D. Refer to PART 3 – EXECUTION for duct sealing requirements.
- E. Ductwork shall be constructed according to the latest edition of SMACNA ductwork construction standards applicable to the type of ductwork, system pressures described above, and the system material construction
- F. Duct sizes shown on the drawings are nominal inside clear.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Duct materials:
 - a. Fiberglass ductboard
 - b. Flexible duct connectors
 - c. Flexible ductwork
 - 2. Dampers and accessories
 - 3. Remote damper operators
 - 4. Access doors
 - 5. Flexible duct connectors
 - 6. Duct liner
 - 7. Sealants, mastics, adhesives and coatings
- B. For all fire dampers, combination fire and smoke dampers, and smoke dampers, submit UL approved installation instructions for each specific application.

PART 2 - PRODUCTS

2.1 DUCTWORK

- A. Ductwork shall be constructed of galvanized steel sheets of the thickness listed in the SMACNA manuals for the pressures referenced above, or of 1" thick (1½" thick if required by the applicable energy code) resin-bonded fiberglass duct board with fire-resistant foil-scrim-kraft (FSK) vapor retarder on the outside surface and a smooth mat finish on the air-side surface. Fabrication and installation shall conform to SMACNA's Fibrous Glass Duct Construction Standards; latest edition. See below for additional requirements.
- B. Single-Wall Rectangular Ducts and Fittings:
1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 2. Transverse Joints: Select joint types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Transverse (Girth) 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. Fiberglass duct board shall be UL 181 listed as a Class 1 Rigid Air Duct with a minimum thermal conductivity of 0.23 at 75°F per ASTM C 518. Thickness shall be as indicated on the drawings or as required by the energy code in effect. Fiberglass duct board shall be Johns Manville Super Duct RC, Knauf Atmosphere Air Duct Board, Owens Corning QuietR Duct Board or Certainteed Ultra*Duct Black Duct Board.
1. Tapes and mastics used to seal fibrous glass ductwork shall be listed and labeled in accordance with UL 181A and shall be marked "181 A-P" for pressure-sensitive tape, "181 A-M" for mastic or "181 A-H" for heat-sensitive tape.
- D. Exhaust ductwork shall be galvanized sheet metal (G 90 minimum) constructed to SMACNA standards and shall not be insulated unless noted otherwise.
- E. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 FLEXIBLE DUCTWORK

- A. Flexible ductwork shall be UL Class 1 air duct.

- B. Flexible ductwork shall comply with the following:
1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems"
 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems"
 3. SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated.
 4. Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1".
 5. ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."
- C. Flexible ductwork shall be installed between main supply ducts and diffusers. Length shall be a maximum of 8'-0" long, except in residential applications, where the length shall be as indicated.
- D. Flexible ductwork shall be Thermaflex M-KE R-6 (R value = 6.0 minimum or as required by local energy code) flexible air duct or approved equal.
- E. Flexible ductwork size shall be the same size as the diffuser neck it serves, unless indicated otherwise.
- F. Flexible duct connections to ceiling diffusers shall be installed without kinks or sags to provide unrestricted airflow. Provide Flex Flow Elbow supports by Thermaflex.

2.3 FIRE DAMPERS

- A. Fire dampers shall be installed at all locations where ductwork or supply or return air openings penetrate any floor, wall or partition with a fire rating.
- B. All fire dampers shall be of the "Dynamic" type as classified in UL Standard 555.
- C. Fire dampers shall have a rating compatible with the floor, wall or partition, shall be tested to UL Standard 555 and be labeled for the intended installation (horizontal or vertical).
- D. Maximum pressure drop: 0.10 in. wg; provide ductwork transitions as required so as not to exceed maximum pressure drop.
- E. Fire Resistance Rating: 1½ hours unless noted otherwise indicated on drawings for 3 hours.
- F. Closure device: Each fire damper shall be equipped with a factory installed heat responsive device (fusible link) rated to close the damper when temperature at the damper reaches: 165°F.

G. Airflow Closure Rating:

1. Dynamic fire dampers shall be selected for the velocity and pressure rating of the intended installation. Refer to the plans and schedules for airflow rates (CFM) and pressures (in. wg).
2. Dampers shall have a minimum velocity rating of 2000 fpm at a pressure rating of 4 in. wg.
3. Dampers in systems operating above 2000 fpm or 4 in. wg shall be selected for a velocity rating of 4000 fpm at a pressure rating of 6 in. wg or a velocity rating of 6000 fpm at a pressure rating of 8 in. wg as required.

H. Types:

1. Curtain: for use in systems up to 4000 fpm velocity; Style B or C with the blade stack out of the airstream (Style A with the blade stack in the airstream may be used behind registers and grilles or where space conditions do not permit the use of a Style B damper).
 - a. Construction:
 - 1) Frame: Galvanized steel (in gauges required by manufacturer's UL listing).
 - 2) Blade design: interlocking galvanized steel
 - 3) Sleeves: Damper shall be supplied as a single assembly with a factory sleeve.
 - 4) Retaining Angles: Damper shall be supplied with factory retaining angles sized to provide installation overlap in accordance with the manufacturer's UL listing.
 - 5) Duct Transition Connection: breakaway type
2. Round: for use in systems up to 2000 fpm velocity.
 - a. Construction:
 - 1) Frame: Galvanized steel (in gauges required by manufacturer's UL listing).
 - 2) Blade design: single galvanized steel blade (in gauge required by manufacturer's UL listing).
 - 3) Retainer plate(s): supplied with damper.
 - 4) Sleeves: Length as required per wall thickness.
 - 5) Duct Transition Connection: breakaway type.
 - 6) Frame: Galvanized steel with mitered and interlocking corners (in gauges required by manufacturer's UL listing).
 - 7) Blade design: 16 ga. galvanized steel strengthened by three longitudinal 1" deep Vee grooves running the entire length of each blade. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through

- the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening.
- 8) Sleeves: Damper shall be supplied as a single assembly with a factory sleeve.
 - 9) Retaining Angles: Damper shall be supplied with factory retaining angles sized to provide installation overlap in accordance with the manufacturer's UL listing.
 - 10) Duct Transition Connection: breakaway type
- I. All dampers shall be installed in strict accordance with the manufacturer's UL approved installation details.
 - J. Where fire dampers are required in a fibrous glass ductboard system, provide sheet metal sleeve per manufacturer's UL installation instructions. Verify gage of sleeve and attachment angle with governing code authorities. Installation shall also conform to SMACNA Figure 5-9 "Fibrous Glass Duct Installation".

2.4 ACCESS DOORS

- A. Hinged, gasketed and latched Access Doors (AD) and/or panels shall be installed at each fire and smoke damper, each duct mounted smoke detector, each valve, at each duct mounted balancing damper or any other mechanical equipment or device that requires accessibility. Doors and panels shall be sized (minimum 18" x 18", duct size allowing), and located to optimize access to dampers, detectors, and other equipment for service and replacement. Access Panels (AP) in walls, ceilings or other surfaces shall be coordinated with architectural finishes and selected by the architect.
- B. Access doors shall be designed for five times the pressure of the duct in which it is mounted.
- C. Access doors for fire dampers, combination fire/smoke dampers and smoke dampers in medium pressure (+4 in.wg and higher) duct systems shall be the implosion type designed to prevent excessive negative pressure downstream resulting in collapsed ductwork. At the contractor's option, the access door may be an integral feature of the damper assembly.
- D. Access doors for grease exhaust ducts shall be in accordance with NFPA 96 (latest edition). Vertical grease ducts shall have an access door at each floor level in an inconspicuous location.
- E. Access doors for fire dampers, combination fire/smoke dampers and smoke dampers shall be permanently identified by a die-cut label with 1/2" high red block letters on a white background. Label shall read FIRE DAMPER.

- F. Duct-Mounted Access Doors: Fabricate access panels per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct".
1. Basis-of-Design Product: Subject to compliance with requirements, provide Ductmate Industries, Inc.; Access Doors or comparable product by one of the following:
 - a. American Warming and Ventilating; a division of Mestek, Inc.
 - b. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 - c. Prior Approved Equal
 2. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision Panel:
 - 1) Observation type doors shall be sandwich type provided at all fire and smoke dampers, humidifiers, in-duct smoke detectors, and UVC emitters.
 - 2) Minimum 12"x12" with 8"x8" viewport, insulated or non-insulated.
 - 3) For ducts smaller than 12-inches, 10"x6" shall be used with a 4"x 2-5/8" viewport with a single pane of safety glass.
 - d. Hinges and Latches: 1"x1" butt or piano hinge with cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 3. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 4. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 inches Square: Continuous hinge and two sash locks.
 - c. Access Doors up to 24 by 48 inches: Continuous hinge and two compression latches.
 - d. Access Doors Larger Than 24 by 48 inches: Continuous hinge and two compression latches.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All ductwork shall be installed in accordance with applicable SMACNA Standards according to the pressure class described in PART 1 - GENERAL.

- B. Seal, inspect and test ductwork prior to insulating or concealing. Seal all ductwork and plenums to meet the following SMACNA duct seal class:
 - 1. Class A: Seal all transverse joint, longitudinal seams, and duct wall penetrations.
 - a. Pressure-sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL 181A or UL 181B by an independent testing laboratory and the tape is used in accordance with that certification.
 - b. All connections shall be sealed, including but not limited to spin-in fittings, taps, other branch connections, access doors, and duct connections to equipment.
 - c. Sealing that would void product listings is not required.
 - d. Spiral lock seams need not be sealed.
 - 2. Tapes, sealants and mastics used to seal metallic and flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181 B-FX" for pressure-sensitive tape or "181 B-M" for mastic/sealant.
 - 3. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked "181 B-C".
- C. Ductwork shall be supported as recommended by SMACNA Standards from structural members. Ductwork shall not be allowed to rest on ceilings, light fixtures or structural members. Ductwork supported from joists shall be supported from the top chord of all joists.
- D. All ductwork accessories shall be installed in strict accordance with manufacturer's recommendations.
- E. All ductwork shall be cleaned inside and out prior to system start up, and shall be left in a neat and orderly manner.
- F. Duct sizes shown on drawings are inside clear dimensions.
- G. Unless otherwise approved, ducts shall be true to dimensions indicated, straight and smooth on the inside with neatly finished joints, securely anchored to the building in an approved manner, and installed to be completely free from vibration under all conditions of operation. Exact routing of ductwork will be dependent on location of framing members. Route ductwork to avoid cutting framing members.
- H. Brace ducts not more than 60 inches on center.
- I. Make slip joints in the direction of air flow.
- J. Offset ducts around obstructions where possible. Where duct must encompass obstruction, area of duct shall remain constant.

- K. Duct tapers shall not exceed 1:4 ratio and transformations 30 degrees between air flow and diverging or converging air flow.
- L. Provide access doors for access to all equipment, dampers and motors concealed by sheet metal.

3.2 BALANCING DAMPERS

- A. Install manual volume dampers where indicated on the drawings and where required to properly balance the air distribution system.
- B. Provide an opposed blade damper behind the face of each supply register which shall be adjustable through the face of the register with a screwdriver.
- C. Provide a butterfly damper in the neck of each supply diffuser unless noted otherwise.

END OF SECTION 233100

SECTION 233400
UNITARY EXHAUST AND SUPPLY FANS AND VENTILATORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to specification section 23 00 00 - HVAC General, all of which applies to work described in this section as if written in full herein. Special attention should be given to Section 2.02 ELECTRICAL WORK for specifics on motor and drive requirements.
- B. Furnish and install all unitary exhaust and supply fans and ventilators of the size, type, capacity and characteristics as shown on the equipment schedules and herein described.
- C. Base fan-performance ratings on actual project site altitude.
- D. Acceptable manufacturers include only those whose products have been in satisfactory use in similar service for not less than five (5) years.
- E. Electrical Standards: Provide electrical motors and products which have been listed and labeled by Underwriters Laboratories Inc. and comply with NEMA Standards.
- F. Certification, Fan Performance: Fans shall be certified to bear the AMCA label for air and sound performance.

PART 2 - PRODUCTS

2.1 CEILING-CENTRIFUGAL AND CABINET FANS

- A. Units shall be direct-drive type with back-draft damper, acoustically insulated cabinets and speed controller.

PART 3 - EXECUTION

3.1 GENERAL

- A. All units shall be installed in accordance with manufacturer's recommendations and as shown on the Drawings.
- B. Ceiling-centrifugal and cabinet fans shall be supported from structural members and shall not rest on the ceiling, on lights or on structural members.

END OF SECTION 233400

SECTION 233700
LOUVERS, GRILLES, REGISTERS AND DIFFUSERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. All work in this section shall be subject to the provisions of Section 23 00 00 - HVAC General
- B. Furnish and install all louvers, grilles, registers and diffusers of the size, type, capacity, and characteristics as shown on the equipment schedules and specified herein.
- C. Equipment schedules and specifications are intended to establish a minimum level of quality and workmanship for the project. When other than the basis of design equipment is proposed, the Contractor shall be responsible for all costs associated with engineering and construction modifications necessary in his or any other trade that may be required to satisfy the Contract Documents.
- D. Refer to the drawings for basis of design manufacturer and acceptable alternates.

PART 2 - PRODUCTS

2.1 GRILLES, REGISTERS AND DIFFUSERS

- A. Units shall be of the type, size, and construction as scheduled or indicated.
- B. Unless otherwise noted or indicated, all air devices shall be supplied with a factory finish of manufacturer's standard white.
- C. Grilles, registers and diffusers shall be ordered with borders compatible with the ceiling system type in which they are installed. Refer to architectural drawings for type of ceiling and/or suspension system.
- D. Aluminum air devices shall be used for all areas subject to excessive moisture or humidity (e.g. showers, pools, bathrooms, etc.).

PART 3 - EXECUTION

3.1 GRILLES, REGISTERS AND DIFFUSERS

- A. All air devices located in ceiling tiles shall be centered or shall be on quarter points of 2 ft. x 2 ft. tiles.

- B. Where a line of sight allows the ductwork, wall, or ceiling structure to be seen behind any units, such ductwork, wall or ceiling structure shall be painted with nonflammable flat black paint to minimize visibility.
- C. All air devices not installed on T-bar ceiling grids shall be securely fastened to adjacent structures.
- D. Where air distribution devices are installed in inaccessible ceilings, provide the spin-in fitting without a volume damper. Provide an opposed blade damper in the neck of the air distribution device with access to the damper control through or at the face of the device.

END OF SECTION 233700

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electrical materials and installation instruction common to most electrical systems and components including but not limited to: equipment, raceways, fittings, sleeve/seals, sleeves, wires and connectors, conductors, demolition, equipment installation requirements common to equipment sections, painting and finishing, concrete bases, supports and anchorages, general coordination, electrical wiring and device coordination.

1.2 DEFINITIONS

- A. Following is a list of abbreviations generally used in Division 26.

1. AHJ – Authority Having Jurisdiction.
2. ETL – Electric Testing Laboratories.
3. NEC – National Electric Code.
4. NEMA – National Electrical Manufacturers Association.
5. NFPA – National Fire Protection Association.
6. OSHA – Occupational Safety and Health Administration.
7. UL – Underwriters Laboratories Inc.

- B. Terms used on the drawings or in the specifications shall have the following meanings:

1. Approved Equal: An Item suggested by the Contractor that is allowed by the Engineer to replace an item listed in the Specifications or Drawings. The burden of proof of equality is the responsibility of the Contractor.
2. Furnish: Supply and deliver, ready for installation, assembly or intended use, all materials, labor, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application for the particular work referred to.
3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at the project site as required to complete all items of work as required for the intended use/operation including all testing, certification, commissioning, and other requirements for final turnover to the Owner.
4. Provide: “Furnish” and “Install.”
5. Owner Furnished, Contractor Installed: The Owner will furnish at his cost and the Contractor shall receive, protect, store and install in the performance of the Work.
6. Finished Spaces: Spaces other than electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
7. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

8. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include installations above ceilings, in shafts, trenches, partitions, or other enclosures.
9. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations embedded in or below masonry or concrete construction, earthwork/trenches, within unheated shelters, crawl spaces or enclosures.
10. Wiring: All wires, raceways, fittings, conductors, connectors, tape, junction and outlet boxes, connectors, splices, and all other items necessary and/or required in connection with such work.
11. Raceway: All raceways, conduit, fittings, hangers, supports, sleeves, etc.

1.3 GENERAL REQUIREMENTS

- A. Examine the Drawings, specifications and other Contract Documents relating to the Work and the work of all trades and become fully informed as to the extent and character of work required. Coordinate all work with that of others to ensure proper and complete installation of all materials, equipment and supports. It is the intent of the drawings, specifications and related contract Documents to provide a complete working installation of all systems and equipment called for, in proper operating condition, finished, tested and ready for its intended use (hereinafter "Design Intent"). Provide all items not specifically shown on the drawings, called for in the specifications or related Contract Documents, but required to conform to the labor, material and equipment to achieve the Design Intent and all scaffolding, access provisions, tools, appliances, consumables, fees, permits and licenses, debris removal/disposal, supervision and labor, including required start-up, check-out and training to provide complete and fully operable systems in full compliance with the Contract Documents.
- B. Before submitting a bid and prior to the start of work, Contractor shall examine all conditions relating to the Work, including that associated with the work of other trades upon which Contractor's work may rely or otherwise depend, to achieve the Design Intent, in accordance with the best trade practices, workmanship and highest quality product installation, taking into account the sequence of the work, delivery, storage and hoisting requirements, requirements for access, testing and temporary services and all other site limitations and project complexities. Report to the Architect/Engineer any conditions which might prevent installation of materials and/or equipment in the manner intended by the Contract Documents or contrary to applicable codes, standards or regulations.
- C. No consideration or allowance will be granted for any alleged misunderstanding of materials, equipment or components to be furnished or work to be done; it being agreed that tender of proposal carries with it agreement to items, terms and conditions required by the Contract Documents.
- D. Site Visit: Visit the site and verify the exact conditions relating to the work and obtain such information as may be necessary to present a complete and comprehensive bid. No allowance will be made for any extra expense due to Contractor's failure to make such a visit and reasonably verify all actual/existing conditions. In the event of a conflict between existing conditions and the requirements of the Contract Documents, perform the necessary work to conform to Design Intent. The Owner or his representative will be the sole individual to interpret the intent of the

Drawings in the event of a conflict between (1) existing conditions and those shown on the drawings, or (2) quality of existing material and quality of material indicated on the drawings or in the specifications. Wherever a conflict such as this occurs, the higher standard shall prevail.

1.4 SPECIAL REQUIREMENTS

- A. When applicable, Contractor acknowledges the ongoing operations of the Owner at or in close proximity to the Project and agrees to coordinate the timing of the Work with the Owner's ongoing operations; perform the Work in a manner that minimizes or eliminates an adverse impact upon the Owner's ongoing operations; confine operations at the site to areas approved by Owner, permitted by law, permits and the Contract Documents; comply with the Owner's standard security, health and safety policies and procedures; not unreasonably encumber the site with any materials or equipment; and not place signs or advertising on or about the site without prior approval of Owner.
- B. Where applicable, all seismic construction, restraints, bracing, mounts and hanging systems shall be in full compliance with the requirements of all Authorities Having Jurisdiction (AHJ's), pre-approval, certification and engineering (including certified engineering calculations and stamps). Contractor shall be solely responsible for obtaining and complying with all requirements of the AHJ.

1.5 SUBMITTALS

- A. Reference Division 01 for submittal requirements.
- B. Submittal Schedule: Provide a detailed submittal schedule including all requirements of this Division and its subdivisions to the Architect and Engineer within thirty days of contract award.
 - 1. Contractor shall submit for the Engineer's approval a Submittal Schedule for the performance of the work that is consistent with the requirements of the project schedule. The Submittal Schedule shall allow reasonable time for the Architect and other consultants review as specified in Division 01 Submittal Procedures. If the time for Architects/Engineers review is not otherwise specified, the review period (from date of receipt) shall be fifteen business days. Once approved by the Architect/Engineer, submittal dates and time limits established by the Submittal Schedule shall not, except for reasonable cause, be changed or exceeded by the Contractor.
 - 2. For each submittal required by the Contract Documents the schedule shall include: specification section number, subsection/paragraph identification number, item description (as stated in the applicable specification section, subsection or other Contract Document) and the scheduled delivery date to the Architect/Engineer.
 - 3. Contractor shall be responsible to the Architect/Engineer and/or Owner for all costs, expenses and impact to the project schedule resulting from any deviation to the approved Submittal Schedule, including but not limited to; payment for required overtime, out-of-house resources/consultants or other higher cost resources of the Architect/Engineer as may be required to perform out of sequence, stacked, critical, delayed, unscheduled or multiple reviews of required submittals necessitated by rejection of a prior submittal, (cumulatively and hereinafter, "Additional Review Costs")

C. General:

1. Review is for general conformance with the Contract Documents and is not intended to otherwise approve or verify dimensions, quantities, or to coordinate the Work shown on shop drawings on or between Contractor and the work of other trades or Sections. Contractor is solely responsible for quantities, dimensions, means and methods. Dimensions shall be confirmed and correlated by Contractor at the jobsite prior to the start of the Work (procurement, fabrication, construction or other commencement activities). Contractor's failure to fully verify conditions at the jobsite prior to commencement of the work shall not relieve Contractor of its obligations under the Contract Documents and Contractor shall be responsible for all damages caused by or related to its failure to comply with the requirements of this provision.
2. Submittal review shall be performed to show compliance with the design intent. Contractor shall specifically note any deviations from the Contract Documents and explain the reason and nature of the deviation. Such deviations will be reviewed or rejected on the submittal. Deviations not so identified shall not relieve the Contractor from the requirements of the Contract Documents.
3. Resubmittals will be reviewed for compliance with comment(s) made on the original submittal only. Architect/Engineer shall not be responsible for changes made upon resubmittal that are not clearly identified (highlighted) and respond directly to the initial rejection. Resubmittals should not be packaged with non-related first time submittals; all resubmittals must be marked with the resubmittal number and date and must otherwise comply with all submittal requirements.
4. Submit shop drawings, commissioning plan(s) and checklists, penetration locations, supplemental data, etc., as may be required by the Contract Documents for all materials, equipment and other components of the work included in all Sections of this Division and other provisions of the Contract Documents in accordance with the requirements of this Division and Division 01.
5. All submittals must be reviewed by Contractor, and bear Contractors review stamp and signoff for Conformity to the Contract Documents, prior to the submission of any required submittal to Architect/Engineer. Submittals that fail to meet this requirement will be considered incomplete, will not be reviewed by Architect/Engineer and will be returned to Contractor, without review and/or rejected and resubmittal will be required. Contractor shall be solely responsible for any and all Additional Review Costs and/or other project costs or schedule impact.
6. Forward all submittals to Architect/Engineer in a coherent, organized fashion, complete and packaged as required herein, Architect/Engineer may reject submittals that fail to comply with this or any other provision of the Contract Documents and Contractor shall be solely responsible for any and all Additional Review Costs and/or other project costs or schedule impact.
7. Subject to other provisions of the Contract Documents and in the absence of a more stringent requirement, Architect/Engineer will review a submittal not more than two (2) times. Contractor shall be solely responsible for any and all Additional Review Costs and/or other project costs or schedule impact.
8. Identify each submittal item by reference to Specification Section paragraph in which item is specified, or drawing/detail number, as applicable. In addition, for equipment submittals, include identification numbers appearing on the equipment schedule.

9. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment. Words “as specified” are not sufficient identification.
 10. Organize submittals in same sequence as they appear in specification sections, articles or paragraphs.
 11. All materials and equipment submittals shall have a summary sheet at the front complete with catalog numbers. Where materials or equipment pertain to more than one building, submittals shall clearly indicate at which locations the materials or equipment is to be installed.
 12. Submittals shall show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping and/or conduit entrance, access requirements for installation and maintenance, physical size and dimension, electrical characteristics and requirements, foundation/curbs and all permanent and temporary support details as well as all information relating to weight, including but not limited to live and dead weights.
- D. Catalog Cuts and Submittal Literature: Catalog cuts, submittal literature and published material may be included to supplement scale drawings.
1. Prepare submittals electronically in accordance with the following and Division 01.
 2. Submittal literature, drawings and diagrams shall be specifically applicable to this project and shall not contain extraneous material or optional choices. Clearly mark literature to indicate the proposed item.
 3. Substitutions: Comply with Division 01 Product Substitution Procedures.
- E. Shop Drawings:
1. Shop drawings shall include all significant Division systems, equipment and components, including but not limited to all terminal devices, connections and elevations. Include all related specialty rooms (i.e., electrical, data/technology). Drawings shall be at a minimum scale of **1/4 inch per 1 ft.-0 inch** and shall be fully coordinated with the work of other trades and/or Sections.
 2. Identify congested areas and clearly indicate solutions to space problems, developed in conjunction with the work of other trades and/or Sections. Identification of space problems without proposed solutions is not acceptable and is grounds for rejection. For such areas indicate, superimposed, the work of all trades and/or Sections involved and:
 - a. Clearly identify each area of congestion and deviations from the Contract Documents, and:
 - b. Proposed solution(s), clearly documented and signed-off by all other trades and/or Sections involved.
- F. Anchorage and Supports: Submit details and calculations for support and anchors that are not specifically detailed on the drawings. All calculations must meet 2010 CBC.
1. Provide details and calculations for electrical equipment per 2010 CBC:
 - a. Having an operating weight over **400 pounds** or more and mounted directly to the floor.

- b. Having an operating weight over **20 pounds** and suspended from the roof, floor, or wall or supported by vibration isolation devices.
 2. Where pre-approved bracing systems will be employed, submit:
 - a. System component brochure describing components used and detailed installation instructions.
 - b. Loads to be transmitted to the structure at anchor points.
 3. Where anchorage, support, and bracing are not detailed on the drawings, and pre-approved systems are not used, submit details and calculations of proposed systems. Include:
 - a. **[Detailed drawings showing system to be installed, stamped by a Structural Engineer registered in the State of California.]**
 - 1) **[Calculations, stamped by a Structural Engineer registered in the State of California.]**
 - 2) **[A certification on the calculation sheet stating, “These calculations demonstrate that the system detailed complies with the requirements of Chapter 16 of the California Building Code. The system on which this bracing will be applied is rigid as defined in Chapter 16.”]**
 - 3) **[Obtain OSHPD approval for the proposed system should a pre-approved system not be utilized.]**
 - b. Anchorage and Supports:
 - 1) Where equipment substitutions change the weight, size, configuration, or other aspects of systems and equipment that will affect the performance of anchorages and/or supports, submit calculations for proposed anchors and supports, and install them as shown in these calculations.
 - 2) Where substitutions will have no effect on anchors and supports detailed on Contract Documents, submit information on sizes, weights, center of gravity and other relevant information to demonstrate this fact.
- G. Shop Fabrication Drawings: Drawings are for the Contractor’s use and shall be its responsibility. Do not submit shop fabrication documents unless specifically requested.
- H. Testing and Balancing: Coordinate Shop Drawings to include any additional components for proper system testing and balancing.
- I. Certificates: Submit final inspection certificates signed by governing authorities.
- J. Operating and Maintenance Instructions and Manuals.
 1. Instructions on major items, including but not limited to: switchgear, generators, pumps, air compressors, water heaters, water softeners, specialty units, fans, air handlers, AC units and temperature controls, shall be by representative of manufacturer of respective equipment.
 2. Submit as identified below and as directed in Division 01.

- a. Names, addresses and phone numbers of contractors and subcontractors. Alphabetical list of all system components, with the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.
- b. Complete operating and maintenance instructions and parts lists of all equipment and component parts. Data sheets to show complete internal wiring, and electrical ratings and characteristics, catalog data on component parts whether furnished by equipment manufacturer or others, names, addresses and telephone numbers of source of supply for parts subject to wear or failure, and description of operating, test, adjustment, and maintenance procedures.
 - 1) Where data sheets included in manual cover equipment, options, or other features not part of equipment actually furnished, line out these references or otherwise clearly mark so remaining text, diagrams, drawings, schedules, and similar information shall apply specifically to equipment furnished.
- c. Operating Instructions should include, but not be limited to:
 - 1) Normal starting, operational and shutdown procedures, including emergency procedures for each type of equipment/system.
 - 2) Equipment wiring diagrams.
 - 3) All other items as may be specified/required by this Section and the Contract Documents.
- d. Maintenance Instructions: All items as may be specified/required by this Section and the Contract Documents.
- e. Manufacturers Data (each piece of equipment):
 - 1) Installation instructions.
 - 2) Drawings and specifications.
 - 3) Parts List, including recommended stock and long lead parts/components.
 - 4) Wiring and riser diagrams.
 - 5) Warranties and guarantees for all equipment, materials and components, including repair, replacement and labor from both Contractor and manufacturer as required by the Contract Documents.
 - 6) Certificates of Installation – manufacturer’s certification of supervision during equipment installation and start-up procedures.
 - 7) Instruction certificates – certificates of compliance with Sections specific training and instruction programs.
 - 8) All other items as may be specified/required by this Section and the Contract Documents.

K. Record Documents:

1. Maintain one complete set of blue-line prints and specifications at the job site exclusively for recording deviations from the drawings which are necessary because of job conditions, request for information and/or approved change orders. Record locations and depths of buried and concealed conduits or other systems components from fixed, easily identifiable objects, such as building walls or other fixed physical objects. Where conduits are

- concealed in walls or other fixed physical objects, indicate distances from building corners or other building features not likely to be disturbed by fixture alterations. Drawings, specifications (as-builts) and approved submittals.
2. Where the project uses a BIM model the Contractor shall keep the model updated in a similar fashion, maintaining the current project record as described in (a), above and submit, an addition to all other requirements of this Section and other provisions of the Contract Documents a complete and accurate BIM model for the project.
 3. Prior to Substantial Completion, obtain from the Architect a complete set of electronic CAD drawings. Record all revisions to these drawings to indicate as-built conditions. Indicate all changes, including RFI's, on this set of documents. Submit one set of blueprints of these revised drawings for review. Make necessary changes and deliver to Architect one set of reproducibles and one electronic copy, including and BIM model, upon Final Completion and Acceptance. Refer to Division 01 for additional requirements.
 4. Provide full size copies of record one-line diagrams, in metal frames with glass front. Obtain Record prints from Owner's Representative at Contractor's cost and have prints framed by a firm normally engaged in this work. Locate diagrams as directed.
 5. All test reports, certifications, and inspection reports.
 6. AHJ/Specialty AHJ Approvals (i.e., Fire Marshal and/or Fire Department system approvals).
 7. Substantial and Final inspection certificate signed by governing authorities.
 8. All other items as may be specified/required by this Section and/or other provisions of the Contract Documents.

1.6 EQUIPMENT DEVIATIONS AND SUBSTITUTIONS

- A. See Division 01 for requirements and procedures related to Deviations and Substitutions. Unless specified elsewhere in the Contract Documents, a minimum of two (2) weeks shall be allowed for evaluation. The burden of all systems re-engineering/design, testing, suitability and constructability is solely placed upon the Contractor for all deviations from the basis of design as reflected in the Contract Documents.
- B. No substitutions will be allowed and/or considered unless the description of a product includes the phrase "approved equal" and then only upon a determination as to equivalency and impact upon the project budget, schedule and the work of others, including any redesign of the project or its system components by the Architect, Engineer or other trades. The final determination as to sufficiency or acceptance of any such substitution and/or deviation properly requested and submitted by Contractor will lie solely with the Architect/Engineer. Contractor may not implement substitutions that have not been approved by Architect/Engineer.
- C. Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings which requires any redesign of any portion of the project, including but not limited to the mechanical, electrical, plumbing, structure, or architectural design or any of their respective subcomponents. Contractor shall be responsible to the Architect/Engineer and/or Owner for all costs, expenses and impact to the project budget and/or schedule resulting from any required investigation, analysis or redesign, including but not limited to; payment for required overtime, out-of-house resources/consultants or other higher cost resources of the Architect/Engineer, Owner or AHJ as may be required to perform the investigation, analysis or redesign (cumulatively and hereinafter, "Deviation Review Costs").

- D. If approved by Architect/Engineer, all such redesign, including all new drawings and detailing required, will be prepared by the Architect/Engineer and their sub-consultants for Change Order documentation for approval by Owner and the Authority Having Jurisdiction will be paid by the Contractor as part of the Deviation Review Costs.
- E. Were such approved deviation requires a different quantity and arrangement of equipment, wiring, conduit, supports, foundations, pads, curbs, or equipment from that specified or indicated on the drawings or other Contract Documents, Contractor shall be responsible for all such costs, including the work of other trades and shall be solely responsible to furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system at no additional cost or schedule impact to the project (cumulatively and hereinafter "Deviation Construction Costs").

1.7 COORDINATION

- A. Drawings and corresponding electronic media are diagrammatic and indicate the general arrangement of systems and work included in the Work. Consult the drawings, details and other electronic media for locations of fixtures and equipment; where same are not definitely located, obtain this information from the Architect/Engineer.
- B. The drawings and related electronic media have been made to scale with the best knowledge of conditions, dimensions and space requirements available at the time of design and shall be followed as closely as possible during performance of the Work and coordination with the work of others. The forgoing however shall not relieve Contractor from its responsibility to verify all conditions. Dimensions and space requirements prior to commencement of the Work and to immediately report any errors or discrepancies to the Architect/Engineer.
- C. Check drawings and related electronic media of other trades to verify spaces and conditions in which work will be performed prior to commencement of the work.
- D. If directed by the Architect/Engineer or required for proper installation, execution and coordination of the work, the Contractor shall, without extra charge, make reasonable modifications in the layout as needed.
- E. Take all dimensions from Architectural and Structural Drawings, certified equipment drawings and from the actual field measurements before fabricating work. All conflicts shall immediately be reported to the Architect/Engineer. Contractor is solely responsible for conflicts known or which reasonably should have been known but not reported or resolved before commencement of the work.
- F. Equipment furnished shall fit in allocated space with due provision for manufacturer's recommended access and proper maintenance requirements. Verify and coordinate space requirements with all trades and equipment which comprise the Work.
- G. Prior to construction, coordinate the Work with that of other trades and building components. Prepare coordination drawings (or other specified electronic media) for all major trades, utilities and other primary systems routing in conjunction with the contract documents to maximize the

pre-installation planning and coordination of trades, utilities and systems and minimize the requirement to manage field coordination through the RFI's, ASI's or other similar processes.

- H. Coordinate connection of systems with interior/exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- I. Before starting work, carefully examine the site and all Contract Documents. Become thoroughly familiar with new and existing conditions governing work on this project. Verify indicated elevations, building measurements, rough-in dimensions and equipment locations before proceeding with any of the work.
- J. Drawings shall be accurately scaled to **1/8 inch – 1 foot** or larger using the same version of AutoCAD or other electronic media as used by Architect/Engineer. Drawings shall include all addenda and Change Order items.
- K. Contractor shall be solely responsible for coordination and shall bear the cost of its failure to coordinate installation or of failure to advise Architect/Engineer of installation conflicts.
- L. Sequence, coordinate, and integrate installations of systems materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to building enclosure.

1.8 ELECTRICAL WIRING AND COORDINATION

- A. In general, power wiring will be provided under Division 26 – Electrical, and control wiring will be provided under Division 23 – Heating Ventilating and Air Conditioning, unless otherwise specified.
- B. The following schedule summarizes the Division or work and material responsibilities.

ITEM	FURNISHED UNDER	SET IN PLACE OR MOUNTED UNDER	WIRED AND CONNECTED UNDER
Equipment motors	MD 1	MD 1	ED 2
Resistance heaters	MD	MD	ED
Fire protection controls, including remote switches, flow switches	MD	MD	ED
Liquid chiller starters, where specified	MD	MD	ED
Motor controls where specified as an integral package	MD	MD	ED
Motor controllers	ED 4	ED 4	ED
Resistance type heater controllers	MD 6	ED 4	ED

ITEM	FURNISHED UNDER	SET IN PLACE OR MOUNTED UNDER	WIRED AND CONNECTED UNDER
Magnetic contactors and magnetic starters with overload trip assembly	ED 4	ED 4	ED
Integral control transformers	MD 6	ED 4	ED
Cover-mounted control devices	MD 6	ED 4	ED
Manual motor starters with overload trip assembly	ED 4	ED 4	ED
Motor starter switches	ED 4	ED 4	D
Disconnect switches fused and unfused	ED 4	ED 4	ED
Thermal or thermal-magnetic circuit breakers	ED 4	ED 4	ED
Fuses	ED 4	ED 4	ED
Duct smoke detectors	ED	MD	ED 3
Smoke and fire/smoke dampers (with and without end switches)	MD	MD	ED 3
Control power source for temperature and equipment control panels	ED	ED	ED
Electric temperature control relays and miscellaneous devices	MD	MD 5	MD 5
Level and float switches	MD	MD 5	MD 5
Pipe mounted control devices such as flow switches, flow sensors, valves, and wells.	MD	MD 5	MD 5
Thermostats and space sensors.	MD	MD 5	MD 5
Duct mounted control devices such as temperature, humidity, flow and pressure sensors.	MD	MD 5	MD 5
Damper actuators.	MD	MD 5	MD 5
Control dampers.	MD	MD	--
Medical Gas Alarms	MD	MD	ED
Variable frequency drives (VFD) specified to be mounted on or in the mechanical equipment.	MD	MD	ED

ITEM	FURNISHED UNDER	SET IN PLACE OR MOUNTED UNDER	WIRED AND CONNECTED UNDER
VFD specified to be mounted separately from the mechanical equipment	MD	ED	ED

- C. Notes: (1) MD: Mechanical Divisions 21, 22, 23. (2) ED: Electrical Division 26. (3) Fire Alarm related and power wiring provided under Division 26; Control-related wiring and relays provided under Divisions 21, 22, 23. (4) If furnished as part of factory equipment under Divisions 21, 22, 23, wiring and connections only by Electrical Division 26. (5) If any control devices carry the Full Load Current to any motor, they shall be furnished under Divisions 21, 22, 23, but shall be set in place and connected under Division 26. (6) Except where indicated as part of a motor control center on the Electrical Drawings. (7) Division 26 shall provide the logic contact closure and the wiring to the local DDC temperature control panel. Division 26 shall also provide interface with the fire alarm system, proof of flow devices (duct/fan air flow switches), connecting wiring, smoke control logic, panel, relays, damper monitoring, and associated devices for a complete smoke control system.

1.9 ACCESSIBILITY

- A. Contractor is responsible for verifying that equipment and devices will fit within the space shown on the drawings. Contractor shall locate all equipment which must be serviced, operated or maintained, in fully accessible positions.
- B. Minor deviations from the drawings may be made to allow for better accessibility, but changes of magnitude or which involve extra cost shall not be made without approval from the Architect/Engineer.

1.10 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with a minimum of five years documented experience. Company personnel shall be approved by manufacturer for all product installations and required training.
- C. Conform to all applicable standards, codes and regulation and industry best practice requirements.
- D. All materials and equipment shall be new, shall bear manufacturer's name, and shall conform to the grade, quality and standards specified herein. Type, capacity and application shall be suitable and capable of satisfactory operation for the purpose intended. All equipment and components shall include UL label and/or marking on equipment body/device including manufacturer's name, pressure rating(s), electrical classification(s), limits and ratings as applicable to individual components for the purpose specified and intended.

- E. Equipment Selection: All items of a given type shall be the product of the same manufacturer. Equipment of greater or larger power, dimensions, capacities, and ratings may be considered provided such proposed equipment is approved in writing by Architect/Engineer and connecting electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. See Deviations and Substitutions for requirements. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings of efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.
- F. Listing and labeling: Provide motors that are listed and labeled. Terms “listed and labeled”: as defined by UL, NEC, Article 100 or other applicable recognized agency as specified in the Contract Documents.
- G. Cutting and Patching: Unless otherwise required by the Contract Documents, Contractor shall be responsible for all cutting, fitting and patching required to complete the Work, or to make portions of the Work and existing conditions fit together properly, and all such areas shall be restored to the conditions existing prior to the cutting, fitting and patching unless otherwise provided in the Contract Documents.
- H. Contractor shall promptly correct any portion of the Work that is defective or not in accordance with the Contract Documents or rejected by the Architect/Engineer or Owner. Contractor shall be responsible for, and pay for all costs arising out of, any additional testing and inspections, demolition, uncovering and replacement and additional design and consulting services required to properly correct any portion of the Work.
- I. Contractor **shall comply** with the Contract Documents and all Laws, standards and handling criteria regarding hazardous substances, wastes and materials, including asbestos-containing materials, lead-based paints, petroleum (or any constituent thereof), mold, radon, and polychlorinated biphenyl (PCB), (“Hazardous Materials”) in performing the Work. Unless required by the Contract Documents, no Hazardous Materials shall be brought onto the Project.
- J. Lead Free Requirements: Contractor shall endeavor to use lead free products and where required by law, ordinance, regulation or standard all materials products and practices shall comply with limitations and requirements as to the allowable limits and/or percentages of lead. Lead free products must be certified by and independent 3rd party.
 - 1. This provision shall apply to any and all similarly regulated materials, products and practices that may be considered hazardous or are otherwise regulated by applicable law, ordinance regulation or standard in the project local.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. All materials and equipment shall be adequately covered and protected against dirt, water, chemical or mechanical damage, and theft. At completion, all work, equipment and materials shall be cleaned, and damage repaired by Contractor. Damaged equipment will be replaced by the Contractor if Owner does not accept repairs done to the equipment. Such replacement shall be scheduled to minimize building system interruption of occupied or scheduled for occupancy.

- B. Material delivered at the site shall not be left exposed to the weather or left unattended. Deliver pipes, tubes and conduit with factory-applied end-caps. Contractor shall be responsible to maintain end-caps or provide temporary end caps on all open-ended piping, tubes and conduit through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- C. Protect stored material from moisture and dirt. Protect plastic pipes and materials from sunlight and support to prevent sagging and bending.
- D. Elevate stored materials above grade. When stored inside, to not exceed structural capacity of the floor.
- E. Provide protective coatings to materials to prevent damage and/or infiltration of moisture and dirt on all materials and equipment including but not limited to cast iron and steel valves.
- F. Contractor shall check the openings in the building and the size of the doors, passages, and openings through which equipment is to be admitted. Wherever necessary, Contractor shall provide the equipment in sections or knocked down in order to admit the equipment through these openings.
- G. Contractor shall provide all rigging, erection and hoisting equipment as required to handle or place equipment and piping in position. This rigging and hoisting equipment shall only be attached and placed on the structure in locations as approved by Architect/Engineer at the site.

1.12 PERMITS, FEES AND UTILITIES

- A. Obtain and pay for all necessary permits, fees and utilities and inspections required to perform the Work.
- B. Coordinate work with local regulatory entities, utility companies and others as required to fully comply with the requirements of this section and the Contract Documents, including those for both temporary and permanent services.
- C. Permits, fees and utility expenses to be paid by Owner, if any, shall only where specifically required by the Contract Documents, and then only to the extent so specified.

1.13 DOCUMENT OWNERSHIP

- A. The Drawings and Specifications, combined with the calculations, field data, notes, and reports, are the intellectual and real property of the Architect and/or Engineer. This covers all forms of written and recorded or electronic media. The reuse of these documents without specific permission of the Engineer is prohibited. The Drawings may be employed by the Owner and Contractor for the express use of constructing, commissioning and operating the facility only upon proper execution of the Agreement for Use of Electronic Files and Data.

1.14 GUARANTEE AND WARRANTY

- A. Contractor warrants to Owner that the materials and equipment provided under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects. Work, materials and equipment not conforming to these requirements, including substitutions not properly approved by Change Order, shall be considered defective. This warranty excludes remedy for damage caused by improper or insufficient maintenance, improper operation or normal wear, tear and usage. Contractor shall assign to Owner, or otherwise assure the Owner has the full benefit of, all warranties and guarantees of manufacturer, subcontractors, sub-subcontractors and suppliers, and Contractor shall perform the Work in a manner that does not adversely affect or invalidate any available warranties or guarantees.
- B. Contractor shall warrant and guarantee all work against faulty material or workmanship for a period of one year from the date of final completion and written acceptance by the Owner, unless specified more stringently elsewhere in the Contract Documents.
- C. If the project is occupied or the systems placed in operation in several phases at the request of the Owner, the guarantee of each system or piece of equipment used shall begin on the date each system or piece of equipment was placed in satisfactory operation, tested, commissioned and accepted, in writing, by the Owner. The use of building equipment for temporary service and testing or phases of work completed prior to the projects final completion and acceptance by the Owner does not constitute the commencement of the warranty period.
- D. If a defect or deficiency in the Work is discovered within the one year Warranty and Guarantee period or within such longer period as may be prescribed by the Laws or by any specific guarantee, and Owner elects to have Contractor correct such defect or deficiency, Owner shall notify Contractor of such defect or deficiency in writing. This period of correction relates only to the specific obligation to correct defects and deficiencies and in no way otherwise limits the Contractor's responsibility for Work that is not in accordance with the Contract Documents, If Contractor fails to timely correct defects or deficiencies in the Work, Owner may, at its sole option, correct them and charge Contractor for all cost therefore.
- E. See Division 01 – Closeout Submittals for additional warranty requirements.
- F. Specific exclusions, if any, from this one year warrantee and guarantee period are listed in the individual specification sections.

1.15 LIMITATIONS OF LIABILITY

- A. To the extent any of the following provisions are not more stringently included in the Contract Document the following Limitations of Liability shall apply:
- B. Architect/Engineer is not responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, and is not responsible for Contractor's failure to perform or furnish the work in accordance with the Contract Documents.

- C. In the event that Architect/Engineer's employees or sub-consultants make comments or issue warnings about safety issues, such comments and warnings shall be considered to have been offered by a Good Samaritan and shall not impose any obligation or responsibility.
- D. Engineer will not be responsible for the acts or omissions of Owner, Contractor, any subcontractor, any supplier, or of any other person or organization performing or furnishing any of the portions of the work.
- E. Contractor understands and acknowledges that Engineer is not authorized to order extra work or issue Change Orders to the work, however in the event and to the degree that Engineer may offer advice, suggestions, and opinions Contractor shall not rely on such advice, suggestions, and opinions unless directed in writing by Owner or its designated representative, and shall, in no event, make any claim against the Engineer for any such advice, suggestions, and opinions.
- F. To the fullest extent permitted by law, Contractor shall indemnify and hold harmless Architect, Engineer, and their joint ventures, officers, directors, partners, employees and agents from and against any and all claims, costs, loses and damages (including but not limited to all fees and charge of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) caused in whole or in part by the negligent acts or omissions of Contractor, Contractor's officers, directors, partners, employees, agents; or Contractor's subcontractors or material men in the performance of Work. Contractor shall direct its insurer to list Architect, Engineer, and their joint ventures, as Additional Insureds on general liability insurance policies covering this project. Prior to commencing work, Contractor shall submit copies of its certificate of insurance to both Architect and Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
 - 2. Manufacturer: Unless otherwise specified, company specializing in manufacturing specified products for at least three years.

2.2 MATERIALS AND EQUIPMENT

- A. The device numbers noted in this specification are generally those of a specific manufacturer and represent the minimum quality required as the basis of design for this project. Subject to the Substitutions and other provisions of the Contract Documents, Contractor may submit equivalent devices from the other manufacturers listed in the section.
- B. Materials and equipment used in carrying out these specifications shall be new and have UL listing, or listing by other recognized testing laboratory when such listings are available.

- C. All material shall bear manufacturer's name, model number, electrical characteristics and other identification and shall be the standard product of manufacturer regularly engaged in production of similar material.
- D. Construction of equipment shall be as follows:
 - 1. All prefabricated equipment shall be designed and constructed in such a manner that all parts of said equipment and the equipment as a whole, including attachments, will resist the forces (including seismic where applicable) to which they may be subjected.
 - 2. Unless otherwise specified or required, design criteria shall be no less than 1.5g for lateral forces and 0.6g for vertical forces.
 - 3. Provisions for support and anchorage of equipment shall be an integral part of each item and shall include the fastening means and all necessary internal and external bracing, brackets and connections.
- E. Specifications for many items are or may be described on the drawings, including but not limited to wiring devices, lighting fixtures, control devices, etc., are or may be described on the drawings. Contractor shall promptly advise Architect of any conflicts or discrepancies.
- F. Except for conduit, conduit fittings, outlet boxes, wire and cable (600V and below only), all items of equipment or material shall be the product of one manufacturer throughout.
- G. The documents contain specifications regarding equipment design, including BIL levels, AIC ratings, and series ratings. In all cases provide equipment sufficient for the use intended. Do not provide materials whose ratings fall below those included in the Documents.

PART 3 - EXECUTION

3.1 DEMOLITION

- A. Refer to Division 01 Sections for "Cutting and Patching" and "Selective Demolition" and "Minor Demolition" in this Section for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove systems, equipment, and components indicated to be removed.
 - 1. Raceways to Be Removed: Remove portion of raceways and wire indicated to be removed and cap or plug remaining piping with same or compatible material.
 - 2. Raceways to Be Abandoned in Place: Remove wire, cap or plug with same or compatible piping material.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

- a. If raceways, wire or other components or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 CONTINUITY OF SERVICES AND CONNECTION TO EXISTING WORK

- A. Contractor, in the performance of the Work shall plan for and incorporate into the work the continuity of services. Where the continuity of service(s) is required to be interrupted Contractor shall plan and schedule the work to minimize interruptions to the facility and its normal operations, prearrange and coordinate all outages/interruptions with Owner's representative, utilities and the work of others. Requests for system interruptions/outages must be submitted at least five days prior to intended shutdown time and then subject to Owner's adjustment and/or approval.
- B. For connections that require a significant down-time or interruption to facility operations (as determined by the Owner), Contractor shall provide for Owner's written approval a detailed plan, schedule and description of the work for each system interruption. The plan shall include a description and schedule of each work item to be completed, designation of site supervisor and contact information, designated work crew as well as facility access and egress points for materials, manpower and equipment, contingency plan for parts, materials and equipment as well as a program to restore systems in the event of unplanned disruption or inability to complete the work in the timeframe scheduled and approved by Owner. Contractor shall confirm scheduled dates with the Owner and provide a minimum of five days advance notice for each operation.
- C. Tap connections shall not be performed on "live," "wet" or "hot," systems.
- D. Contractor shall include all costs for overtime labor, expedited materials, equipment and contingency planning as necessary to maintain continuity of services, schedule and complete necessary connections. Contractor shall also include provisions for maintaining any and all supplemental systems that may be required to remain in service for the safety, protection and critical operations of the facility and its occupants including but not limited to; Fire Alarm, Security, Phone/Data, BAS, Emergency Power and similarly related critical or emergency systems. Such provisions shall include but not be limited to temporary power, lighting, materials, equipment and/or installations (including removal and cleanup thereof) required to maintain such systems and as required to safely and properly complete the work.
- E. Contractor shall be liable for any and all damages resulting from unscheduled outages/interruptions or for those not confined to the pre-approved timeframes to complete the work.

3.3 UTILITY SERVICE(S)

- A. Contractor shall be responsible for verifying and coordinating the work with local utility companies providing service to the facility and/or site and coordination with the work of others. This shall include, but not be limited to:

1. Confirmation of schedule and service routing and sequence of the work to be performed by each utility, Contractor, subcontractor or others to ensure that the work can be performed without impact to the project schedule and with minimum interruption to services.
2. Verification of utility services point of entry to the facility, including applicable invert elevations, proper placement of sleeves and/or penetrations and sealant thereof.
3. Establishing utility point of contact, documenting the local utility company representatives:
 - a. Company:
 - b. Contact Person:
 - c. Contact Telephone Number:
 - d. Provide required connections for each incoming utility service.

3.4 ELECTRICAL SYSTEMS

- A. Visit site and observe conditions under which work must be performed.
- B. Before starting work, carefully examine Architectural, Civil, Landscape, Structural, Plumbing, Heating, Ventilating and Air Conditioning drawings to become thoroughly familiar with conditions governing work on this project. Verify elevations, measurements, rough-in requirements of equipment and it installation location before proceeding with the work. Install equipment with access as required by the NEC.
- C. Circuit "tags" on the Electrical Drawings in the form of arrows are used to indicate home runs of raceways to electrical distribution points. These tags show the circuits in each home run and the panel designation. Do not combine circuits other than those shown or allowed on the Drawings. Show the actual circuit numbers on the finished record drawing, and on the panel directory card. Provide an insulated grounding conductor sized in accordance with NEC in every power circuit.
- D. The general directions and location of homeruns are indicated on Drawings and are to be extended to panels as though routes were completely shown. Items which are installed other than as shown on Drawings and without receiving prior written approval will be ordered removed and installed as shown without additional cost to Owner.
- E. The Drawings do not indicate the exact number of wires in each conduit for the branch circuit wiring. Provide the correct quantity of wires as indicated by: the circuit numbers indicated, wiring diagrams, and by applicable requirements of the NEC.
- F. Electrical Drawings are diagrammatic and shall not be scaled for exact sizes. Adjust location of conduits, panels, equipment, pull boxes and fixtures to accommodate the work and to prevent interferences.
 1. Lines which pitch have right-of-way over those that do not. Lines whose elevation cannot be changed have right-of-way over lines whose elevations can.
 2. Make offsets, transitions, and changes in direction in raceways as required to maintain proper headroom pitch of sloping lines.

- G. Wire and cable routing shown on the Drawings is approximate. Route wire and cable as required to meet Project Conditions.
- H. When wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.
- I. The Drawings are diagrammatic. They do not show every offset, bend, conduit body, elbow or junction box that may be required to install work in the space provided and avoid conflicts. Follow the Drawings as closely as is practical and install additional bends, offsets and elbows where needed by local job site conditions. Provide necessary junction boxes to meet code regulations for the allowed number of conduit bends.
- J. Establish sizes and locations of the various concrete bases required. Coordinate and provide all necessary anchor bolts together with templates for holding these bolts in position.
- K. Provide supports, blocking, hangers, and auxiliary structural members required for support of work.
- L. Furnish and set all sleeves for passage of raceways through structural, masonry, and concrete walls, floors, and elsewhere for proper protection of the raceways.
- M. Establish size, location, and count of cast-in conduits or conduits to be concealed underneath the foundations. Coordinate with steel reinforcing.
- N. The architectural drawings govern the locations and elevations of all electrical equipment, devices and fixtures. Resolve conflicts with the Architect prior to rough-in.
- O. Verify that the physical dimension of each item of electrical equipment will fit the available space. Coordinate electrical equipment space requirements with the allotted space provisions, and access routes through the construction area.
- P. Coordinate rough-in and wiring requirements for all mechanical, kitchen and other equipment with equipment supplier and installer. Make installation in accordance with rough-in and wiring diagrams provided by equipment supplier and installer.
- Q. Coordinate all aspects of the electrical, telephone and other utility services with the appropriate serving utility company.
- R. Coordinate underground work with other contractors working on the site. Common trenches may be used with other trades. In such areas, maintain clearances as required by codes and ordinances.
- S. Coordinate underground work with foundation plans and work.
- T. Existing wires, conduits, pipes, ducts or other service facilities are shown in a general way only. The Contractor shall visit the site and make exact determination of the existence of any such facilities prior to submission of his bid. It is understood that he will be responsible for making the exact determination of the location and condition of these facilities.

- U. The location of utilities indicated on the plans is taken from existing public records. The exact location and elevation of public utilities must be determined by the Contractor. The Contractor shall ascertain whether any additional facilities other than those shown on the Drawings may be present.
- V. Call to the attention of the Architect any error, conflict or discrepancy in Plans and/or Specifications. Do not proceed with any questionable items of work until clarification of same has been made. Supplementary Details and Plans may be supplied as required and they will become a part of the Contract Documents.
- W. Arrange work to reduce interruption of any existing service to minimum. When interruptions are unavoidable, consult Owner or Utility involved and agree in writing, with copy to the Architect, upon a mutually satisfactory time and duration.
- X. No circuits shall be turned off without prior approval from Owner. Coordinate with the operations, normal activities, building access, etc. Coordinate work with other crafts for proper scheduling.

3.5 EQUIPMENT INSTALLATION

- A. Follow manufacturer's instructions.
- B. Where the product has no manufacturer's instructions, follow these specifications. Where neither the manufacturer nor these specifications contain such instructions, install in accordance with the standards listed above. No allowance of any kind will be made for negligence on part of Contractor to foresee means of bringing in or installing equipment into position.
 - 1. Verify all dimensions by field measurements.
 - 2. Install systems, materials, and equipment to provide the maximum headroom possible.
 - 3. Install systems, materials, and equipment to comply with approved submittal data, including coordination drawings
 - 4. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 - 5. Fit surface panels, devices and outlets with neat, appropriate trims, plates or covers, without over-hanging edges, protruding corners or raw edges, to leave a finished appearance.
 - 6. Extend maintenance and access components (i.e., grease fittings, service panels, and similar items) to accessible locations.
 - 7. Install equipment to allow right of way for piping installed at required slope.
- C. Locations:
 - 1. Verify all locations with actual field conditions, architectural, structural, electrical, plumbing, heating and ventilating plans to avert possible installation conflicts.
 - 2. Architect reserves the right to make minor changes prior to installation without cost to Owner.
 - 3. Coordinate work with that of other trades to assure symmetrical placing of fixtures, sprinkler heads and other exposed components with respect to ceiling tile, grilles, etc. See Architectural reflected ceiling plan for exact location of light fixtures and other equipment.

4. Any work which is incorrectly installed without prior verification without required coordination will be ordered removed and relocated and any changes or damage resulting to other work shall be repaired and/or replaced at no cost to the Owner.
5. In general, locate all finished devices or other exposed finished devices as indicated on or by symbols on drawings. Where devices or other exposed finished components occur in face, decks or base millwork, walls, ceilings or other finished surfaces carefully coordinate with details and arrangements of same.
6. All mounting heights shown on drawings are from finish floor to centerline unless otherwise indicated or required by code. Mounting heights at non-typical locations shown with (+) sign and height required noted adjacent to such device. Devices located in concrete block, brick or tile walls are to be adjusted in height to coordinate with modular joints of the materials. Verify requirements with Architect prior to installation.
7. Wiring Requirements: Install wiring complete to every outlet with all devices shown and/or required. All wiring to be in raceways and concealed throughout finished areas unless specifically noted otherwise. For the purpose of electrical specifications, all areas, with the exception of boiler rooms, mechanical rooms and mechanical spaces, are to be considered as finished areas.

D. Equipment Connections:

1. Coordinate the work with that of other trades to ensure all required connections are provided to ensure proper installation and operation.
2. Provide complete electrical connections for all items of equipment requiring such connections, including incidental wiring, materials, devices and labor necessary for a finished working installation.
3. Verify the location and method for connecting to each item of equipment prior to roughing-in. Check voltage and phase of each item of equipment before connection.
4. Make motor connections for the proper direction of rotation.

3.6 NOISE CONTROL

- A. Provide insulation, isolators and other sound attenuation requirements as specified by Contract Documents.
- B. Back to back or straight through boxes are not permitted unless specifically noted on the drawings.
- C. Contactors, transformers, starters and similar noise producing devices shall not be placed on walls which are common to occupied spaces unless specifically called for on the drawings. Where equipment is mounted on wall common to occupied spaces, provide shock mounting or noise isolators to effectively prevent transmission to occupied spaces.
- D. Ballasts, contactors, starters transformers and like equipment found noticeably noisier than similar equipment of same type are to be removed and replaced as directed by Architect at no cost to Owner.
- E. Route raceways along corridors or other noncritical noise space to minimize penetrations through sound rated walls. Seal raceway penetrations through sound rated walls.

3.7 FIRE WALL PENETRATIONS

- A. Perform necessary fire rated wall sealing for the work in accordance with Division 07 - Thermal and Moisture Protection.
- B. Provide necessary wall material to maintain fire wall rating where flush mounted equipment or components installed.
- C. Where systems or components penetrate floors, ceilings, ducts, chases and fire walls, provide fire stopping to maintain integrity of the fire assembly. Fire stopping method shall be approved by the authority having jurisdiction.
- D. Where electrical boxes with total area exceeding **16 sq inches** are located in fire resistive walls, fire stopping shall be provided to maintain integrity of the fire assembly.
- E. Where electrical boxes are installed on opposite sides of a rated wall, horizontal separation between the boxes shall be a minimum of **24 inches**. Horizontal separation of these boxes may be less than **24 inches** if a UL approved protective material is utilized.
 - 1. Electrical boxes shall not be installed back to back in rated walls.
 - a. The aggregate surface area of the boxes shall not exceed **100 sq inches** per **100 sq ft.** of wall surface.

3.8 EQUIPMENT SUPPORT

- A. General:
 - 1. Provide a system of supporting devices and hangers for support and bracing of piping, conduit and equipment as required by code or as provided under this Division as indicated on plans and as described herein.
 - 2. Do not install supporting devices so as to obstruct access to equipment.
 - 3. Floor-mounted equipment shall not be held in place solely by its own dead weight. Include floor anchor fastening in all cases.
 - 4. Do not support ductwork, piping, conduits, conductors, or equipment from other piping, conduits, ceiling grids, equipment, ductwork, or ceiling supports. In all cases, provide independent supports for such components and equipment.
- B. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to code (including seismic codes where applicable).
 - 1. Construct concrete bases and form equipment anchorages as detailed in the structural drawings.
 - 2. Construct concrete bases of dimensions indicated, but not less than **4-inches** larger in both directions than supported unit.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use concrete and reinforcement as specified in Division 03 Sections and the Structural Drawings.

C. Metal Supports and Anchorages:

1. Refer to local codes, practices and standards for installation and material requirements and limitations relating to the use of metal supports and anchorages (including applicable seismic requirements).
2. Refer to Division 05 Section "Metal Fabrications" for structural steel.
3. Field Welding: Comply with AWS D1.1.

D. Wood Supports and Anchorages:

1. Refer to local codes, practices and standards for installation and material requirements and limitations relating to the use of wood supports and anchorages (i.e., fire retardant materials).
2. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor materials and equipment.
3. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
4. Attach to substrates as required to support applied loads.

E. Grouting:

1. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
2. Clean surfaces that will come into contact with grout.
3. Provide forms as required for placement of grout.
4. Avoid air entrapment during placement of grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases and provide smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout.

3.9 PAINTING

- A. Painting of systems, equipment, and components is specified in Division 09. Unless and to the extent that painting is not specified elsewhere in the Contract Documents, all exposed materials in finished areas and on exterior walls shall be painted to match surrounding surfaces.
- B. Contractor shall be responsible for and shall coordinate the timing of painting with the work of other trades and to minimize the requirements for damage and touchup to the work.

- C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.10 CUTTING, PATCHING AND CORE DRILLING

A. General:

1. Refer to Divisions 01, 03, and other related provision of the Contract Documents, including Structural Drawings and Specifications for requirements relating to cutting, patching and core drilling of walls, floors and other surfaces.
2. Do not cut or break any steel or wood framing, concrete, masonry, or partitions, etc., without permission from the Architect or as shown on the Drawings.
3. Subject to the provisions of this Section and other portions of the Contract Documents cut, channel, chase and drill floors, walls, partitions and ceilings as necessary for the proper installation, support and anchorage of piping, ductwork, raceway, boxes, and other equipment.
4. Repair any damage to the building, piping, equipment, or finish.
5. Perform repairs with materials matching the original and install in accordance with appropriate sections of the Contract Documents.
6. Where trenching is done through existing paving, walks, curbs, etc., Contractor is responsible for patching and repairs to original condition.
7. In new work, patch and refinish all finished surfaces damaged by this Contractor to match adjacent surface.
8. Where new work is installed in the existing building, patch and refinish surfaces damaged to match existing. Refinishing to be as directed by the Architect.
9. All related refinishing to be as directed by the Architect.

- B. All cutting, patching and/or core drilling of structural systems that are do not appear on or that deviate in any way from the Structural Drawings must be preapproved by the Structural Engineer and Contractor shall provide all data, calculations and/or other requirements as maybe required by the Structural Engineer, prior to commencement of the work, including but not limited to:

1. X-Ray of structural systems to show the actual location of reinforcement.
2. Size and dimensions of penetrating ductwork, piping or conduit including placement within desired opening and required clearances, means of fastening and/or support including all anchoring systems and fasteners.
3. As a general rule, subject to adjustment by Structural Engineer, penetrating ductwork, piping or conduit shall pass through the center of all structural openings, avoiding structural members by minimums specified on the Structural Drawings.

- C. Core Drilling Layouts: Unless otherwise specified in the Contract Documents Contractor shall provide to the Structural Engineer a complete floor by floor core drilling layout for all required floor core penetrations in advance of the work for Structural Engineer's review and approval. Core drilling layouts shall include size, dimension and specific locations of core drilling for all trades. Contractor shall not be permitted to conduct independent coring without providing such layout to Structural Engineer.

3.11 EXCAVATION, BACKFILL AND WATERPROOFING

- A. Refer to Divisions 01, 02, and other related provisions of the Contract Documents, including but not limited to Sitework and Structural Drawings and related specifications for requirements relating to excavation, backfill and waterproofing for each trade.
- B. Do necessary trenching and excavating for installation of underground piping, raceways and equipment. Use necessary precautions not to affect the bearing value of soil under and near footings. Excavate trenches with proper pitch **6-inches** deeper than required by line grade and prefill to line grade with pea gravel. Where trenching occurs through existing paving, walks, curbs, etc., patch and repair to original conditions. Compact backfill with vibratory or roller compaction equipment in **9-inch** layers to 90 percent density. Dispose of excess excavated material as directed. Backfill under floor slabs and under hard surfaced yard areas (i.e., walks, drives, parking areas) to be crushed rock unless otherwise indicated, compacted in **9-inch** layers. Backfill material and compaction to comply with Site Work Section of these Specifications.
- C. Provide and maintain ample means and devices with which to promptly remove and dispose of water entering the excavation during the time it is being prepared for the piping, raceways or equipment laying, during the laying of materials or equipment and until the backfill has been completed.
- D. Avoid, if possible, penetrations of waterproof membranes. Where such penetration is required, perform it prior to waterproofing and in accordance with Architectural details. Where penetrations are not detailed or must be conducted through waterproof membranes, provide a detail of the penetrations for approval of the Architect.

3.12 SAFETY AND PROTECTION

- A. The Contract Documents do not include nor is Architect/Engineer responsible for the design of construction details or instructions relating to Contractor' safety or protective measures or precautions or as it pertains to its means, methods, techniques, sequences or procedures required for to perform the work.
- B. Provide necessary shoring, railing, barricades, protective devices, temporary systems/supports, safety instructions and procedures to perform the work safely and to comply with the Safety Requirements of the governing authorities.
- C. Unless otherwise specifically detailed and included, the Contract Documents represent the finished state of all systems and components related to the work and it is Contractor's sole responsibility to provide the necessary means, methods, equipment and protection of the work and those performing the work during construction. Neither Architect/Engineer nor any of their respective subconsultants shall be responsible or liable for Contractors failure to adequately protect the work or those performing the work during construction.

3.13 FUTURE PROVISIONS TO BE INCLUDED IN THE WORK

- A. The following provisions shall be provided for and included in the work:

1. Provide pull line in each empty conduit provided for future installation of wiring.
2. At all systems such as fire alarm, clock and program, intercom, etc., where future stations are to be fed from adjacent outlets or terminal cabinets, all conductors required for complete installation of additional units are to be provided to nearest outlet or terminal cabinet as required. In general, all wiring installed so it will not be necessary to remove existing conductors and re-pull additional wiring to install additional units. All spare conductors properly labeled and terminated in outlet boxes or at terminals in terminal cabinets.

3.14 CLEANING

A. General:

1. At all times keep the premises free from accumulation of waste materials or rubbish caused by the employees or the work. At the completion of the work, remove all superfluous materials, equipment and debris related to or resulting from the work.
2. All systems, equipment and component including but not limited to all panels, compartments, points of access, surface areas, panels, whether concealed or not shall be free from debris, filings, clippings, dirt, dust and debris and in a new condition. Touch up paint where necessary.
3. Where existing systems are expanded and/or remodeled, clean the new installation prior to making final connection to the existing systems.

3.15 ASBESTOS OR OTHER HAZARDOUS BEARING MATERIAL

- #### A.
- If during the course of work, the Contractor observes the existence of asbestos, asbestos bearing material or other hazardous material, the Contractor shall immediately terminate further work and notify the Owner of the condition. The Owner will, after consultation with the Architect, determine a further course of action.

3.16 COOPERATION WITH OTHER TRADES

- #### A.
- Contractor shall cooperate with and coordinate the work with that of all other trades in the performance of the work, including but not limited to; delivery of equipment and materials, furnishing material and location requirements of sleeves, bucks, chases, supports, mountings, backings, inserts, anchor bolts, cast-in-place box-out or steel embeds, routings, sequencing, locations, finished devices, etc., for proper installation of its work. Contractor shall be responsible for any and all removal, replacement or repairs to its work or the work of others for its failure to fully comply with this provision.

3.17 OPERATION AND INSTRUCTION

- #### A.
- Upon completion of the work and prior to final acceptance, Contractor shall operate the equipment for a period as required to fully instruct the Owner and its authorized representatives

in all details of operation, adjustment and maintenance. Absent more stringent requirements found elsewhere in the Contract Documents, Contractor shall, at a minimum:

1. Schedule with Owner and its designated representatives a single time and location for a one-day instruction class and submit three copies of certificate, signed by Owner's representatives, attesting to the Owner's authorized representatives having been so instructed. All arrangements shall be made through Architect and Owner's Representative.
2. Thoroughly review and instruct Owner and its designated representatives on all aspects of systems and facilities operations and maintenance utilizing the Instructions and Manuals submitted under the provisions of this Section. Any required instructions from manufacturer's representatives shall be given during this period.
3. This requirement is in addition to any "Operation Test" specified in the Contract Documents.

END OF SECTION 260100

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 building wire.
 - 2. Aluminum building wire.
 - 3. Metal-clad cable, Type MC.
 - 4. Armored cable, Type AC.
 - 5. Connectors and splices.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600-V or less.
- B. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- D. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

2.2 ALUMINUM BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600-V or less.
- B. Standards:
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Aluminum, complying with ASTM B800 and ASTM B801.
- D. Conductor Insulation:
 1. Type THHN and Type THWN-2: Comply with UL 83.

2.3 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Standards:
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. Comply with UL 1569.
 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Circuits: Single circuit and multi-circuit with color-coded conductors.
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Ground Conductor: None.
- F. Conductor Insulation:
 1. Type TFN/THHN/THWN-2: Comply with UL 83.
- G. Armor: **Steel, Aluminum**, interlocked.

2.4 ARMORED CABLE, TYPE AC

- A. Description: A factory assembly of insulated current-carrying conductors without an equipment grounding conductor in an overall metallic sheath. Type AC Cable is constructed with soft-drawn copper insulated conductors which are individually wrapped with a moisture-resistant, flame-retardant paper covering. Interlocking armor is applied over the assembly. An aluminum bond wire is placed inside the armor, runs longitudinally and is in intimate contact with the armor for its entire length.
- B. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. Comply with UL 4.
 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Circuits: Single circuit and multi-circuit with color-coded conductors.
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Ground Conductor: None.
- F. Conductor Insulation: Type THHN/THWN-2. Comply with UL 83.
- G. Bonding Conductor: Bare solid aluminum.
- H. Armor: **Steel, Aluminum**, interlocked.

2.5 COLOR CODING

- A. All power conductors identified as to phase and voltage by means of color impregnated insulation, as follows:
- | 1. | Voltage | ØA | ØB | ØC | Neutral | Ground | Travelers |
|----|-----------|-------|--------|--------|---------|--------|-----------|
| | 208Y/120V | Black | Red | Blue | White | Green | Yellow |
| | 480Y/277V | Brown | Orange | Yellow | Gray | Green | Lavender |
- Note: Travelers are for 3 and 4-way switching.
2. Class 1 and 2 Control Cables: Black.
 3. For wire sizes No. 8 AWG and larger, color banding tape, minimum **2-inches** wide, may be used at all accessible locations in lieu of colored insulation.

2.6 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Feeders: Copper for feeders smaller than No. 2 AWG; copper or aluminum for feeders No. 2 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Feeders: **Type THHN/THWN-2 or XHHW-2, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC**
- B. Branch Circuits: **Type THHN/THWN-2, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC.**
- C. Homerun Circuits: Type THHN-THWN, single conductors in raceway.
- D. Branch Circuits (from wiring device to homerun junction box): **Armored cable, Type AC Metal-clad cable, Type MC. Metal-clad cable, Type MC, HCF rated.**
- E. Class 1 Control Circuits: Type THHN/THWN-2, in raceway.
- F. Class 2 Control Circuits: Type THHN/THWN-2, in raceway.

3.3 INSTALLATION, GENERAL

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least **6-inches** of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to this specification and Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. Perform each of the following visual and electrical tests:
 - a. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - b. Inspect compression-applied connectors for correct cable match and indentation.
 - c. Inspect for correct identification.
 - d. Inspect cable jacket and condition.
 - e. Insulation-resistance (Megger) test on each conductor for ground and adjacent conductors. Apply a potential of 1000-V dc for 600-V rated cable for a one-minute duration.
 - f. Continuity test on each conductor and cable.
 - g. Uniform resistance of parallel conductors.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

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. Steel slotted support systems.
2. Aluminum slotted support systems.
3. Nonmetallic slotted support systems.
4. Conduit and cable support devices.
5. Support for conductors in vertical conduit.
6. Structural steel for fabricated supports and restraints.
7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
8. Fabricated metal equipment support assemblies.

B. Related Requirements:

1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Saddles.
 - i. Brackets.

2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.
1. Hangers: Include product data for components.
 2. Slotted support systems.
 3. Equipment supports.
 4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For hangers and supports for electrical systems.
1. Include design calculations and details of hangers.
 2. Include design calculations for seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Suspended ceiling components.
 2. Ductwork, piping, fittings, and supports.
 3. Structural members to which hangers and supports will be attached.
 4. Size and location of initial access modules for acoustical tile.
 5. Items penetrating finished ceiling, including the following:
 - a. Luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Projectors.
- B. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.
- B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**
 - 1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified
 - 2. Component Importance Factor: **1.5**.
- C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame Rating: Class 1.
 - 2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum **13/32-inch (10-mm)** diameter holes at a maximum of **8-inches (200-mm)** o.c. in at least one surface.
 - 1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Material for Channel, Fittings, and Accessories: **Galvanized steel**
 - 4. Channel Width: Selected for applicable load criteria.
 - 5. Retain one or more of "Metallic Coatings," "Nonmetallic Coatings," and "Painted Coatings" subparagraphs below. Coordinate with appropriate coating or painting Section.
 - 6. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 7. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 8. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 9. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Aluminum Slotted Support Systems: Extruded-aluminum channels and angles with minimum **13/32-inch (10-mm)** diameter holes at a maximum of **8-inches (200-mm)** o.c. in at least one surface.

1. **Manufacturers:** Subject to compliance with requirements, provide products by available manufacturers.
 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 3. Channel Material: 6063-T5 aluminum alloy.
 4. Fittings and Accessories Material: 5052-H32 aluminum alloy.
 5. Channel Width: Selected for applicable load criteria.
 6. Retain "Nonmetallic Coatings" or "Painted Coatings" Subparagraph below, or both. Coordinate with appropriate coating or painting Section.
 7. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 8. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 9. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with minimum **13/32-inch (10-mm)** diameter holes at a maximum of **8-inches (200-mm)** o.c., in at least one surface.
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 2. Channel Width: Selected for applicable load criteria.
 3. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
 4. Fitting and Accessory Materials: Same as those for channels and angles, **except metal items may be stainless steel.**
 5. Rated Strength: Selected to suit applicable load criteria.
 6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- D. Conduit and Cable Support Devices: **Steel Steel and malleable-iron** hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for 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.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Approved for the application.
2. Mechanical-Expansion Anchors: Insert-wedge-type, [**zinc-coated**] [**stainless**] steel, for use in hardened Portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Approved for the application.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: [**All**] [**Stainless**]-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 1. NECA 1.
 2. NECA 101
 3. NECA 102.
 4. NECA 105.
 5. NECA 111.

- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as **required by NFPA 70**. Minimum rod size shall be **1/4-inch (6-mm)** in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted [**or other**] 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**
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for **1-1/2-inch (38-mm)** and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, **EMT** may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus **200 lb (90 kg)**.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete **4-inches (100-mm)** thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than **4-inches (100-mm)** thick.

6. To Light Steel: Sheet metal screws.
 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid 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. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05-mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, manholes, and underground utility construction.
2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.
3. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

- B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

- C. Source quality-control reports.

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. ARC: Comply with ANSI C80.5 and UL 6A.

- D. IMC: Comply with ANSI C80.6 and UL 1242.

- E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit and IMC.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: **0.040-inch (1-mm)**, minimum.

- F. EMT: Comply with ANSI C80.3 and UL 797.

- G. FMC: Comply with UL 1; [**zinc-coated steel** [or [**aluminum**.

- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

- I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

CEB ARCHITECTS PLUS

Section 260533

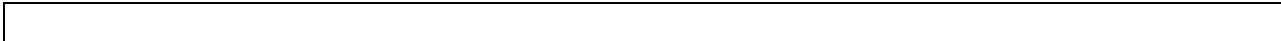
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Compression.
3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040-inch (1-mm), with overlapping sleeves protecting threaded joints.

2.2 NONMETALLIC CONDUITS 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. Fiberglass:
 1. Comply with NEMA TC 14.
 2. Comply with UL 2515 for aboveground raceways.
 3. Comply with UL 2420 for belowground raceways.
- C. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: Type EPC-40-PVC complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. LFNC: Comply with UL 1660.
- F. Rigid HDPE: Comply with UL 651A.
- G. Continuous HDPE: Comply with UL 651A.
- H. Coilable HDPE: Preassembled with conductors or cables and complying with ASTM D 3485.
- I. RTRC: Comply with UL 2515A and NEMA TC 14.
- J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- K. Fittings for LFNC: Comply with UL 514B.
- L. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type as required by the installation 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.



- C. Wireway Covers: **[Hinged type [Screw-cover type [Flanged-and-gasketed type** unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets or PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

2.5 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. Manufacturer's standard enamel finish or as otherwise specified.

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

CEB ARCHITECTS PLUS

Section 260533

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.

- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.

- D. Tele-Power Poles:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.

 2. Material: Galvanized steel with ivory baked-enamel finish or Aluminum with clear anodized finish.
 3. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

- 2.6 BOXES, ENCLOSURES, AND CABINETS
 - A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work.

 - B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

 - C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

 - D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, Type FD, with gasketed cover.

 - E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

 - F. Metal Floor Boxes:
 1. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Nonmetallic Floor Boxes: Nonadjustable

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing **50-lb (23-kg)**. Outlet boxes designed for attachment of luminaires weighing more than **50-lb (23-kg)** shall be listed and marked for the maximum allowable weight.

I. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing **70-lb (32-kg)**.

- 1.
- 2.

3. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

J. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

K. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773.

L. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250 and environment installed.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic or Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:

1. NEMA 250, NEMA type for environment installed galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
2. Standard: Comply with SCTE 77.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin.

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
2. Standard: Comply with SCTE 77.

2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: [GRC [IMC [RNC, Type EPC-40-PVC [RNC, Type EPC-80-PVC.

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2. Concealed Conduit, Aboveground: **[GRC [IMC [EMT [RNC, Type EPC-40-PVC.**
 3. Underground Conduit: **RNC, [Type EPC-40-PVC [Type EPC-80-PVC, [direct buried [concrete encased.**
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): **[LFMC [LFNC.**
 5. Boxes and Enclosures, Aboveground: NEMA 250, **[Type 3R [Type 4.**
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: **EMT ENT or RNC.**
 2. Exposed, Not Subject to Severe Physical Damage: **EMT RNC identified for such use.**
 3. Exposed and Subject to Severe Physical Damage: **GRC IMC.** Raceway locations include 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 ENT or RNC, Type EPC-40-PVC.**
 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 MC.**
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 **stainless steel nonmetallic** in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: **3/4-inch** trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. 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 **setscrew or compression, steel cast-metal** 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 (49 deg C)**.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least **6-inches (150-mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D.
- E. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- F. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within **12-inches (300-mm)** of enclosures to which attached.
- I. Raceways Embedded in Slabs:
 - 1. Run conduit larger than **1-inch (27-mm)** trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum **10-ft. (3-m)** intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of **2-inches (50-mm)** of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from ENT to **RNC, Type EPC-40-PVC, GRC or IMC** before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- N. Cut conduit perpendicular to the length. For conduits **2-inch (53-mm)** trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- O. 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.

- P. 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.
- Q. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- R. 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.
- S. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

T. Expansion-Joint Fittings:

1. Install in each run of above ground RNC that is located where environmental temperature change may exceed **30 deg F (17 deg C)** and that has straight-run length that exceeds **25-ft. (7.6-m)**. Install in each run of aboveground conduit that is located where environmental temperature change may exceed **100 deg F (55 deg C)** and that has straight-run length that exceeds **100-ft. (30-m)**.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: **125 deg F (70 deg C)** temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: **155 deg F (86 deg C)** temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: **125 deg F (70 deg C)** temperature change.
 - d. Attics: **135 deg F (75 deg C)** temperature change.

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3. Install fitting(s) that provide expansion and contraction for at least **0.00041-inch per foot of length of straight run per deg F (0.06-mm per meter of length of straight run per deg C)** of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least **0.000078-inch per foot of length of straight run per deg F (0.0115-mm per meter of length of straight run per deg C)** of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

U. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of **72-inches (1830-mm)** of flexible conduit for recessed and semi-recessed luminaires, 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.

V. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

W. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- Y. Locate boxes so that cover or plate will not span different building finishes.
- Z. 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.
- AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- BB. Set metal floor boxes level and flush with finished floor surface.
- CC. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than **6-inches (150-mm)** in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within **12-inches (300-mm)** of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with **3-inches (75-mm)** of concrete for a minimum of **12-inches (300-mm)** on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of **60-inches (1500-mm)** from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

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- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from **1/2-inch (12.5-mm)** sieve to No. 4 (**4.75-mm**) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures **1-inch (25-mm)** above finished grade.
- D. Install handholes with bottom below frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 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."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

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. Sleeve-seal fittings.
4. Grout.
5. 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.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast in place floor or wall sleeves: plastic pipe sleeve.

- B. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50-inches (1270-mm) and with no side larger than 16-inches (400-mm), thickness shall be 0.052-inch (1.3-mm).
 - b. For sleeve cross-section rectangle perimeter 50-inches (1270-mm) or more and one or more sides larger than 16-inches (400-mm), thickness shall be 0.138-inch (3.5-mm).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
- 1.
 2. Link-Seal or equal
 3. Sealing Elements: [EPDM] [Nitrile (Buna N)] rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 4. Pressure Plates: [Carbon steel] [Plastic] [Stainless steel].
 5. Connecting Bolts and Nuts: [Carbon steel, with corrosion-resistant coating,] [Stainless steel] of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

- A. Description: Nonshrink; 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 (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: 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 FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall, so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide [**1/4-inch (6.4-mm)**] annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed[**or unless seismic criteria require different clearance**].
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors [**2-inches (50-mm)**] above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables and refer to architectural documents for waterproofing.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using mechanical sleeve seals. Allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Allow for **1-inch (25-mm)** annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 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. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

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. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.

- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E and Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600-V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase-and Voltage-Level Identification, 600-V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
 - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Color for Neutral: White
 - e. Color for Equipment Grounds: Green.
 - 3. Colors for 240-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Color for Neutral: White.
 - d. Color for Equipment Grounds: Green.
 - 4. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.

- b. Phase B: Orange.
 - c. Phase C: Yellow.
 - d. Color for Neutral: Gray.
 - e. Color for Equipment Grounds: Green with a yellow stripe.
 5. Colors for Isolated Grounds: Green with white stripe.
- C. Raceways and Cables Carrying Circuits at More Than 600-V:
 1. Black letters on an orange field.
 2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."
- D. Warning Label Colors:
 1. Identify system voltage with black letters on an orange background.
- E. Warning labels and signs shall include, but are not limited to, the following legends:
 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
 1. Manufacturers: Provide products designated for the application.
- B. Snap-around Labels: Slit, pretension, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
 1. Manufacturers: Provide products designated for the application.
- C. Self-Adhesive Wraparound Labels: Preprinted 3-mil thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.
 1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 2. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Polyester or Vinyl, thermal, transfer-printed, 3-mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:
 - a. 1-1/2- by 6-inches for raceway and conductors.
 - b. 3-1/2- by 5-inches for equipment.
 - c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretension, flexible, solid-colored acrylic sleeves, 2-inches long, with diameters sized to suit diameters and that stay in place by gripping action
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F (93 deg C). Comply with UL 224.

2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3-mils thick by 1- to 2-inches wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch wide black stripes on 10-inch centers placed diagonally over orange background and is 12-inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
- E. Underground-Line Warning Tape:

1. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
2. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE"
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

3. Tag:
 - a. Pigmented polyolefin, bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: **3-inches (75-mm)**.
 - c. Thickness: **4-mils (0.1-mm)**.
 - d. Weight: **18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m)**.
 - e. Tensile according to ASTM D 882: **30-lbf (133.4-N)** and **2500-psi (17.2-MPa)**.

- F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be **1-inch**.

2.6 TAGS

- A. Metal Tags: Brass or aluminum, **2- by 2- by 0.05-inch** with stamped legend, punched for use with self-locking cable tie fastener.
 1. Manufacturers: Subject to compliance with requirements.
- B. Nonmetallic Preprinted Tags: Polyethylene tags, **0.015-inch** thick, color-coded for phase and voltage level, with factory screened or printed permanent designations; punched for use with self-locking cable tie fastener.
- C. Write-on tags not permitted.

2.7 SIGNS

- A. Baked-Enamel Signs:
 1. Manufacturers: Subject to compliance with requirements
 2. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
 3. **1/4-inch** grommets in corners for mounting.
 4. Nominal Size: **7- by 10-inches**.
- B. Metal-Backed Butyrate Signs:
 1. Manufacturers: Subject to compliance with requirements.
 2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with **0.0396-inch (1-mm)** galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
 3. **1/4-inch (6.4-mm)** grommets in corners for mounting.
 4. Nominal Size: **10- by 14-inches (250 by 360-mm)**.
- C. Laminated Acrylic or Melamine Plastic Signs:
 1. Manufacturers: Subject to compliance with requirements.

2. Engraved legend.
3. Thickness:
 - a. For signs up to **20-sq. inch (129-sq. cm)**, minimum **1/16-inch (1.6-mm)** thick.
 - b. For signs larger than **20-sq. inch (129-sq. cm)**, **1/8-inch (3.2-mm)** thick.
 - c. Engraved legend with **black letters on white face**
 - d. Drilled for mechanical fasteners with **1/4-inch (6.4-mm)** grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: **3/16-inch (5-mm)**.
 2. Tensile Strength at **73 deg F (23 deg C)** according to ASTM D 638: **12,000-psi (82.7-MPa)**.
 3. Temperature Range: **Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C)**.
 4. Color: Black, except where used for color-coding.
- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 1. Minimum Width: **3/16-inch (5-mm)**.
 2. Tensile Strength at **73 deg F (23 deg C)** according to ASTM D 638: **12,000-psi (82.7-MPa)**.
 3. Temperature Range: **Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C)**.
 4. Color: Black.
- D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
 1. Minimum Width: **3/16-inch (5-mm)**.
 2. Tensile Strength at **73 deg F (23 deg C)** according to ASTM D 638: **7000-psi (48.2-MPa)**.
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: **Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C)**.
 5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600-V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. System Identification for Raceways and Cables over 600-V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum **3/8-inch (10-mm)** high letters for emergency instructions at equipment used for power transfer and load shedding.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- M. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- P. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with **1/2-inch (13-mm)** high letters on **1-1/2-inch (38-mm)** high label; where two lines of text are required, use labels **2-inches (50-mm)** high.
- Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of **6-inches (150-mm)** where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

- U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- W. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at **6- to 8-inches (150- to 200-mm)** below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds **16-inches (400-mm)** overall.
 - 2. Limit use of underground-line warning tape to direct-buried cables.
 - 3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- X. Metal Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using cable ties.
- Y. Nonmetallic Preprinted Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using cable ties.
- Z. Baked-Enamel Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with **1/2-inch (13-mm)** high letters on minimum **1-1/2-inch (38-mm)** high sign; where two lines of text are required, use signs minimum **2-inches (50-mm)** high.
- AA. Metal-Backed Butyrate Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with **1/2-inch (13-mm)** high letters on **1-1/2-inch (38-mm)** high sign; where two lines of text are required, use labels **2-inches (50-mm)** high.
- BB. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with **1/2-inch (13-mm)** high letters on **1-1/2-inch (38-mm)** high sign; where two lines of text are required, use labels **2-inches (50-mm)** high.

CC. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Concealed Raceways, Duct Banks, more than 600-V, within buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3-inch (75-mm) high, black letters on 20-inch (500-mm) centers.
 1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10-ft. (3-m) maximum intervals.
- D. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600-V: Vinyl wraparound labels.
 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-ft. (15-m) maximum intervals in straight runs, and at 25-ft. (7.6-m) maximum intervals in congested areas.
- E. Accessible Raceways and Metal-Clad Cables, 600-V or Less, for Service, Feeder, and Branch Circuits, More Than 30-A and 120-V to Ground: Identify with self-adhesive raceway labels vinyl tape applied in bands.
 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-ft. (15-m) maximum intervals in straight runs, and at 25-ft. (7.6-m) maximum intervals in congested areas.
- F. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
 1. "EMERGENCY POWER."
 2. "POWER."
 3. "UPS."
- G. Power-Circuit Conductor Identification, 600-V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at **50-ft. (15-m)** maximum intervals in straight runs, and at **25-ft. (7.6-m)** maximum intervals in congested areas.
- H. Power-Circuit Conductor Identification, More Than 600-V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.
- I. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- J. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.
- K. Conductors to Be Extended in the Future: Attach marker tape to conductors.
- L. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- M. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- N. Concealed Raceways and Duct Banks, More Than 600-V, within Buildings: Apply floor marking tape to the following finished surfaces:
 1. Floor surface directly above conduits running beneath and within **12-inches (300-mm)** of a floor that is in contact with earth or is framed above unexcavated space.
 2. Wall surfaces directly external to raceways concealed within wall.
 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- O. Workspace Indication: Apply floor marking tape or tape and stencil to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- P. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- Q. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
 1. Apply to exterior of door, cover, or other access.

2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.

- R. Arc Flash Warning Labeling: Self-adhesive labels.

- S. Operating Instruction Signs: Baked-enamel warning signs or laminated acrylic or melamine plastic signs.

- T. Emergency Operating Instruction Signs: Baked-enamel warning signs or laminated acrylic or melamine plastic signs with white legend on a red background with minimum **3/8-inch (10-mm)** high letters for emergency instructions at equipment used for power transfer and load shedding.

- U. Equipment Identification Labels:
 1. Indoor Equipment: Baked-enamel signs or laminated acrylic or melamine plastic sign.
 2. Outdoor Equipment: Laminated acrylic or melamine sign.
 3. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of an engraved laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchgear.
 - e. Switchboards.
 - f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - g. Substations.
 - h. Emergency system boxes and enclosures.
 - i. Motor-control centers.
 - j. Enclosed switches.
 - k. Enclosed circuit breakers.
 - l. Enclosed controllers.
 - m. Variable-speed controllers.
 - n. Push-button stations.
 - o. Power-transfer equipment.
 - p. Contactors.
 - q. Remote-controlled switches, dimmer modules, and control devices.
 - r. Battery-inverter units.
 - s. Battery racks.
 - t. Power-generating units.
 - u. Monitoring and control equipment.
 - v. UPS equipment.

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

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END OF SECTION 260553

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. Description:

1. Furnish and install a complete system for the control of lighting and other equipment as indicated on the plans, and as further defined herein. This specification is based on the system referenced in the drawings. An AutoCAD drawing of the facility showing coverage patterns and technical data must be provided with substitution request. All substitutions must clearly identify any and all exceptions to the specifications, with a detailed explanation as to the exception. If substitution is approved, the contractor shall bear the responsibility of a fully functional system to the Owner's and an Architect's satisfaction.
2. The lighting control system specified in this section shall provide time-based, sensor-based (both vacancy/occupancy and daylight), and manual lighting control without the use of any centrally hardwired switching equipment (relay panels). The system's control shall be exerted by directly switching lighting loads on and off and/or dimming.
3. The system shall include but not be limited by the following list: digital switches, digital photocells, Digital Time Clock (DTC) and interface cards to dimming systems, building automation systems, and other devices. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways and electrical boxes and fittings required for installation of control equipment and wiring. They are not the work of this section.
4. The lighting control system shall include the ability to network lighting control devices and relays in multiple areas and or buildings. The system shall include the ability for remote access and control. Specific relays shall be able to be controlled remotely from multiple locations.

B. Section Includes:

1. Wall Switch Sensors
2. Ceiling and Corner Mount Sensors
3. Daylight (Photocell) Sensors
4. Power (Relay) Packs and Supplies
5. Scene Controllers
6. Communication Bridges
7. Sensors to perform vacancy and occupancy modes of control
8. Outdoor motion sensors
9. Emergency shunt relays

C. Related Requirements:

1. Section 265000 "General Lighting Provisions"
2. Section 265100 "Interior Lighting Systems"
3. Section 265600 "Exterior Lighting Systems"

4. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.3 SUBMITTALS

- A. Shop Drawings: Submit dimensioned drawings of lighting control system and accessories including, but not necessarily limited to, relay devices, switches, DTC, photocells, network interface devices, remote access, dimming modules and other interfaces. Shop drawings shall indicate exact location of each device or an RFI to confirm location. Plans are diagrammatical. EC to verify all lighting control material requirements from approved shop drawings. "Cut Sheet" submittal not acceptable.

- B. Product Data: Submit for approval manufacturer's data on the specific lighting control system and components. Submittal shall be electronic format with hard copy available. To prevent departures from approved system operation, electronic files submitted shall be able to be directly downloaded to the specified system at manufacturer facility. Submit a complete bill of materials with part numbers, description and voltage specifications.

- C. Manufacturer shall provide free software that can be used to specify the system, detail all programming and generate a single line in a format that can be dropped into industry standard CAD packages.

- D. One Line Diagram: Submit a one-line diagram of the system configuration indicating the type, size and number of conductors between each component if it differs from that illustrated in the riser diagram in these specifications. Submittals that show typical riser diagrams are not acceptable.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

- B. Software and Firmware Operational Documentation:
 1. Software operating and upgrade manuals.
 2. Program Software Backup: Provide names, versions, and website addresses for locations of installed software.
 3. Device address list.
 4. Printout of software application and graphic screens.
 5. Provide video of training session for Owner.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of lighting control software.
 - b. Faulty operation of lighting control devices.
 - 2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OCCUPANCY AND PHOTOCELLS

- A. Passive Infrared (PIR) or PIR/Ultrasonic Dual Technology and Microphonic detection technologies shall be acceptable.
- B. Sensors shall be available with zero, one, or two integrated Class 1 switching relays.
- C. Sensors shall be available with one or two occupancy "poles," each of which provides a programmable time delay.
- D. Sensors shall be available in multiple lens options which are customized for specific applications.
- E. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors, or similar low voltage connection.
- F. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
- G. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
- H. Sensors shall be equipped with an automatic override for 100-hour burn-in of lamps. This feature must be available at any time for lamp.

2.2 WALL SWITCH SENSORS

- A. Sensor shall recess into single-gang switch box and fit a standard GFI opening.
- B. Sensor must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.

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- C. Sensor shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.
- D. Sensors shall be available in four colors (Ivory, White, Almond, Gray).

2.3 CEILING AND CORNER MOUNT SENSORS

- A. Sensor shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
- B. Sensors with dimming control can control 0- to 10-V dc dimmable ballasts by sinking up to 20-mA of Class 2 current (typically forty or more ballasts).
- C. All sensors have at least one or two occupancy poles, each of which provides a programmable time delay.

2.4 DAYLIGHT (PHOTOCELL) SENSORS

- A. Sensor shall provide for an On/Off set-point, and a deadband to prevent the electric light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
- B. Sensors' set-point and deadband shall be automatically calibrated through the sensor's micro-controller by initiating the "Automatic Set-point Programming" subroutine. Further adjustment may be made manually if needed. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
- C. Sensors with dimming control can control 0- to 10-V dc dimmable ballasts by sinking up to 20 mA of Class 2 current (typically forty or more ballasts).
- D. Photocell sensor's set point shall be automatically calibrated through the sensor's micro-controller by initiating the "Automatic Set-point Programming" subroutine. Min and Max dim settings as well as set-point may be manually entered.
- E. Dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be controlled as an "offset" from the primary zone and shall be the zone farthest from the natural light source.

2.5 POWER (RELAY) PACKS AND SUPPLIES

- A. Power Packs shall accept 120- or 277-V ac (or optionally 347-V ac), be plenum rated, and provide Class 2 power to the system.
- B. All devices shall have two RJ-45 ports.
- C. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device pushbutton.

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- D. Power Pack shall securely mount to junction location through a threaded 1/2-inch chase nipple. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
- E. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
- F. Power Pack shall incorporate a Class 1 relay and contribute low voltage power to the rest of the system. Slave Packs shall incorporate the relay but shall not be required to contribute system power. Power Supplies shall provide system power only but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
- G. Class 1 Relays used in Power (Slave) Packs shall provide 16-Amp switching of all load types and be rated for 400,000 cycles.

2.6 SCENE CONTROLLERS

- A. Device shall recess into single-gang switch box and fit a standard GFI opening.
- B. Device shall provide user control via pushbuttons. Touch screens are also acceptable in larger formats.
- C. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- D. All sensors shall have two RJ-45 ports.
- E. Device shall have two or four buttons for selecting programmable lighting control profiles. Touch screens are also acceptable.
- F. Device shall have LEDs indicating current selection.

2.7 COMMUNICATION BRIDGES

- A. Device shall surface mount to a standard 4-inch x 4-inch square junction box.
- B. Device shall have 8 RJ-45 ports.
- C. Device shall be capable of aggregating communication with connected daisy-chains of system devices.
- D. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.

3.1 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 EQUIPMENT INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable.
- B. Install products in accordance with manufacturer's instructions.
- C. Define each dimmer/relay load type, assign each load to a zone, and set control functions.
- D. Sensor locations indicated are diagrammatic. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage, in accordance with manufacturer's recommendations.
- E. LED Light Engine/Array Lead Length: Do not exceed **100-ft. (31-m)**.
- F. Switches: Provide outlet boxes, single or multi-gang, as shown on the plans for the low voltage digital switches. Mount switches as per plans. Supply faceplates per plans and specifications. EC is specifically responsible to supply and install the required low voltage cable between all switches and panels. All low voltage wire to be run in conduit, per local codes.

3.3 WIRING

- A. Do not mix low voltage and high voltage conductors in the same conduit. No exceptions without written authorization from manufacturer.
- B. Ensure low voltage conduits or control wires do not run parallel to current carrying conduits.
- C. Follow manufacturer recommendations for all systems low voltage wiring. Contact manufacturer for maximum run lengths as needed.
- D. The specified lighting control system shall be installed by the electrical contractor who shall make all necessary wiring connections to external devices and equipment, to include photocell. EC to wire per manufacturer instructions.

3.4 INSTALLATION AND SET-UP

- A. Contractor to test all low voltage cable for integrity and proper operation prior to turn over. Verify with system manufacturer all wiring and testing requirements.
- B. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, commissioning of the lighting control system and Owner instruction includes:
 - 1. Confirmation of entire system operation and communication to each device.
 - 2. Confirmation of operation of individual relays, switches, occupancy sensors and daylight sensors.
 - 3. Confirmation of system Programming, photocell settings, override settings, etc.
 - 4. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.
 - 5. Controls manufacturer to provide advanced on-site commissioning services. Controls manufacturer to provide commissioning schedule to Lighting Designer (or Architect) three weeks ahead of visit. Lighting Designer (or architect) to be on-site to provide final approval of lighting scenes, dimming ranges and lighting control function. Contractor to coordinate services at appropriate stages of construction.
 - 6. Controls manufacturer to provide on-site training for facilities personnel and staff. Training to take place sixty to ninety days after system has been commissioned as stated in Section E. Contractor to coordinate services at appropriate stages of construction.
- C. All devices shall be located so that they are readily accessible and not exposed to physical damage.

3.5 SERVICE AND OPERATION MANUALS

- A. Submit operation and service manuals. Complete manuals shall be bound in flexible binders and data shall be typewritten or drafted. Electronic copies shall also be provided to the Owner.
- B. Manuals shall include instructions necessary for proper operation and servicing of system and shall include complete wiring circuit diagrams of system, wiring destination schedules for circuits and replacement part numbers. Manuals shall include as-built cable Project site plot plans and floor plans indicating cables, both underground and in each building with conduit, and as-built color coding used on cables. Programming forms of systems shall be submitted with complete information.
- C. Comply with energy code lighting control system "Acceptance Requirements." Acceptance tests are used to verify that lighting controls were installed and calibrated correctly. These tests may require that a responsible party certify that controls are installed and calibrated properly. This is the installing contractor's responsibility. Verify requirements with building authority.

3.6 DOCUMENTATION

- A. Each relay shall have an identification label indicating the originating branch circuit number and panelboard name as indicated on the drawings. Each line side branch circuit conductor shall have an identification tag indicating the branch circuit number.
- B. Provide a point-to-point wiring diagram for the entire lighting control system. Diagram must indicate exact mounting location of each system device. This accurate “as-built” shall indicate the loads controlled by each relay and the identification number for that relay, placement of switches and location of photocell. Original to be given to Owner, copies placed inside the door of each PLCP.

3.7 SERVICE AND SUPPORT

- A. Start Up: EC shall contact and schedule Start-up with manufacturer. EC is responsible for coordinating with GC and the Owner the installation any communication devices needed for startup.
- B. EC shall verify communication (telephone, internet, Ethernet, etc.) links and protocol needed for remote or on-site programming by manufacturer.
- C. Provide a factory technician for on-site training of the Owners’ representatives and maintenance personnel. Coordinate timing with General Contractor. Provide one to two days of factory on-site training. Video record training session and provide digital copy to Owner.

3.8 CLEANING

- A. Division 01 General Requirements: Section 017700, “Final Cleaning” article.
- B. Clean photocell lens as recommended by manufacturer.
- C. Clean all switch faceplates.

END OF SECTION 260923

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. Straight-blade convenience, hospital-grade, isolated-ground, and tamper-resistant receptacles.
2. USB charger devices.
3. GFCI receptacles.
4. SPD receptacles.
5. Hazardous (classified) location receptacles.
6. Twist-locking receptacles.
7. Pendant cord-connector devices.
8. Cord and plug sets.
9. Toggle switches.
10. Decorator-style convenience.
11. Wall switch sensor light switches with dual technology sensors.
12. Wall switch sensor light switches with passive infrared sensors.
13. Wall switch sensor light switches with ultrasonic sensors.
14. Digital timer light switches.
15. Residential devices.
16. Wall-box dimmers.
17. Wall plates.
18. Floor service outlets.
19. Poke-through assemblies.
20. Prefabricated multioutlet assemblies.
21. Service poles.

1.3 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated; Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. Pass & Seymour: Pass& Seymour/Legrand.

- B. BAS: Building automation system.

- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.
- H. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

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

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.6 MAINTENANCE MATERIAL SUBMITTALS

Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.
- D. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

- E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STRAIGHT-BLADE RECEPTACLES

- A. Duplex Convenience Receptacles: 125-V, 20-A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
- B. Hospital-Grade, Duplex Convenience Receptacles: 125-V, 20-A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Manufactures: Approved for the application.
 2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
- C. Isolated-Ground, Duplex Convenience Receptacles: 125-V, 20-A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
- D. Tamper-Resistant Convenience Receptacles: 125-V, 20-A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Description: Labeled and complying with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 USB CHARGER DEVICES

- A. Tamper-Resistant, USB Charger Receptacles: 12-V dc, 2.0-A, USB Type A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 1310, and FS W-C-596.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
 3. USB Receptacles: as identified on the drawings Type A.
 4. Line Voltage Receptacles: as identified on the drawings, two pole, three wire, and self-grounding.
- B. Hospital-Grade, USB Charger Receptacles: 12-V dc, 2.0-A, USB Type A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, UL 1310, and FS W-C-596.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 2. Description: Labeled and complying with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
 3. USB Receptacles: as identified on the drawings Type A.
 4. Line Voltage Receptacles: as identified on the drawings, two pole, three wire, and self-grounding.

2.4 GFCI RECEPTACLES

- A. General Description:
1. 125-V, 20-A, straight blade, feed and non-feed-through type as required by the application.
 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Tamper-Resistant, Duplex GFCI Convenience Receptacles:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.

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

- a. **Eaton (Arrow Hart).**
- b. **Hubbell Incorporated; Wiring Device-Kellems.**
- c. **Leviton Manufacturing Co., Inc.]**

2.5 [SPD RECEPTACLES]

A. General Description: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 1449, and FS W-C-596, with integral SPD in line to ground, line to neutral, and neutral to ground.

1. 125-V, 20-A, straight-blade type.
2. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400-V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
3. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex SPD Convenience Receptacles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

C. Isolated-Ground, Duplex SPD Convenience Receptacles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
2. Grounding: Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Hospital-Grade, Duplex SPD Convenience Receptacles: Comply with UL 498 Supplement sd.

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

- E. Isolated-Ground Hospital-Grade Duplex SPD Convenience Receptacles: Comply with UL 498 Supplement.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

 2. Grounding: Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.6 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

- A. Hazardous (Classified) Locations Receptacles: Comply with NEMA FB 11 and UL 1010.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. EGS/Appleton Electric.

2.7 [TWIST-LOCKING RECEPTACLES]

- A. Twist-Lock, Single Convenience Receptacles: 125-V, 20-A; comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

- B. Twist-Lock, Isolated-Ground, Single Convenience Receptacles: 125-V, 20-A; comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
2. Grounding: Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.8 [PENDANT CORD-CONNECTOR DEVICES]

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.9 [CORD AND PLUG SETS]

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.10 [TOGGLE SWITCHES]

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277-V, 20-A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.

- c. Leviton Manufacturing Co., Inc.

C. Pilot-Light Switches: 120/277-V, 20-A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
2. Description: Single pole, with LED-lighted handle, illuminated when switch is off.

D. Key-Operated Switches: 120/277-V, 20-A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277-V, 20-A; for use with mechanically held lighting contactors.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277-V, 20-A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

2.11 DECORA-STYLE DEVICES

- A. Convenience Receptacles: Square face (Decora style), 125-V, 15-A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

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1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

- B. Tamper-Resistant Convenience Receptacles: Square face, 125-V, 15-A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.**
 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

 2. **Description:** Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.

- C. Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125-V, 15-A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.**
 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

 2. **Description:** Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.]

- D. GFCI, Feed Through Type, Convenience Receptacles: Square face, 125-V, 15-A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.**
 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

- E. GFCI, Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125-V, 15-A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.**

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.
- F. Toggle Switches: Square Face, 120/277-V, 15-A; comply with NEMA WD 1, UL 20, and FS W-S-896.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
- G. Lighted Toggle Switches: Square Face, 120-V, 15-A; comply with NEMA WD 1 and UL 20.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

Description: With LED-lighted handle, illuminated when switch is off.

2.12 LIGHTING CONTROL DEVICES

- A. Reference lighting control device sections for the following lighting control devices:
1. Wall Switch Sensor Light Switch, Dual Technology.
 2. Wall Switch Sensor Light Switch, Passive Infrared.
 3. Wall Switch Sensor Light Switch, Ultrasonic.
 4. Digital Timer Light Switch.
 5. Wall box dimmers.

2.13 [RESIDENTIAL DEVICES]

- A. Residential-Grade, Tamper-Resistant Convenience Receptacles: 125-V, 15-A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.
- B. Weather-Resistant and Tamper-Resistant Convenience Receptacles: 125-V, 15-A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.

2.14 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: As required by Division 01 of this specification.
 3. Material for Unfinished Spaces: As required by Division 01 of this specification.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant **die-cast aluminum** with lockable cover.

2.15 FINISHES

- A. Device Color:
1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Emergency Power System: **[Red]** <Insert color>.
 3. SPD Devices: Blue.
 4. Isolated-Ground Receptacles: **[Orange]** [As specified above, with orange triangle on face].
- B. Wall Plate Color: For plastic covers, match device color.

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing 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**] [**down**], and on horizontally mounted receptacles to the [**right**] [**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 online and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 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**] [**white**] [**red**]-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Perform the following tests and inspections.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.

- C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Receptacle switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Molded-case switches.
 - 7. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than **minus 22 deg F** and not exceeding **104 deg F**.
 - 2. Altitude: Not exceeding **6600-ft**.

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.3 NONFUSIBLE SWITCHES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
 - 2. General Electric Company: www.geindustrial.com.
 - 3. Schneider Electric; Square D Products: www.schneider-electric.us.
- B. Type GD, General Duty, Three Pole, Single Throw, 240-V ac, 600-A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Three Pole, Single Throw, [240] [600]-V ac, 1200-A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Six Pole, Single Throw, [240] [600]-V ac, 200-A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
 - 4. Auxiliary Contact Kit: [One] [Two] NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac.
 - 5. Hookstick Handle: Allows use of a hookstick to operate the handle.

6. Lugs: [**Mechanical**] [**Compression**] type, suitable for number, size, and conductor material.
7. Service-Rated Switches: Labeled for use as service equipment.

2.4 MOLDED-CASE CIRCUIT BREAKERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 1. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
 2. General Electric Company: www.geindustrial.com.
 3. Schneider Electric; Square D Products: www.schneider-electric.us.
- B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be [**100 percent rated**][**series rated**][**100 percent rated or series rated as indicated on the Drawings**]. [**Circuit breaker/circuit breaker**] [**Fuse/circuit breaker**] combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations. Any series rated combination used shall be marked on the end-use equipment along with the statement "Caution - Series Rated System. _____-Amps Available. Identical Replacement Component Required."
- E. MCCBs shall be equipped with a device for locking in the isolated position.
- F. Lugs shall be suitable for **194 deg F** rated wire, sized according to the **167 deg F** temperature rating in NFPA 70.
- G. Standards: Comply with UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250-A and larger.

- I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 1. Instantaneous trip.
 2. Long- and short-time pickup levels.
 3. Long- and short-time time adjustments.
 4. Ground-fault pickup level, time delay, and I-squared t response.
- K. Current-Limiting Circuit Breakers: Frame sizes 400-A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- L. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- M. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- N. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- O. Features and Accessories:
 1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: [**Mechanical**] [**Compression**] type, suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 5. Communication Capability: [**Circuit-breaker-mounted**] [**Universal-mounted**] [**Integral**] [**Din-rail-mounted**] communication module with functions and features compatible with power monitoring and control system, specified in Section 260913 "Electrical Power Monitoring and Control."
 6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

8. Auxiliary Contacts: [**One SPDT switch**] [**Two SPDT switches**] with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
9. Alarm Switch: One [**NO**] [**NC**] contact that operates only when circuit breaker has tripped.
10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
11. Zone-Selective Interlocking: Integral with [**electronic**] [**ground-fault**] trip unit; for interlocking ground-fault protection function.
12. Electrical Operator: Provide remote control for on, off, and reset operations.
13. Accessory Control Power Voltage: Integrally mounted, self-powered; 120-V ac.

2.5 MOLDED-CASE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
 2. General Electric Company: www.geindustrial.com.
 3. Schneider Electric; Square D Products: www.schneider-electric.us.
- B. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- C. Features and Accessories:
 1. Standard frame sizes and number of poles.
 2. Lugs:
 - a. [**Mechanical**] [**Compression**] type, suitable for number, size, trip ratings, and conductor material.
 - b. Lugs shall be suitable for **194 deg F** rated wire, sized according to the **167 deg F** temperature rating in NFPA 70.
 3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

6. Auxiliary Contacts: [**One SPDT switch**] [**Two SPDT switches**] with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
7. Alarm Switch: One [**NO**] [**NC**] contact that operates only when switch has tripped.
8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
10. Electrical Operator: Provide remote control for on, off, and reset operations.
11. Accessory Control Power Voltage: [**Integrally mounted, self-powered**] [**Remote mounted and powered**]; 120-V ac.

2.6 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be [**finished with**] [**gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1)**] [**gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12)**] [**a brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel)**] [**copper-free cast aluminum alloy (NEMA 250 Types 7, 9)**].
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be [**externally operable with the operating mechanism being an integral part of the box, not the cover**] [**directly operable through the front cover of the enclosure (NEMA 250 Type 1)**] [**directly operable through the dead front trim of the enclosure (NEMA 250 Type 3R)**] [**externally operable with the operating mechanism being an integral part of the cover (NEMA 250 Types 7, 9)**]. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.
- F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify [Architect] [Construction Manager] [Owner] no fewer than seven days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without [Architect's] [Construction Manager's] [Owner's] written permission.
 - 4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, [Type 3R] [Type 4X].
 - 3. [Kitchen] [Wash-Down] Areas: NEMA 250, [Type 4X] <Insert type>, [stainless steel] <Insert material>.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 6. Hazardous Areas Indicated on Drawings: NEMA 250, [Type 7] [Type 9] <Insert type> [with cover attached by Type 316 stainless steel bolts].

3.4 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections[**with the assistance of a factory-authorized service representative**].
- E. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.

- d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
 - i. Verify correct phase barrier installation.
 - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
2. Electrical Tests:
- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
 - e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

F. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:
 - a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and clearances.
 - d. Verify that the unit is clean.
 - e. Operate the circuit breaker to ensure smooth operation.
 - f. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - g. Inspect operating mechanism, contacts, and chutes in unsealed units.
 - h. Perform adjustments for final protective device settings in accordance with the coordination study.
2. Electrical Tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-

- V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
- e. Determine the following by primary current injection:
 - 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
 - f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
 - g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
 - h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
 - i. Verify operation of charging mechanism. Investigate units that do not function as designed.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 4. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than sixty days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker eleven months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

- G. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- H. Prepare test and inspection reports.
 - 1. Test procedures used.
 - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges **to values indicated on the Drawings.**

END OF SECTION 262816