

manufacturer agrees to repair or replace pre-manufactured metal copings and related work that does not remain watertight within 20 years from date of Substantial Completion

1. Failures: Include, but are not limited to, following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
 1. Manufacturer: PAC-Clad - Petersen Aluminum Corp.
 2. Product: PAC-Continuous Cleat Coping.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 1. Architectural Products Co.
 2. Cheney Flashing Company.
 3. Hickman, W. P. Company.
 4. Johns Manville
 5. Metal-Era, Inc.
 6. MM Systems Corporation.
 7. PAC-Clad - Petersen Aluminum Corp.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Manufacture and install copings to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Wind Design Standard: Manufacture and install copings that have tested according to ANSI/SPRI/FM 4435/ES-1 and is capable of resisting design wind pressures as indicated on Drawings.
- C. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

2.3 METAL FLASHING MATERIALS

- A. Coil-Coated Metallic-Coated Steel Sheet:

1. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755.
 2. Galvanized Thickness: 0.034 inches nominal (22 gauge).
 3. Surface: Smooth, flat finish.
 4. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621, fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Color: As selected by Architect from manufacturer's full range.
 5. Concealed Color and Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
- B. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, G90 coating designation; structural quality, mill phosphatized for field painting, not less than 0.028 inches thick (24 gauge) nominal unless otherwise indicated.

2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.

2.5 PARAPET WALL COPINGS

- A. Copings: Sloping formed-metal coping cap in section lengths not exceeding 12 feet, with pre-fabricated, mitered corner units and end cap units, fabricated of coil-coated metallic-coated steel sheet.
- B. Concealed Continuous Anchorage: Two-piece hold down cleats fabricated of galvanized sheet steel, one for inside face and one for outside face.
- C. Joints: Splice plates of same shape, material and color as coping.
1. Concealed plate installed below copings.
 2. Exposed plate installed on top of coping.
 3. Pre-applied neoprene strips between plates.

2.6 RELATED MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads; of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

- C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing.

- 1. Provide permanently elastic, non-sag, nontoxic, non-staining tape.

- D. Elastomeric Sealant: Silicone sealant as specified in Division 07 Section "Joint Sealants."

2.7 FINISH

- A. Finish Quality Standards: In addition to standards specified elsewhere, perform work according to following, unless otherwise specified:

- 1. NAAMM's "Metal Finishes Manual for Architectural and Metal Products".
 - 2. AA's DAF-45 Designation Systems for Aluminum Finishes.

- B. Appearance of Finished Work:

- 1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one half of range of approved submittal samples.
 - 2. Noticeable variations in same piece are not acceptable.
 - 3. Variations in appearance of other components are acceptable if they are within range of approved submittal samples and they are assembled or installed to minimize contrast as determined by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:

- 1. Examine substrates, areas, and conditions to verify conditions affecting performance of the Work.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. General: Install copings according to manufacturer's written instructions. Anchor securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete parapet wall copings.

- 1. Install with provisions for thermal and structural movement.
 - 2. Torch cutting is not permitted.

- B. Install copings and accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks; and to result in watertight performance.

- C. Mechanically fasten concealed continuous anchorage cleats to wood blocking at top of parapet wall at manufacturer's recommended spacing.

- D. Provide for thermal expansion of copings. Space movement joints at a maximum of 12 feet with no unplanned joints within 18 inches of corners or intersections.

E. Anchor copings to resist uplift and outward forces according to performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's recommended spacing.

3.3 CLEANING

- A. Remove temporary protective coverings and strippable films as manufactured roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

3.4 ADJUSTING

- A. Replace copings that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 72 33
ROOF HATCH

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof hatch.
2. Ladder safety post.
3. Safety railing.
4. Related materials to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

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

B. Manufacturer's standard details for conditions to be encountered in the work.

1. Include dimensions, layout, joints, details, and interface with adjacent work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

1. Manufacturer: BabcockDavis.
2. Products:
 - a. Roof Hatch: BG3636.
 - b. Ladder Safety Post: BSP.
 - c. Safety Railing: BSRCA.

B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."

1. BabcockDavis.
2. The Bilco Company.
3. JL Industries, Inc.
4. Kingspan Light + Air, North America.
5. Milcor.
6. Nystrom, Inc.
7. Williams Bros. Corporation.

2.2 PRIMARY METALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, G90 coating designation; structural quality, mill phosphatized for field painting, not less than 0.028 inches thick (24 gauge) nominal unless otherwise indicated.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, AZ50 coated.

2.3 ROOF HATCH AND ACCESSORIES

- A. Roof Hatches: Metal roof-hatch units with single-leaf lid and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Loads: Minimum 40 foot pounds per square foot external live load and 20 foot pounds per square foot internal uplift load.
 - 2. Hatch Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.079 inch thick.
 - 3. Size: 48 inches square.
 - 4. Construction:
 - a. Insulation: Glass-fiber board.
 - b. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - c. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - d. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 - e. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
 - 5. Hardware: Galvanized-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
- B. Ladder Safety Post: Manufacturer's standard ladder safety post for attachment to roof access ladder.
 - 1. Operation: Post locks in place on full extension; release mechanism to return post to closed position.
 - 2. Height: 42 inches above finished roof deck.
 - 3. Material: Steel tube.
 - 4. Post: 1-5/8 inch diameter pipe.
 - 5. Finish: Manufacturer's standard baked enamel or powder coating; yellow.
- C. Safety Railing: Manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
 - 1. Height: 42 inches above finish roofing.
 - 2. Posts and Rails: Galvanized steel pipe, 1-1/4 inches in diameter or galvanized steel tube, 1-5/8 inches in diameter; include weep holes or other means to drain entrapped water in hollow sections of handrail and railing members.
 - 3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
 - 4. Maximum Opening Size: Constructed to prevent passage of a sphere 21 inches in diameter.
 - 5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing

- system; manufacturer's standard hinges and self-latching mechanism.
- 6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
- 7. Joints: Fabricated to be watertight.
- 8. Fasteners: Manufacturer's corrosion resistant, finished to match railing system.
- 9. Finish: Manufacturer's standard baked enamel or powder coating; yellow.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide non-removable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153 or ASTM F2329.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine substrates to receive roof hatch and associated work for compliance with requirements and other conditions affecting performance.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. General:
 - 1. Install roof hatch level, plumb, true to line and elevation.
 - 2. Anchor securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof hatch to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Roof Hatch:
 - 1. Install roof hatch so top surface of hatch curb is level.
 - 2. Attach safety railing to roof hatch curb.
 - 3. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.

END OF SECTION

SECTION 07 84 13
PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire resistive rated assemblies for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
2. Related materials necessary to complete installation.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each type of product indicated.
- B. Shop Drawings: Documentation for each firestop system, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.
- C. Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) from firestop manufacturer where no UL, FM Approvals, or other listed assembly is available for particular firestop configuration. Follow International Firestop Council (IFC) recommended guidelines for evaluating firestop systems in EJs.
- D. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an EJ or equivalent fire-resistance-rated assembly developed in accordance with current IFC guidelines.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Company with one of following independent qualification approvals:
 1. FM Global: Approved, certified, or licensed according to FM Global 4991.
 2. UL: Certified according to "Qualified Firestop Contractor Program Requirements."
 3. Manufacturer Qualification: Qualified by firestopping manufacturer as having been provided the necessary training to install firestopping products according to specified requirements. Manufacturer's willingness to sell firestopping products to installer does not in itself confer qualifications.
- B. Fire-Test-Response Characteristics: Provide firestop systems that comply with the following requirements and those specified in Part 2 "Performance Requirements" Article:
 1. Firestopping tests are performed by a 3rd party testing agency. A qualified testing and inspecting agency is UL, OPL, ITS, FM, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 2. Firestop systems are identical to those tested per testing standard referenced in Part 2 "Performance Requirements" Article. Provide rated systems bearing classification marking of qualified testing and inspecting agency.
- C. Coordinate construction of openings and penetrating items to ensure that firestop systems are installed according to specified requirements.

- D. Do not cover up firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 - 1. 3M Fire Protection Products.
 - 2. Hilti, Inc.
 - 3. NUCO Inc.
 - 4. RectorSeal Corporation.
 - 5. Specified Technologies Inc.
 - 6. Tremco Fire Protection Systems.

2.2 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Firestop systems with the following ratings determined per ASTM E814 or UL 1479:
 - 1. F-Rated Systems: Provide firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.
 - 3. L-Rated Systems: Where firestop systems are indicated in smoke barriers, provide firestop systems with L-ratings indicated at both ambient temperatures and 400 degrees F.
 - 4. W-Rated Systems: Provide products with a Class 1 W-rating according to UL 1479. W-ratings determine the capability of the firestop system to maintain watertightness of the penetration through a floor or wall assembly at ambient air conditions under 3 feet of water pressure head (1.3 psi) for a period of 72 hours. W-ratings may be applicable for building structures whose floors are subjected to incidental standing water.
- C. For firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to

- possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide firestop systems not requiring removal of insulation.
 4. Provide paintable firestop systems for areas exposed to view.
- D. For firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

2.3 MATERIALS, GENERAL

- A. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Sealants: 250 grams per liter.
 2. Sealant Primers for Nonporous Substrates: 250 grams per liter.
 3. Sealant Primers for Porous Substrates: 775 grams per liter.

2.4 FIRESTOPPING

- A. Compatibility: Firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating firestop systems, under conditions of service and application, as demonstrated by single firestop system manufacturer based on testing and field experience.
1. Firestopping installed by multiple sub-contractors must be of similar type and color to allow for consistent observation and verification.
- B. Accessories: Components for each firestop system that are needed to install fill materials and to comply with Part 2 "Performance Requirements" Article. Use only components specified by firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
1. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances, and other conditions affecting performance of the work.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.
 3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install firestop systems to comply with Part 2 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- D. Identification: Identify firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. Include the following information on labels:
1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Firestop system designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Firestop system manufacturer's name.
 6. Installer's name.

3.3 FIRESTOPPING MARKING AND IDENTIFICATION

- A. Labels: Identify fire-resistive joint systems with permanent preprinted metal or plastic labels according to FM 4991.
1. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system.
 2. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed.
 3. Locate in floor-ceiling or attic spaces at 15 feet from end of wall and at intervals not exceeding 30 feet.
 4. Label to include the words "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS" using lettering not less than 3 inches high with a minimum 0.373 inch strokes.

3.4 FIELD QUALITY CONTROL

- A. Where deficiencies are found, repair or replace firestop systems so they comply with requirements.
- B. Proceed with enclosing firestop systems with other construction only after inspection reports are issued and firestop installation comply with requirements.

3.5 CLEANING

- A. General: Remove excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved by fire resistive joint system manufacturers and that do not damage materials in which openings occur.

3.6 PROTECTION

- A. General: Maintain conditions during and after installation that ensure fire resistive joint systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated penetration firestopping and install new products to produce systems complying with specified requirements.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Joint sealants, backing materials, and accessories necessary to complete their installation, including but not limited to:

1. Exterior Silicone Sealant – Class 50.
2. Interior Silicone Sealant.
3. Interior Acrylic Latex Sealant.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each joint sealant product and accessory indicated, specified, or required.

1. Include data to indicate performance criteria, limitations, substrate preparation, installation requirements, and curing requirements.

- B. Shop Drawings: In schedule form including:

1. Joint location and designation.
2. Product manufacturer, name, formulation, and color.
3. Detailed drawings for each installation condition, including joint conditions, sealant profiles, backings, substrates, and other application related information; manufacturer's standard drawing details are acceptable if necessary information is conveyed.

- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing full range of colors available for each product exposed to view.

- D. Samples for Verification: Samples for each kind and color of joint sealants in 1/2 inch wide joints formed between two 6 inch long strips of material matching appearance of exposed surfaces adjacent to joint sealants.

- E. Pre-Construction Compatibility and Adhesion Test Reports: Written reports from sealant manufacturer of testing required by "Quality Assurance" Article below.

- F. Pre-Construction Staining Test Reports: Written reports from sealant manufacturer of testing required by "Quality Assurance" Article.

- G. Manufacturer's Field Service Reports: Written reports of inspections by manufacturer's technical representative required by "Field Quality Control" Article.

- H. Field Adhesion Test Reports: Written reports of testing required by "Field Quality Control" Article below.

- I. Manufacturer's Special Warranty: Sample of unexecuted warranty stating obligations, remedies, limitations, and exclusions.

1.3 QUALITY ASSURANCE

A. Installer Qualifications for Exterior Sealant Installations:

1. Experience: Installer with minimum of 5 years specialized experience in performing specified Work similar in design, material and extent to scope of Project, and with a record of successful in-service performance.
2. Supervision: Installer shall maintain a competent supervisor who is on job site during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required.
3. Manufacturer Acceptance: Installer shall be certified, approved or acceptable to manufacturer to install products.
4. Personnel Training: Installing personnel shall be trained by manufacturer to install products specified.

B. Mock-Up: Before work begins, install sealant in joints of constructed work to demonstrate product and material qualities, to demonstrate execution of work qualities, and to verify compliance with Contract Documents. Approval does not constitute approval of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.

1. Install products according to specified requirements.
2. Work shall be representative of those to be expected for work.
3. Obtain approval from Architect before starting work of this Section.
4. Approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

C. Pre-Installation Conference for Silicone Sealant Installations: Before beginning Work of this Section, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

- a. Owner.
- b. Architect.
- c. Contractor, including supervisor.
- d. Sealant installer, including supervisor.
- e. Installers of adjacent Work, including supervisor.
- f. Manufacturer's technical representative.

2. Minimum Agenda: Installer shall demonstrate understanding of Work required by describing detailed procedures for preparing, installing, and cleaning Work. Demonstration shall include, but not be limited to, following topics:

- a. Tour representative areas of required Work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of installation and other preparatory Work performed by other installers.
- b. Review Contract Document requirements.
- c. Review approved submittals.
- d. Review installation procedures.
- e. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.4 FIELD CONDITIONS

- A. Ambient Conditions: Do not proceed with installation of joint sealants under following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
- B. Weather Conditions Limitation: Proceed with Work only when existing and forecasted weather conditions will permit installation according to manufacturer's instructions and warranty requirements.

1.5 WARRANTY

- A. Manufacturers Special Warranty for Silicone Sealants: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within 20 years' from date of Substantial Completion.
- B. Installers Special Warranty: Installer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within 2 years' from date of substantial completion.
- C. Exclusions: Includes, but not limited to, deterioration or failure of joint sealants from following:
 - 1. Movement of structure caused by structural settlement or errors attributable to design or construction resulting in stresses on sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
- B. Single Source Responsibility: Furnish each product from single manufacturer.

2.2 MATERIALS, GENERAL

- A. Compatibility: Joint sealants, backings, and other related materials shall be compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.

- B. Volatile Organic Compounds (VOC) Content of Interior Sealants: Sealants and primers for use inside weatherproofing system shall comply with following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 - 1. Elastomeric Sealants: 250 grams per liter.
 - 2. Primers for Non-Porous Substrates: 250 grams per liter.
 - 3. Primers for Porous Substrates: 775 grams per liter.
- C. Suitability for Contact with Food: Comply with authorities having jurisdiction for joints in repeated contact with food.

2.3 EXTERIOR ELASTOMERIC SEALANTS

- A. Exterior Silicone Sealant – Class 50:
 - 1. Product Quality Standard: ASTM C920, Type S, Grade NS, Class 50.
 - 2. Description: Single component, non-sag, neutral cure, non-staining as determined by pre-construction stain testing, and non-bleeding, silicone sealant.
 - 3. Joint Movement Capability: Plus 50 percent, minus 50 percent.
 - 4. Primers: Product provided by sealant manufacturer if required by conditions.
 - 5. Acceptable Manufacturers and Products:
 - a. Dow Corning; 756 Silicone Building Sealant.
 - b. Momentive Performance Materials, GE Silicones; Silpruf SCS2000.
 - c. Pecora Corp.; 864NST.
 - d. Sika Corp., Construction Products Div.; SikaSil 295.
 - e. Tremco Commercial Sealants & Waterproofing; Spectrem 3.
 - 6. Color: As selected from manufacturer's standard colors.

2.4 INTERIOR ELASTOMERIC SEALANTS

- A. Acoustical Sealants: Specified in Division 09 Section "Gypsum Board."
- B. Fire Resistive Sealants: Specified in Division 07 Section "Fire Resistive Joint Sealants."
- C. Interior Silicone Sealant:
 - 1. Product Quality Standard: ASTM C920, Type S, Grade NS, Class 25.
 - 2. Description: Single component, non-sag, moisture curing, silicone sealant specially formulated with fungicide for use in sanitary non-porous applications.
 - 3. Acceptable Manufacturers and Products:
 - a. Dow Corning; 786 Silicone Sealant.
 - b. Momentive Performance Materials, GE Silicones; Sanitary SCS1700.
 - c. Pecora Corp.; 898.
 - d. Sika Corp., Construction Products Div.; Sikasil GP or GN Plus.
 - e. Tremco Commercial Sealants & Waterproofing; Tremsil 200.
 - 4. Color: As selected from manufacturer's standard colors.

D. Interior Acrylic Latex Sealant:

1. Product Quality Standard: ASTM C834, Type and Grade as required by conditions.
2. Description: Single component, non-sag, moisture curing, general purpose, paintable, siliconized acrylic latex sealant.
3. Joint Movement Capability: Plus 7.5 percent, minus 7.5 percent
4. Acceptable Manufacturers and Products:
 - a. Pecora Corp.; AC 20.
 - b. Tremco Commercial Sealants & Waterproofing; Tremflex 834.
5. Color: As selected from manufacturer's standard colors.

2.5 JOINT SEALANT BACKING

A. Foam Backer Rods:

1. Product Quality Standard: ASTM C1330, Type C, Type O, Type B.
2. Description: As defined by ASTM C717, extruded polyethylene, polyurethane, or polyolefin in one of the following forms:
 - a. Type C: Closed cell structure.
 - b. Type B: Bicellular structure with surface skin (only for exterior applications).
3. Size: Diameter approximately 25 percent larger than joint width, unless otherwise directed by manufacturer.
4. Acceptable Manufacturers:
 - a. Adfast.
 - b. Alcot Plastics Ltd.
 - c. BASF Corporation.
 - d. Construction Foam Products; a Division of Nomaco, Inc.

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

2.6 ACCESSORIES

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to receive joint sealants and associated Work to which joint sealants will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Cleaning of Joints: Clean out joints immediately before installing joint backings and sealants to comply with joint sealant manufacturer's written instructions and following requirements:

1. Remove foreign material that could interfere with adhesion of joint sealant, including, but not limited to, dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form-release agents from concrete.
4. Clean non-porous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer, or as indicated by prior experience, or as required by pre-construction compatibility and adhesion testing. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. ASTM C1193 for use of joint sealants as applicable to materials, applications, conditions indicated, and following profile configurations:
 - a. Fillet: Figure 5.
 - b. Bridge: Figure 6.
 - c. Butt: Figure 8A (concave tooling), generally hour-glass shape with 2:1 width-to-depth ratio.

2. Substrate material allowed by sealant's ASTM C920 Use Classification.
 3. Respective manufacturer's written installation instructions.
- B. Joint Sealant Backings: Install kind required to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear backings.
 3. Install bond-breaker tape behind sealants where backings are not used between sealants and backs of joints.
- C. Joint Sealants: Install at same time as backings using proven techniques that comply with following:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
 4. Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - a. Remove excess sealant from surfaces adjacent to joints.
 - b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - c. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

- A. In-Progress Cleaning: Remove excess sealant or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

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

3.6 JOINT SEALANT SCHEDULE

- A. Exterior Elastomeric Sealant Schedule:
1. Exterior Silicone Sealant – Class 50: Moving joints on exterior side of exterior walls.

B. Interior Elastomeric Sealant Schedule:

1. Interior Silicone Sealant:

- a. Non-moving joints in moist or damp areas which are susceptible to mildew.
- b. Non-moving joints in kitchens and toilet rooms.
- c. Non-moving joints in repeated contact with food.

2. Interior Acrylic Latex Sealant:

- a. Non-moving joints where another type of sealant is not otherwise specified or scheduled.
- b. Minimal moving joints due to temperature change.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.
3. Related materials necessary to complete installation.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each type of product indicated, specified, or required.

1. Include manufacturer's written installation instructions.
2. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

- B. Shop Drawings: Scaled and dimensioned drawings of products to be incorporated into Work:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

- C. Samples for Verification:

1. Fabrication: Prepare Samples approximately 8 by 10 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing glazing if applicable.

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

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver steel doors and frames 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.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store steel doors and frames 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

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
- B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

2.2 INTERIOR STEEL METAL DOORS AND FRAMES

- A. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.
 - 1. Doors:
 - a. Thickness: 1-3/4 inches.
 - b. Face:
 - 1) Metallic-coated steel sheet, minimum thickness of 0.053 inch.
 - 2) Smooth surfaces without visible joints or seams on exposed faces.
 - c. Edge Construction: Continuously welded with no visible seam.
 - d. Core: Vertical steel stiffened.
 - e. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.
 - 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, except 0.067 inch for openings exceeding 4 feet wide.
 - b. Sidelite and Transom Frames: Fabricated from same material as adjacent door frame.
 - c. Construction: Full profile welded.
 - 3. Exposed Finish: Prime.

2.3 EXTERIOR STEEL METAL DOORS AND FRAMES

A. Maximum-Duty Doors and Frames: ANSI/SDI A250.8, Level 4; ANSI/SDI A250.4, Level A.

1. Doors:

- a. Thickness: 1-3/4 inches.
- b. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum G60 or A60 coating.
- c. Edge Construction: Continuously welded with no visible seam.
- d. Edge Bevel: Manufacturer's standard beveled edges.
- e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
- f. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
- g. Core: Vertical steel stiffened with polyisocyanurate insulation.

2. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum G60 or A60 coating.
- b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.4 BORROWED LITES

A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch.

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.5 LOUVERS

A. Provide louvers for interior doors, where indicated with blades or baffles formed of 0.020 inch thick, cold-rolled steel sheet set into 0.032 inch thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.

B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
 3. Postinstalled Expansion Anchor: Minimum 3/8 inch diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A879, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A1008 or ASTM A1011; hot-dip galvanized in accordance with ASTM A153, Class B.

2.7 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153.
- E. 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 steel frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Division 08 Section "Glazing."
- H. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing minimum of 94 percent zinc dust by weight.

2.8 FABRICATION

- A. Steel Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
1. Sidelite Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

- b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- B. Hardware Preparation: Factory prepare steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing steel doors and frames for hardware.
- C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
 - 2. Provide fixed and removable stops and moldings for multiple glazed lites so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of steel doors and frames.
 - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.9 STEEL FINISHES

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine substrates to receive steel and associated Work for compliance with requirements and other conditions affecting performance.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. Install steel doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Steel Frames: Comply with NAAMM-HMMA 840.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 - 2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
 - 3. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 4. Solidly pack mineral-fiber insulation inside frames.
 - 5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
 - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Steel Doors: Fit and adjust steel doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Steel Doors: Comply with NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
 - 2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with manufacturer's written instructions.

3.4 INSTALLATION TOLERANCES

- A. Installation Tolerances: Adjust steel frames to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

3.5 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 in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 08 31 13
ACCESS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors for walls and ceilings.
2. Access doors whether indicated or not shown; coordinate location of access panels with Architect prior to installation.
3. Accessories indicated, specified, or required to complete installation

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each type of access door and frame indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

- A. Fire-Rated Access Doors: Units complying with NFPA 80 that are identical to assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. NFPA 252 or UL 10B for vertical access doors.
 2. ASTM E 119 or UL 263 for horizontal access doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products indicated below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and does not change concept expressed in Contract Documents as judged by Architect.
- B. Other Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Sections.
1. Acudor Products, Inc.
 2. Babcock-Davis; A Cierra Products Co.
 3. Bauco Access Panel Solutions, Inc.
 4. Elmdor Access Panels.
 5. J. L. Industries, Inc.
 6. Larsen's Manufacturing Company.
 7. Milcor Inc.
 8. Nystrom, Inc.
 9. Williams Brothers Corporation of America.

2.2 STEEL MATERIALS

- A. Steel Sheet: Uncoated cold-rolled steel sheet substrate complying with ASTM A 1008, Commercial Steel (CS), exposed.
- B. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- C. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304; remove tool and die marks and stretch lines, or blend into finish; No. 4 finish.

2.3 NON-FIRE-RATED ACCESS DOORS IN DRYWALL WALLS AND CEILINGS

A. Non-Fire-Rated Aluminum Access Doors with Concealed Doors and Frames:

- 1. Metal: Fabricated from aluminum extrusions according to schedule at end of PART 3.
- 2. Door: 2.8 mm thick extruded aluminum with recess for screwed-in gypsum board inlay.
- 3. Frame: 2.8 mm thick extruded aluminum with galvanized steel internal corner reinforcement.
- 4. Hinges: Galvanized steel pivot hinges.
- 5. Lock: Screwdriver cam lock.
- 6. Basis of Design:
 - a. Manufacturer: Bauco Access Panel Solutions, Inc.
 - b. Product: BaucoPlus II 58.
 - c. Size: As required by conditions.

B. Non-Fire-Rated Steel Access Doors with Exposed Doors and Frames:

- 1. Metal: Fabricated from steel or stainless steel sheet according to schedule at end of PART 3.
- 2. Door: Minimum 14 gage sheet metal, set flush with exposed face flange of frame.
- 3. Frame: Minimum 16 gage sheet metal with 1-1/4 in wide, surface-mounted trim.
- 4. Hinges: Continuous piano.
- 5. Lock: Screwdriver cam lock.
- 6. Option: Gasketing at exterior locations.
- 7. Basis of Design:
 - a. Manufacturer: Nystrom Building Products.
 - b. Product: Model NT.
 - c. Size: As required by conditions.

C. Non-Fire-Rated Steel Access Doors with Concealed Doors and Frames:

- 1. Metal: Fabricated from steel or stainless steel sheet according to schedule at end of PART 3.
- 2. Door: Minimum 14 gage sheet metal, set flush with surrounding finish surfaces.
- 3. Frame/Drywall Bead: Minimum 16 gage sheet metal with minimum 22 gage drywall bead flange.
- 4. Hinges: Continuous piano.
- 5. Lock: Screwdriver cam lock.
- 6. Basis of Design:
 - a. Manufacturer: Nystrom Building Products.
 - b. Product: Model NW.
 - c. Size: As required by conditions.

2.4 FIRE-RATED ACCESS DOORS IN DRYWALL WALLS AND CEILINGS

A. Fire-Rated Access Doors with Exposed Doors and Frames:

1. Metal: Fabricated from steel or stainless steel sheet according to schedule at end of PART 3.
2. Rating: 1-1/2 hours; B Label.
3. Door: Self-closing; minimum 20 gage sheet metal, set flush with exposed face flange of frame; 2 inches of fire rated insulation.
4. Frame: Minimum 16 gage sheet metal with 1-1/4 in wide, surface-mounted trim; fire-rated gasketing.
5. Hinges: Continuous piano.
6. Lock: Flush key operated lock.
7. Basis of Design:
 - a. Manufacturer: Nystrom Building Products.
 - b. Product: Model IT.
 - c. Size: As required by conditions.

B. Fire-Rated Access Doors with Concealed Doors and Frames:

1. Metal: Fabricated from steel or stainless steel sheet according to schedule at end of PART 3.
2. Rating: 1-1/2 hours; B Label.
3. Door: Self-closing; minimum 14 gage sheet metal, set flush with surrounding finish surfaces; 2 inches of fire rated insulation.
4. Frame/Drywall Bead: Minimum 16 gage sheet metal with minimum 22 gage drywall bead flange; fire-rated gasketing.
5. Hinges: Continuous piano.
6. Lock: Flush key operated lock.
7. Basis of Design:
 - a. Manufacturer: Nystrom Building Products.
 - b. Product: Model IW.
 - c. Size: As required by conditions.

2.5 FABRICATION

- A. General: Provide access doors manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view, provide materials with smooth, flat surfaces without blemishes.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:

1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors.
- B. Set access doors accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.
- D. Furnish access doors that are required to access above ceiling equipment whether indicated on drawings or not.

3.3 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors that are warped, bowed, or otherwise damaged.

3.4 SCHEDULE

- A. Provide access doors, where indicated on the drawings, and where scheduled below.
 1. Aluminum non-fire-rated at walls and ceilings not in damp locations.
 2. Steel non-fire-rated at walls and ceilings not in damp locations.
 3. Steel fire-rated at rated walls and ceilings not in damp locations.
 4. Stainless steel non-fire-rated at ceramic tile and other damp locations.
 5. Stainless steel non-fire-rated at exterior areas.

END OF SECTION

SECTION 08 33 13
OVERHEAD COILING COUNTER DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum slat coiling counter doors, push-up operated.
2. Related materials necessary to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturers technical literature for each type and size of coiling counter door and accessory indicated, specified, or required.

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

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

C. Samples for Verification: For each type of exposed finish on curtain slats, in manufacturer's standard sizes.

D. Maintenance Data: For inclusion in maintenance manual required by appropriate Division 01 Section.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

1. Manufacturer: Overhead Door Corporation
2. Product: 650, manual push up.

- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."

1. Clopay Building Products.
2. The Cookson Company.
3. Cornell Innovative Door Solutions.
4. McKeon Rolling Steel Door Co.
5. Overhead Door Corporation.
6. Raynor.
7. Wayne-Dalton Corp.

2.2 COUNTER DOOR ASSEMBLY

- A. Counter Door: Coiling counter door formed with curtain of interlocking aluminum slats for between jambs mounting.
- B. Operation Cycles: Door components and operators capable of operating for not less than 100,000 cycles. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Door Curtain Slats: Flat profile interlocking slats fabricated of aluminum; end locks attached to alternate slats to maintain curtain alignment and prevent lateral slat movement.
- D. Bottom Bar: Manufacturer's standard continuous aluminum angle shape; finished to match slats.
- E. Curtain Jamb Guides: Aluminum with continuous integral wear strips to prevent curtain-to-guide contact and to minimize operational noise.
- F. Hood: Aluminum; square.
- G. Sill Configuration: No sill.
- H. Locking: Slide bolt locks.

2.3 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate coiling counter-door curtain of interlocking aluminum slats in a continuous length for width of door without splices.
- B. Curtain Jamb Guides: Manufacturer's standard aluminum angles or channels, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.4 HOODS

- A. General: Form sheet aluminum hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

2.5 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.6 ALUMINUM FINISH

- A. Finish Quality Standards: In addition to standards specified elsewhere, perform work according to following, unless otherwise specified:
 - 1. NAAMM's "Metal Finishes Manual for Architectural and Metal Products".
 - 2. AA's DAF-45 Designation Systems for Aluminum Finishes.
- B. Appearance of Finished Work:
 - 1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one half of range of approved submittal samples.
 - 2. Noticeable variations in same piece are not acceptable.
 - 3. Variations in appearance of other components are acceptable if they are within range of approved submittal samples and they are assembled or installed to minimize contrast as determined by Architect.
- C. Interior Clear Anodized Aluminum Finish: AAMA 611, AA-M12C22A31, Class II, not less than 0.010 mm thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Install coiling counter doors complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

END OF SECTION

SECTION 08 33 23
OVERHEAD COILING DOOR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulated service doors.
2. Related materials necessary to complete installation.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.

1. Wind Loads: As indicated on Drawings.

1.3 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: For each exposed product and for each color and texture specified.

D. Maintenance Data: For inclusion in maintenance manual required by appropriate Division 01 Section.

1.4 QUALITY ASSURANCE

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

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
1. Manufacturer: Overhead Door Corporation
 2. Product: 625, Stormtite Insulated Heavy-Duty Rolling Doors.
 3. Finish: PowderGuard Premium.
 4. Color: As selected by the Architect from manufacturer's full range.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Sections.
1. Clopay Building Products.
 2. The Cookson Company.
 3. Cornell Innovative Door Solutions.
 4. McKeon Rolling Steel Door Co.
 5. Overhead Door Corporation.
 6. Raynor.
 7. Wayne-Dalton Corp.

2.1 SERVICE DOOR ASSEMBLY

- A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
- B. Operation Cycles: Not less than 50,000.
- A. Air Infiltration at Exterior Door: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283 or DASMA 105.
- B. Curtain R-Value at Exterior Door: 5.0 deg. F x h x sq. ft./Btu, minimum.
- C. Door Curtain Material: Galvanized steel.
- D. Door Curtain Slats: Flat profile slats of 2-5/8-inch inch center-to-center height.
1. Interior Facing: Metal.
 2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- E. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- F. Hood: Match curtain material and finish.
1. Shape: Round.
 2. Mounting: Face of wall.
- G. Electric Door Operator:

1. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.
2. Operator Location: Wall.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
4. Motor Exposure: Interior.
5. Emergency Manual Operation: Chain type.
6. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.
7. Remote-Control Station: Interior.
8. Other Equipment: Audible and visual signals.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
 2. Insulation at Exterior Door: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
 3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
- B. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from metal to match curtain slats and finish.
- C. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.
 1. Provide jamb gasket to minimize noise of operating door and to prevent scratching of door finish from opening and closing.

2.3 HOOD

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 1. Galvanized Steel: Nominal 0.028 inch thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653.
 2. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.4 LOCKING DEVICES

- A. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.5 CURTAIN ACCESSORIES

- A. Weatherseals for Exterior Door: Weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
- B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door. Provide pull-down straps or pole hooks for doors more than 84 inches high.

2.6 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
 - 1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.7 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
- D. Electric Motors:

1. Electrical Characteristics:
 - a. Phase: Single phase.
 - b. Volts: 115 V.
 - c. Hertz: 60.
 2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
 3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
- E. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.
1. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
- F. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop;" full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- G. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- J. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
- 2.8 FINISHES
- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:

1. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Proceed with installation only after unsatisfactory conditions have been corrected.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion. Lubricate bearings and sliding parts as recommended by manufacturer. Adjust seals to provide weathertight fit around entire perimeter.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 1. Adjust exterior doors and components to be weather-resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.4 DEMONSTRATION

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

END OF SECTION

SECTION 08 41 13
FIRE-RATED ALUMINUM FRAMED STOREFRONT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior fire-rated aluminum-framed storefront installed as stick assemblies.
2. Related materials necessary to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

1. Include Underwriters Laboratories, Inc. listings.

B. Shop Drawings: Show adaptation of manufacturer's standard fire-rated aluminum framed entrances and storefronts to Project; include attachments to other work.

1. Include plans, elevations and details of product showing component dimensions; framed opening requirements, dimensions, tolerances, and attachment to structure.
2. Include vertical-to-horizontal intersection framing, including, but not limited to, following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Glazing.

C. Samples for Verification: 12 inch long section of aluminum extrusions or formed shapes for each type of exposed finish required.

D. Manufacturer's Special Warranty: Sample of unexecuted warranty stating obligations, remedies, limitations, and exclusions.

E. Maintenance Data: For aluminum-framed storefronts to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Company with not less than 5 years' experience in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.

B. Preinstallation Conference: Conduct conference at Project site.

C. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are classified and labeled by UL, for fire ratings indicated, based on testing according to NFPA 257. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.

1.4 WARRANTY

- A. Special Assembly Warranty: Standard form in which Installer agrees to repair or replace components of fire-rated aluminum-framed storefront that do not comply with requirements or that fail in materials or workmanship within five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

- 1. Manufacturer: Technical Glass Products.
- 2. Storefront: Fireframes Aluminum Series.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

- 1. Sheet and Plate: ASTM B 209.
- 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
- 3. Extruded Structural Pipe and Tubes: ASTM B 429.
- 4. Structural Profiles: ASTM B 308.

- B. Steel Reinforcement:

- 1. Structural Shapes, Plates, and Bars: ASTM A36.
- 2. Cold-Rolled Sheet and Strip: ASTM A1008.
- 3. Hot-Rolled Sheet and Strip: ASTM A1011.

2.3 STOREFRONT

- A. Frames: Extruded aluminum clad steel frames.
- B. Framing Members: Manufacturer's standard steel framing members of thickness required and reinforced as required to support imposed loads.
- C. Brackets and Reinforcements: Manufacturer's standard steel with nonstaining, nonferrous shims for aligning system components.
- D. Fasteners and Accessories: Manufacturer's standard fasteners and accessories compatible with adjacent materials.
- E. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

2.4 GLAZING

- A. Glazing: As specified in Division 08 Section "Glazing."

2.5 FABRICATION

- A. Shop Fabrication: Fabricate aluminum extrusion framing that, when assembled, have following characteristics:
1. Straight, sharp profiles, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 4. Provisions for field replacement of glazing.

2.6 ALUMINUM FINISHES

- A. Finish Quality Standards: In addition to standards specified elsewhere, perform work according to following, unless otherwise specified:
1. NAAMM's Metal Finishes Manual.
 2. AA's DAF-45 Designation Systems for Aluminum Finishes.
- B. Appearance of Finished Work:
1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one half of range of approved submittal samples.
 2. Noticeable variations in same piece are not acceptable.
 3. Variations in appearance of other components are acceptable if they are within range of approved submittal samples and they are assembled or installed to minimize contrast as determined by Architect.
- C. Interior Clear Anodized Aluminum Finish: AAMA 611, AA-M12C22A31, Class II, not less than 0.010 mm thick

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
1. Examine substrates to receive fire-rated aluminum framed storefront and associated work for compliance with requirements and other conditions affecting performance.
 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. General Requirements:
1. Comply with manufacturer's written installation instructions.
 2. Do not install damaged components.
 3. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
 4. Fit joints to produce hairline joints free of burrs and distortion.
 5. Rigidly secure non-moving joints.

- B. Install glazing as specified in Division 08 Section "Glazing."

3.3 ERECTION TOLERANCES

- A. Erection Tolerances: Install glazed steel curtain walls to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION

SECTION 08 41 26
INTERIOR ALL-GLASS ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior all-glass entrance and storefront systems.
2. Related materials necessary to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical product literature for each type of product indicated, specified, or required.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for all-glass system.

B. Shop Drawings:

1. Include plans, elevations, and sections.
2. Include details of fittings and glazing, including isometric drawings of fittings.
3. Door hardware locations, mounting heights, and installation requirements.

C. Samples for Verification: For each type of exposed finish indicated, prepared on Samples of sizes indicated below:

1. Metal Finishes: 6 inch long sections of fittings, and other items.
2. Glass: 6 inches square, showing exposed-edge finish.

D. Manufacturer's Special Warranty: Sample of unexecuted warranty stating obligations, remedies, limitations, and exclusions.

E. Maintenance Data: For all-glass systems to include in maintenance manuals. Furnish a complete set of specialized tools and maintenance instructions as required for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation of units required for this Project.

B. Preinstallation Conference: Conduct conference at Project site.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of all-glass systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including excessive deflection.
 - b. Deterioration of metals, metal finishes, and other materials.
2. Warranty Period: Two years from date of Substantial Completion for assembly and components unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
1. J. E. Berkowitz.
 2. Dormakaba.
 3. General Glass International.
 4. C. R. Laurence Co.
 5. Oldcastle BuildingEnvelope.
 6. Virginia Glass Products Corp.

2.2 INTERIOR ALL-GLASS ENTRANCE AND STOREFRONT SYSTEMS

- A. Fitting Configuration:
 1. Manual-Swinging, All-Glass Entrance Doors: Continuous rail fitting at top and bottom.
 2. All-Glass Storefronts: Continuous rail fitting at top and bottom.
- B. Fitting Material: Aluminum.
- C. Rail Fittings:
 1. Height:
 - a. Top Rail: 3-1/2 inches
 - b. Bottom Rail: 3-1/2 inches.
 2. Profile: Tapered.
 3. End Caps: Manufacturer's standard precision-fit end caps for rail fittings.
- D. Anchors and Fastenings: Concealed.
- E. Materials:
 1. Aluminum: ASTM B221, with strength and durability characteristics of not less than Alloy 6063-T5.
 - a. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
 - b. Color: Black.

2.3 GLASS

- A. Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), Quality-Q3, tested for surface and edge compression in accordance with

ASTM C1048 and for impact strength in accordance with 16 CFR 1201 for Category II materials.

1. Class 1: Clear monolithic; thickness as required by conditions, but not less than 3/8 inches.
2. Exposed Edges: Machine ground and flat polished.
3. Butt Edges: Flat ground.
4. Corner Edges: Lap-joint corners with exposed edges polished.

2.4 BUTT-GLAZING SEALANTS

- A. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Uses NT, G, and A; clear.

2.5 FABRICATION

- A. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.
 1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.
- B. Factory assemble components and factory install hardware and fittings to greatest extent possible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Install all-glass entrance and storefront systems and associated components according to manufacturer's written instructions.
- B. Set units level, plumb, and true to line, with uniform joints.
- C. Maintain uniform clearances between adjacent components.
- D. Install butt-joint sealants according to manufacturer's written instructions and as specified in Section 079200 "Joint Sealants."

END OF SECTION

SECTION 08 42 13
ALUMINUM-FRAMED ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Manual swinging, exterior and interior glazed aluminum-framed entrance doors and accessories indicated, specified, or required to complete installation.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product.
 - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components, and profiles.
- B. Shop Drawings: Detailed and dimensioned plans, elevations, sections, and large-scale details. Show adaptation of manufacturer's standard aluminum-framed entrances to project; include attachments to other work.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: 12 inch long section of aluminum extrusions or formed shapes for each type of exposed finish required.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12 inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- F. Warranties: Sample of special warranties.
- G. Maintenance Data: For aluminum-framed entrances to include in maintenance manuals

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Company with not less than 5 years' experience in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.
- B. Accessibility Requirements: Comply with codes, regulations and standards indicated on the Drawings.

1.4 WARRANTY

- A. Special Installer Warranty: Installer agrees to repair or replace components of aluminum-framed entrances that do not comply with requirements or that fail in materials or workmanship within two years from date of Substantial Completion.

- B. Special Manufacturer's Warranty on Finishes: Manufacturer agrees to repair finish or replace aluminum-framed entrances that shows evidence of deterioration of factory-applied finishes within 20 years from date of Substantial Completion.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a Number 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 - 1. CRL - United States Aluminum Corp.
 - 2. EFCO.
 - 3. Kawneer North America.
 - 4. Oldcastle BuildingEnvelope.
 - 5. Tubelite, Inc.
 - 6. YKK AP America Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance door systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Water Penetration under Static Pressure: Test in accordance with with ASTM E331 and showing no evidence of water penetration through fixed glazing and framing areas of entrance doors when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.
- C. Structural: Test in accordance with ASTM E330 at 150 percent of positive and negative wind-load design pressures, entrance doors, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 - 1. Test Durations: As required by design wind velocity, but not less than 10 seconds.

2.3 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

2.4 ENTRANCE DOORS

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

2.5 ENTRANCE DOOR HARDWARE

- A. Hardware: As specified in Division 08 Section "Door Hardware."

2.6 FABRICATION

- A. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. Fit joints to produce hairline joints free of burrs and distortion.
 - 2. Rigidly secure joints.
 - 3. Provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 4. Provide weather sweeps applied to door bottoms.
- B. Entrance Door Hardware: Cut, drill, and tap for hardware.

2.7 ALUMINUM FINISHES

- A. Finish Quality Standards: In addition to standards specified elsewhere, perform work according to following, unless otherwise specified:
 - 1. NAAMM's Metal Finishes Manual.
 - 2. AA's DAF-45 Designation Systems for Aluminum Finishes.
- B. Appearance of Finished Work:
 - 1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one half of range of approved submittal samples.
 - 2. Noticeable variations in same piece are not acceptable.
 - 3. Variations in appearance of other components are acceptable if they are within range of approved submittal samples and they are assembled or installed to minimize contrast as determined by Architect.
- C. Exterior Clear Anodized Aluminum Finish: AAMA 611, AA-M12C22A41, Class I, not less than 0.018 mm thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates, areas, and conditions to verify actual locations, dimensions, and other conditions affecting performance of the Work.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

B. Glazing: Install as specified in Division 08 Section "Glazing."

C. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

END OF SECTION

SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conventionally glazed aluminum-framed storefront installed as stick assemblies.
2. Related materials necessary to complete installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Document Concept: Drawings and Specifications express concept of aluminum-framed storefront work, however, they may not indicate or specify total work that may be required, nor shall they be construed as engineered.
- B. Delegated Engineering Responsibility: Require manufacturer to employ a delegated engineering professional to provide engineering for each member and component of aluminum-framed storefront work, including attachment to building structural frame, required to meet concept expressed in Contract Documents that includes, but is not limited to, following:
1. Comprehensive engineering analysis indicating location, type, magnitude, and direction of loads imposed on exterior wall and building structural frame.
 2. Preparation of engineering calculations, shop drawings, and other submittals.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.
1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components, and profiles.
- B. Shop Drawings: Detailed and dimensioned plans, elevations, sections, and large-scale details. Show adaptation of manufacturer's standard aluminum-framed storefronts to project; include attachments to other work.
1. Include details for assembly expansion and contraction.
 2. Include details of how wall will accommodate infiltrated and condensate water.
 3. Include vertical-to-horizontal intersection framing, including, but not limited to, following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: 12 inch long section of aluminum extrusions or formed shapes for each type of exposed finish required.

- E. Delegated-Design Submittal: Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Manufacturer's Special Warranty: Sample of unexecuted warranty stating obligations, remedies, limitations, and exclusions.
- G. Maintenance Data: For aluminum-framed storefronts to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company with not less than 5 years' experience in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.
- B. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installations similar to this Project, and, that has a record of successful in-service performance.
- C. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

- A. Special Installer Warranty: Installer agrees to repair or replace components of aluminum-framed storefront that does not comply with requirements or that fail in materials or workmanship within two years from date of Substantial Completion.
- B. Special Finish Warranty, Class I Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum wall panels that show evidence of deterioration of anodized finishes within five years from date of Substantial Completion. Deterioration includes, but is not limited to, the following:
 - 1. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - 2. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - 3. Cracking, crazing, flaking, or blistering.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 - 1. CRL - United States Aluminum Corp.
 - 2. EFCO.
 - 3. Kawneer North America.
 - 4. Oldcastle BuildingEnvelope.
 - 5. Tubelite, Inc.

6. YKK AP America Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Comply with performance requirements specified, as determined by testing of manufacturer's standard aluminum-framed storefront representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Withstand movements of supporting structure indicated on Drawings from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
- B. Wind Loads: As indicated on Drawings.
- C. Structural-Test Performance: Test according to ASTM E 330 as follows:
1. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 2. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 in, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 in.
 3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to 2 times the length of cantilevered member divided by 175.
 4. The center deflection of the window stool trim, when subjected to a 250 pound vertical concentrated load, shall not exceed 1/8 in.
- E. Air Infiltration Resistance Criteria: Withstand not more than 0.06 cfm/sq ft of fixed area at static air pressure differential not less than 6.24 ft lbs/sq ft according to ASTM E 283.
- F. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq ft.
- G. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 2. Test Interior Ambient-Air Temperature: 75 deg F.
 3. Test Performance: No buckling, stress on glass, sealant failure, or excess stress on

framing, anchors, and fasteners and no reduction of performance when tested according to AAMA 501.5.

2.3 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 - 4. Structural Profiles: ASTM B 308.

2.4 STOREFRONT

- A. Framing Members: Manufacturer's standard formed- or extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally broken.
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: Center.
 - 4. Glazing Side: Outside.
 - 5. Sightline: 2 inches.
 - 6. Depth: 6-1/2 inches.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

2.5 SUN CONTROL FINS

- A. Sunshades: Vertical assemblies consisting of manufacturer's standard brackets and device, designed for attachment to storefront with mechanical fasteners.

2.6 ENTRANCE DOORS

- A. Entrance Doors: As specified in Division 08 Section "Aluminum-Framed Entrances."

2.7 GLAZING

- A. Glazing: As specified in Division 08 Section "Glazing."

2.8 ACCESSORY MATERIALS

- A. Fasteners: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding device, type, and size required, sufficient to correctly attach or anchor specified item to substrate indicated without failure; compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.
- C. Concealed Flashing: Dead-soft, 0.018-inch thick stainless steel, ASTM A 240 of type recommended by manufacturer.
- D. Exposed Flashing: Aluminum with same finish as storefront frames.
- E. Framing Sealants: Manufacturer's standard sealants.
- F. Bituminous Paint: Cold-applied asphalt-mastic paint complying with ASTM D1187 requirements except containing no asbestos, formulated for 30 mil thickness per coat.

2.9 FABRICATION

- A. Shop Fabrication: Fabricate aluminum extrusion framing that, when assembled, have following characteristics:
 1. Straight, sharp profiles, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 6. Provisions for field replacement of glazing.
- B. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 1. Provide compression weatherstripping at fixed stops.
- C. Entrance Door Hardware: Cut, drill, and tap for hardware before applying finishes.

2.10 ALUMINUM FINISHES

- A. Finish Quality Standards: In addition to standards specified elsewhere, perform work according to following, unless otherwise specified:
 1. NAAMM's Metal Finishes Manual.
 2. AA's DAF-45 Designation Systems for Aluminum Finishes.
- B. Appearance of Finished Work:
 1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one half of range of approved submittal samples.
 2. Noticeable variations in same piece are not acceptable.
 3. Variations in appearance of other components are acceptable if they are within range of approved submittal samples and they are assembled or installed to minimize contrast as determined by Architect.
- C. Exterior Clear Anodized Aluminum Finish: AAMA 611, AA-M12C22A41, Class I, not less than 0.018 mm thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates, areas, and conditions to verify actual locations, dimensions, and other conditions affecting performance of the Work.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. General Requirements:

1. Comply with manufacturer's written installation instructions.
2. Do not install damaged components.
3. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
4. Fit joints to produce hairline joints free of burrs and distortion.
5. Rigidly secure non-moving joints.
6. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and impediments to movement of joints.
7. Seal joints watertight unless otherwise indicated.
8. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within wall to exterior.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install transition assembly components to cover gap between the window frame and the adjacent exterior wall to maintain continuity of air barrier.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

E. Install glazing as specified in Division 08 Section "Glazing."

3.3 ERECTION TOLERANCES

A. Install to comply with the following non-accumulating maximum tolerances:

1. Plumb: 1/8 in in 10 ft; 1/4 in in 40 ft.
2. Level: 1/8 in in 20 ft; 1/4 in in 40 ft.
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 in wide, limit offset from true alignment to 1/16 in.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 in wide,

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

END OF SECTION

SECTION 08 43 33
ALUMINUM-FRAMED INTERIOR STOREFRONT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conventionally glazed aluminum-framed interior storefront installed as stick assemblies.
2. Related materials necessary to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components, and profiles.

B. Shop Drawings: Detailed and dimensioned plans, elevations, sections, large-scale details, and attachments to other work.

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

D. Samples for Verification: For each type of exposed finish required.

E. Manufacturer's Special Warranty: Sample of unexecuted warranty stating obligations, remedies, limitations, and exclusions.

F. Maintenance Data: For aluminum-framed interior storefront to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Company with not less than 5 years' experience in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

1. Manufacturer: Kawneer North America.
2. System: TriFab 400.

B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."

1. CRL - United States Aluminum Corp.
2. EFCO.
3. Kawneer North America.
4. Oldcastle BuildingEnvelope.
5. Tubelite, Inc.
6. YKK AP America Inc.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209.
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 4. Structural Profiles: ASTM B 308.

2.3 INTERIOR STOREFRONT

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Nonthermal.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Center.
 4. Sightline: 1-3/4 inches.
 5. Depth: 4 inches.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Division 08 Section "Glazing."

2.5 ACCESSORY MATERIALS

- A. Fasteners and Accessories: Manufacturer's standard fasteners and accessories compatible with adjacent materials.
1. Reinforce members as required to receive fastener threads.

2.6 FABRICATION

- A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

2.7 ALUMINUM FINISHES

- A. Finish Quality Standards: In addition to standards specified elsewhere, perform work according to following, unless otherwise specified:

1. NAAMM's Metal Finishes Manual.
2. AA's DAF-45 Designation Systems for Aluminum Finishes.

B. Appearance of Finished Work:

1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one half of range of approved submittal samples.
2. Noticeable variations in same piece are not acceptable.
3. Variations in appearance of other components are acceptable if they are within range of approved submittal samples and they are assembled or installed to minimize contrast as determined by Architect.

C. Interior Clear Anodized Aluminum Finish: AAMA 611, AA-M12C22A31, Class II, not less than 0.010 mm thick

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates, areas, and conditions to verify actual locations, dimensions, and other conditions affecting performance of the Work.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. General Requirements:

1. Comply with manufacturer's written installation instructions.
2. Do not install damaged components.
3. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
4. Fit joints to produce hairline joints free of burrs and distortion.

B. Glazing: Install as specified in Division 08 Section "Glazing."

END OF SECTION

SECTION 08 62 23
TUBULAR SKYLIGHTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tubular daylighting devices
2. Related materials necessary to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

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

B. Shop Drawings: Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.

C. Manufacturer's Special Warranty: Sample of unexecuted warranty stating obligations, remedies, limitations, and exclusions.

D. Maintenance Data: For inclusion in maintenance manual required by appropriate Division 01 Section.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than 20 years' experience in producing products and materials similar in design and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications: Entity with not less than 5 years' experience in performing specified work similar in design, products, and extent indicated for this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.

C. Quality Standards:

1. IAEE compliant.
2. NFRC certified.
3. AAMA/WDMA/CSA/ 101/I. S. 2/A440 tested and labeled.
4. FM 4431 approved.
5. ICC AC-16 compliant.

1.4 WARRANTY

A. Manufacturer's Special Warranty: Furnish manufacturer's written material agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor defects for a period of 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 1. Crystalite, Inc.
 2. Elite Solar Lighting & Fans.
 3. Kennedy Skylights.
 4. Solatube International, Inc.
 5. Velux America LLC.

2.2 TUBULAR DAYLIGHTING DEVICES

- A. Description: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Install tubular skylights in accordance with manufacturer's written instructions.
- B. Coordinate installation of units with installation of substrates, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that finished installation is weather tight.
 1. Anchor tubular unit skylights securely to supporting substrates.
 2. Install tubular skylights true to line and without distortion.

- C. Where metal surfaces of tubular unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, provide permanent separation as recommended by manufacturer.
- D. Align device free of warp or twist, maintain dimensional tolerances.

END OF SECTION

SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Glazing for the following applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
1. Exterior storefront.
 2. Interior storefront.
 3. All-glass entrances and storefronts.
 4. Glazed entrances.

1.2 DELEGATED ENGINEERING REQUIREMENTS

- A. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E1300 by a qualified professional engineer licensed in the state the Project is located, using the following design criteria:
1. Design Wind Pressures: As indicated on Drawings.
 2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
 4. Glazing Analysis: Prepared by manufacturer for primary glass or fabricator for fabricated glass units, analyze each glass type and glazing condition for following:
 - a. Thermal Analysis:
 - 1) Evaluate effects of partial and full shading under expected service temperature ranges.
 - 2) Evaluate effects of heat build-up and related thermal stresses on spandrel and/or shadow box areas under expected temperature ranges. Glass manufacturer to approve condition.
 - 3) Evaluate that specified probability of breakage, glass statistical factor, will not be reduced.
 - b. Wind Load Analysis: Evaluate effects of wind loading.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each glass product and glazing material indicated.
- B. Shop Drawings: Include following in shop drawings for aluminum-frames entrances and storefront:
1. Glass types, make-up, shape, sizes and thicknesses.
 2. Glazing materials manufacturers, products, types, and profiles.
 3. Glass bite, edge, clearance, and depth of glazing channel.
 4. Sealant thickness, bit and profile.
 5. Location by elevation of each type of glass, including safety glazing.

- C. Glass Samples: For each type of glass product; 12 inches square.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Test Reports: Preconstruction adhesion and compatibility test report from glazing sealant manufacturer.

1.4 QUALITY ASSURANCE

- A. Glazing Standards: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 degrees F, and the fire-resistance rating in minutes.
- D. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.5 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated glass manufacturer agrees to replace coated glass units that deteriorate within 10 years from date of Substantial Completion.
 - 1. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions.
 - 2. Defects include peeling, cracking, and other indications of deterioration in coating.
- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating glass manufacturer agrees to replace insulatingglass units that deteriorate within 10 years from date of Substantial Completion.
 - 1. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions.

2. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

2.2 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 7 computer program, expressed as Btu/square foot x hour x degree F.
 2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.
- D. Provide notation clearly visible in corner of every pane of glazing material indicating the designation number of the glazing assembly listed in the Contract Documents.

2.3 GLASS PRODUCTS

- A. Float Glass: ASTM C1036, Type I, Quality Q3, Class I (clear) unless otherwise indicated.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
- D. Low-E-Coated Vision Glass: ASTM C1376.

E. Silicone Coating for Spandrel Glass:

1. Description: Water-based silicone elastomeric coating that creates a colorfast rubber-like film.
2. Color: As selected by the Architect from manufacturer's full range.

2.4 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190, and complying with other requirements specified.

1. Sealing System: Dual seal with manufacturer's standard primary and secondary sealants of polyisobutylene and silicone.
2. Spacer: Standard aluminum black spacers.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

2.5 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.

1. Thickness: 3/4 inches.
2. Appearance: Clear, wireless and tint-free.
3. Visible Light Transmittance: Must meet 0.81.
4. Fire Rating: 90 minutes with hose stream.

2.6 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. Neoprene complying with ASTM C864.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.7 MISCELLANEOUS GLAZING MATERIALS

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

B. Setting Blocks: 100 percent silicone.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances, and other conditions affecting performance of the work.
2. Proceed with installation only after unsatisfactory conditions have been corrected.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 GLAZING, GENERAL

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

3.3 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

- E. Install gaskets so they protrude past face of glazing stops.

3.4 ADJUSTING

- A. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

3.5 PROTECTION

- A. Protect exterior glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

END OF SECTION

SECTION 08 83 00
MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Annealed monolithic glass mirrors and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product.
 - 1. Silvered mirrored glass. Include description of materials and process used to produce mirrored glass that indicates source of glass, glass coating components, edge sealer, and quality-control provisions.
 - 2. Mirror mastic.
 - 3. Mirror hardware.
- B. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Installer experienced in performing specified work similar in design, material and extent to scope of Project, and with a record of successful in-service performance.

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 PROJECT CONDITIONS

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

1.6 WARRANTY

- A. Manufacturers Special Warranty: Furnish warranty for a period of 5 years from date of substantial completion agreeing to repair or replace defects, faulty work and failures, including deterioration, signed by an authorized representative of manufacturer.
- B. Deterioration: Includes, but is not limited to, discoloration, black spots, and clouding of the silver film.
- C. Exclusions: Includes defects that are attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified in Section 010500 - Design Selections to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and does not change concept expressed in Contract Documents as judged by Architect.

2.2 SILVERED FLAT GLASS MIRRORS

- A. General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
- B. Annealed Monolithic Glass Mirrors: Mirror Select Glazing Quality, clear.

2.3 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

2.4 MIRROR HARDWARE

- A. Top and Bottom J-Channels: Type 304 stainless steel extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
 - 1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.05 inch.
 - 2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.3075 inch.
 - 3. Finish: No. 4 satin.
- B. Fasteners: Stainless steel flat head machine screws.
- C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.5 FABRICATION

- A. Mirror Edge Treatment:
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Conditions:

1. Examine substrates to which mirrors will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

- #### A.
- Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- #### A.
- Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

- #### B.
- Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Top and Bottom J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
2. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch between back of mirrors and mounting surface.

3.4 PROTECTION

- #### A.
- Protect mirrors from breakage and contaminating substances resulting from construction operations.
- #### B.
- Do not permit edges of mirrors to be exposed to standing water.

END OF SECTION

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-structural metal framing for gypsum board walls, shaftwalls, partitions and furr-downs.
2. Field-built suspended grid system for interior gypsum board ceilings.
3. Pre-engineered suspended grid system for interior gypsum board ceilings.
4. Accessories indicated, specified, or required to complete installation.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each type of product indicated.
- B. Stud Determination: Written analysis of wall height, loads and installations indicating typical size, gauge and spacing and listing any areas in which gauge and spacing deviate from design. Obtain approval of Architect when stud size requires adjustment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."

1. Pre-Engineered Suspended Grid System for Interior Ceilings:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; 640-C Drywall Furring System.
 - c. USG Corporation; Drywall Suspension System.
2. Steel Framing:
 - a. CEMCO - California Expanded Metal Co.
 - b. ClarkDietrich Building Systems.
 - c. Craco Manufacturing, Inc.
 - d. MarinoWare.
 - e. Scafco Steel Stud Company.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire Resistance Rated Assembly Characteristics: Provide materials and construction identical to those tested according to ASTM E119/NFPA 251/UL 263 by one of following independent testing and inspecting agency as evidenced by design designation included in their associated approval manual:
1. UL – "Fire Resistance Directory", Category BXUV.
 2. GA-600 – "Fire Resistance Design Manual".

3. Other agency acceptable to authorities having jurisdiction.
 - B. Smoke Resistance Rated Assembly Characteristics: Provide materials and construction identical to those tested according to indicated fire resistance rated assemblies by independent testing and inspecting agency acceptable to authorities having jurisdiction.
 - C. Sound Resistance Rated Assembly Characteristics: Provide materials and construction identical to those tested according to ASTM E90 and classified according to ASTM E413 by independent and testing agency acceptable to authorities having jurisdiction.
 - D. Horizontal Deflection: For non-composite wall assemblies, limited to L/240 of the wall height based on horizontal loading of the following:
 1. Shaftwall Assemblies: 10 foot-pounds per square foot.
 2. Typical Partitions: 5 foot-pounds per square foot.
- 2.3 FIELD-BUILT SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS
- A. General:
 1. Steel Sheet Components: ASTM C645, cold-rolled, commercial-steel sheet.
 2. Protective Coating: ASTM A653, G40, hot-dip galvanized.
 - B. Carrying Channels (Main Runners): C-shape, base-steel thickness of not less than 0.0538 inch and minimum 1/2 inch wide flanges.
 1. Depth: Not less than 2 inches.
 - C. Furring Channels:
 1. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
 2. Asymmetrical-Shaped Resilient Furring Channels: ASTM C645, 7/8 inch deep.
 - D. Hanger Attachments:
 1. Post-Installed Anchors: Torque-controlled, expansion anchor fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488 by an independent testing agency.
 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E1190 by an independent testing agency.
 - E. Wire:
 1. Material Quality Standard: ASTM A641, Class 1, zinc-coated, soft annealed, mild steel wire.
 2. Tie Wire Minimum Size: Not less than single 0.0625 inch (16 gauge) diameter strand or double 0.0475 inch (18 gauge) diameter strands. Preformed furring channel clips are acceptable.
 3. Hanger Wire Minimum Size: Not less than 0.1620 inch (8 gauge) diameter.

2.4 PRE-ENGINEERED SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS

A. Suspension Grid System:

1. Material Quality Standard: ASTM C645, heavy-duty rating.
2. Description: Manufacturer's standard direct-hung suspended grid system composed of main beams and cross furring members that interlock to form a modular supporting network for application of gypsum board.
3. Material: Sheet steel with corrosion protection coating.
4. Main Beams: Inverted T-shaped profile of single or double mounting flange; minimum 1-1/2 inch profile height with top bulb and minimum 1-3/8 inch wide knurled mounting flange; factory punched for hanger wire, and to receive cross furring members.
5. Cross Furring Members:
 - a. Tees: Inverted T-shaped profile of single or double mounting flange; 1-1/2 inch profile height with top bulb and minimum 1-3/8 inch wide knurled mounting flange; with ends formed for positive interlocking with main beam.
 - b. Channels: Inverted hat shaped profile; minimum 7/8 inch profile height and minimum 1-3/8 inch wide knurled mounting flange; with ends formed for positive interlocking with main beam.
6. Wall Angle: Angle shaped profile with each leg not less than 1-1/4 inches.
7. Curved Members: Where curved ceilings are indicated, members shall be rolled by manufacturer; field fabricated curved members not permitted.
8. Accessories: Specifically designed as an integral part of suspended grid system.

B. Hanger Attachments:

1. Post-Installed Anchors: Torque-controlled, expansion anchor fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488 by an independent testing agency.
2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E1190 by an independent testing agency.

C. Wire:

1. Material Quality Standard: ASTM A641, Class 1, zinc-coated, soft annealed, mild steel wire.
2. Hanger Wire Minimum Size: Not less than 0.1620 inch (8 gauge) diameter.

2.5 NON-STRUCTURAL METAL FRAMING FOR WALLS, SHAFTWALLS, PARTITIONS, AND FURR-DOWNS

A. General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: ASTM C 645, cold-rolled, commercial-steel sheet.
2. Protective Coating: ASTM A 653, G40, hot-dip galvanized.

B. Wall, Partition, and Furr-Down Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks (equivalent gauge thickness).

1. Conventional Steel Studs and Tracks:
 - a. Stud Description: C-shaped members with 1-1/4 inch flange edges bent back 90 degrees and bent again to form 3/16 inch wide minimum return lip; of web depth indicated on Drawings and uncoated base metal thickness indicated in Schedule at end of this Section; with web punchouts.
 - b. Track (Runner) Description: U-shaped members formed from dimpled surface galvanized steel sheet with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.
 2. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional steel studs and tracks; of web depth indicated on Drawings and uncoated base metal thickness indicated in Schedule at end of this Section; with web punchouts.
 - a. Minimum Base-Steel Thickness: As required by horizontal deflection performance requirements, but not less than 0.0190 inch.
- C. Shaftwall Studs and Track: ASTM C645.
1. Stud Description: CH-shaped members.
 2. Track (Runner) Description: J-shaped members.
- D. Slip-Type Head Joints: Where indicated, provide one of the following, unless indicated otherwise:
1. Single Long-Leg Track System: ASTM C645 top track with 2 inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 2. Double-Track System: ASTM C645 top outer tracks, inside track with 2 inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
 3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Base-Metal Thickness: Not less than 0.0359 inch.
- G. Cold-Rolled Channel Bridging: 0.0538 inch bare-steel thickness, with minimum 1/2 inch wide flanges.
1. Depth: 1-1/2 inches.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068 inch thick, galvanized steel.
- H. Hat-Shaped, Rigid Furring Channels:

1. Minimum Base Metal Thickness: Not less than 0.0179 inch.
 2. Depth: 7/8 inch.
- I. Cold-Rolled Furring Channels: 0.0538 inch bare-steel thickness, with minimum 1/2 inch wide flanges.
 1. Depth: 3/4 inch.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
 3. Tie Wire: ASTM A641, Class 1 zinc coating, soft temper, not less than 0.0625 inch diameter wire, or double strand of 0.0475 inch diameter wire.
 - J. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
- 2.6 FASTENERS
- A. Powder Actuated Fasteners for Attaching Metal Framing to Structure: ANSI A10.3; low velocity, powder actuated fasteners; drive pins and washers fabricated from corrosion-resistant materials; powder loads suitable for application indicated; and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E1190 by a qualified independent testing agency.
 - B. Metal Framing Screws: Screw fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten metal framing and furring members securely to substrates involved; complying with recommendations of gypsum board manufacturers for applications indicated.
- 2.7 RELATED MATERIALS
- A. Foam Gasket Isolation Strip at Exterior Walls: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 1. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances, and other conditions affecting performance of the work.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.
 3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Standards: ASTM C754.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- F. Supplemental Accessories: Install supplementary framing, blocking, reinforcing, and bracing in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, hand rails, furnishings, or similar construction. Comply with details indicated and recommendations of installation quality standards or manufacturer.

3.3 INSTALLING FIELD-BUILT SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS

- A. Isolate suspended grid system from building structure where it abuts or is penetrated by building structure to prevent transfer of loading imposed by structural movement.
- B. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Do not attach hangers to steel roof deck.
 - 4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 6. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- C. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- D. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.4 INSTALLING PRE-ENGINEERED SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS

- A. Installation Quality Standard: In addition to standards listed elsewhere, perform suspended ceiling work according to ASTM C636, unless otherwise specified in this Section.
- B. Pattern: Lay out spaces and arrange suspension system in a regular pattern, parallel or perpendicular to surrounding walls.

C. Hangers for Ceiling System: Suspend hangers from building structural members and as follows:

1. Install hangers plumb and free from contact with mechanical and electrical equipment, insulation or other objects within ceiling plenum that are not part of supporting structural frame or ceiling suspension system. Within limitations allowed by installation quality standards, splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers required to support suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by installation quality standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Install metal framing components for suspended ceilings so that members are level to within 1/8 inch in 12 feet as measured both lengthwise on each member and transversely between parallel members.
5. Do not connect or suspend any ceiling components from ducts, pipes or conduit.

D. Perimeters: Using wallboard screws through wallboard into metal studs, attach perimeter wall angle where suspended grid system meets vertical surfaces; cut main beams and cross furring members to fit into wall angle.

E. Main Beams:

1. Suspend main beams spaced 48 inch on center from structure with wire hangers spaced not greater than 48 inch on center.
2. Install main beams level within 1/8 inch in 12 feet with hanger wire taut and tightly wrapped to prevent vertical movement or rotation.
3. Do not make local kinks or bends in hanger wires as a means of leveling.

F. Cross Furring Members:

1. Install cross furring members at right angles to main beams, spaced as required and join to main beams with positive interlock.
2. Install cross furring members to within 1/32 inch of their required location and within 0.015 inch of same horizontal plane as main beam, and never below continuous member.
3. Install additional cross furring members at right angles to beams and cross furring members to support ends of recessed light fixtures, diffusers or grilles.

G. Concentrated Load Conditions: Provide additional hanger wires at each corner of recessed light fixtures and other concentrated load conditions to prevent excess deflection.

3.5 INSTALLING METAL FRAMING FOR WALLS, SHAFTWALLS, PARTITIONS AND FURROWS

A. Priority: Assemble various assemblies giving priority to partitions with higher rating; extend partition with higher rating intact through partition with lower rating.

B. Joinery and Connections: Install various metal framing components according to details indicated; for situations and conditions not indicated, comply first with installation quality standards, then second with respective manufacturers recommendations.

- C. General Requirements: Construct partition framing of studs, tracks, and headers using screws of number and spacing required.
1. Install studs of uncoated base metal thickness as determined by metal stud schedule at end of this Section.
 2. Extend partition framing full height to underside of structure above, except where partitions are indicated to terminate at, or immediately above, suspended ceilings.
 3. Continue framing over door frames and openings to provide support for wallboard.
 4. Space studs as indicated on schedule at end of this section.
 5. Cut studs 1 inch short of full height to provide deflection relief at head of wall conditions.
 6. Install studs so that flanges point in same direction.
 7. Attach with screws through each stud flange and track (runner) flange.
 8. For fire resistance rated, smoke resistance rated, and sound resistance rated assemblies that are required to extend to underside of structure above to obtain ratings, install framing around structural and other members extending below floor slabs or roof decks, as needed to support wallboard closures and make partitions continuous from floor to underside of structure above.
 9. Avoid lapping studs; if unavoidable, lap studs minimum 8 inch and secure with screws.
 10. At intersections and corners, locate studs no more than 2 inch from partition intersections and corners and secure with screws through both flanges of studs and tracks.
 11. Install horizontal bridging at 48 inch on centers vertically where indicated or required by installation quality standard.
- D. Metal Track (Runner) Requirements:
1. Floors: Install tracks (runners) using powder actuated fasteners spaced not more than 16 inch on centers.
 2. Head of Wall: Install deep leg deflection tracks using powder actuated fasteners to laterally support assembly, and to avoid axial loading of assembly by deflection from building structure above.
 3. Head of Wall: Where indicated, install proprietary deflection and firestop track (runner) using powder actuated fasteners.
- E. Support for Wall Mounted Accessory/Equipment: Install back-up plate or track (runner) turned on its side, using screws as indicated or as required, to studs to properly transfer accessory/equipment load to metal framing.
- F. Openings: Frame single door, double door, above ceiling openings, and below ceiling openings using studs, tracks (runners), clip angles, and headers.
1. Install 2 studs on each side of each opening in configuration indicated, including strap plates; extend from floor to underside of structure above; do not cut these studs under any circumstances.
 2. Construct header of appropriate configuration for type of opening to be spanned and secure with clip angles; include sound attenuation blankets within cavity when partition is scheduled to have a sound resistance rating.
 3. Install short intermediate studs 16 inch on center between top track and header.
 4. At partitions indicated to terminate immediately above ceiling, install diagonal bracing at not less than spacing as indicated.
- G. Supplementary Framing: Install around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by metal framing.
- H. Penetrations: Maintain fire-resistance rating of assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring

devices, elevator call buttons, elevator floor indicators, and similar items.

I. Chase Partitions:

1. Position double row of studs vertically in tracks (runners), opposite each other in pairs with flanges pointing in same direction.
2. Space as indicated on schedule at end of this section.
3. Attach with screws through each stud flange and track (runner) flange.
4. Cross brace between rows of studs with one of following at 48 inches on center maximum vertically, attached to stud webs with screws:
 - a. Coated glass-mat gypsum board, 12 inch high by chase width.
 - b. Metal studs turned on side, webs back-to-back.

J. Furred Walls:

1. Erect furring channels vertically, spaced 16 inches on centers maximum, unless otherwise indicated.
2. Attach with powder actuated fasteners, staggered on flanges.
3. Splice ends by nesting channels 8 inches and securely anchoring to surface.
4. Miter 24 inch long horizontal furring channels at corners and space 24 inches on centers vertically.
5. Locate furring channels around perimeter of openings and secure to surfaces.

K. Control Joints:

1. Construct metal framing as indicated by installation quality standard to allow wallboard control joints to function as intended.
2. For control joints located in fire resistance rated walls and partitions, construct of metal studs and mineral wool, full height of partition, according to assembly fire test reports.

L. Installation Tolerances: Install each metal stud metal framing and furring member so that fastening surfaces do not vary more than 1/8 inch from plane formed by faces of framing members.

M. Z-Furring Members:

1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches on centers.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

3.6 SCHEDULES

A. Metal Stud Schedule:

1. Stud Depth: As indicated on Drawings.
2. Spacing: Maximum 16 inches on centers, unless otherwise indicated, or, as required to comply with respective assembly test report.
3. Uncoated Base Metal Thickness for Walls, Partitions and Furr-Downs: As determined by manufacturer's limiting height engineering data for L/240 at 5 pounds per square foot

lateral load within following minimum parameters of uncoated base metal thickness:

- a. 0.0283 inch (22 gauge): Typical applications unless otherwise indicated.
 - b. 0.0312 inch (20 gauge): Following applications:
 - 1) Typical at walls supporting ceramic tile.
 - 2) Typical at walls with wallboard on one side only.
 - 3) Typical at door jambs.
 - 4) Typical at walls supporting wall hung cabinets or shelving.
4. Uncoated Base Metal Thickness for Shaftwalls: As determined by manufacturer's limiting height engineering data for L/240 at 10 pounds per square foot lateral load.

END OF SECTION

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.
3. Sound attenuation blankets.
4. Related materials necessary to complete installation.

1.2 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C11 for definitions of terms not defined in this Section or in other referenced quality standards.
- B. Damage: Stored or installed materials are classified as defective and nonconforming Work according to following:
1. Wet or damp, or have been at any time.
 2. Exhibit evidence of active or dormant mold or mildew.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product indicated, specified or required.
- B. Rated Assembly Design Classification: Documentation issued by testing agency for each rated assembly design selected.
1. Fire Resistance Rated Assemblies.

1.4 FIELD CONDITIONS

- A. Environmental Conditions: Comply with ASTM C840 requirements or respective wallboard manufacturers written recommendations, whichever are more stringent.
- B. Do not install wallboards until installation areas are enclosed.
- C. Do not install 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Resistance Rated Assembly Characteristics: Provide materials and construction identical to

those tested according to ASTM E119 / NFPA 251 / UL 263 by one of following independent testing and inspecting agency as evidenced by design designation included in their associated approval manual:

1. UL – “Fire Resistance Directory”, Category BXUV.
2. GA-600 – “Fire Resistance Design Manual”.
3. Other agency acceptable to authorities having jurisdiction.

2.2 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products and assemblies (a) specified below, and, (b) as indicated on Drawings by reference to an independent laboratory test number, to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and does not change intent of Contract Documents as judged by Architect.
- B. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section “Substitution Procedures.”

2.3 INTERIOR GYPSUM WALLBOARDS

- A. Sizes: Maximum lengths and widths available that will minimize short edge-to-short edge butt joints and to correspond to support system indicated.
- B. Typical Paper-Faced Type X Gypsum Board:
 1. Material Quality Standard: ASTM C1396, Type X.
 2. Description: Noncombustible gypsum core with paper surfacing on face, back and long edges.
 3. Thickness: 5/8 inch.
 4. Long Edges: Tapered.
 5. Acceptable Manufacturers and Products:
 - a. CertainTeed Corp.; ProRoc Type X Gypsum Board.
 - b. G-P Gypsum Corp.; ToughRock Fireguard Gypsum Board X.
 - c. National Gypsum Co.; Gold Bond Brand Fire-Shield X Gypsum Board.
 - d. USG Corp.; Sheetrock Mold-Tough Firecode X Core.
- C. Typical Paper-Faced Type C Gypsum Board:
 1. Material Quality Standard: ASTM C1396, Type C.
 2. Description: Noncombustible, enhanced gypsum core with paper surfacing on face, back and long edges.
 3. Thickness: 5/8 inch.
 4. Long Edges: Tapered.
 5. Acceptable Manufacturers and Products:
 - a. CertainTeed Corp.; ProRoc Type C Gypsum Board.
 - b. G-P Gypsum Corp.; ToughRock Fireguard Gypsum Board C.
 - c. National Gypsum Co.; Gold Bond Brand Fire-Shield C Gypsum Board.
 - d. USG Corp.; Sheetrock Mold Tough Firecode C Core.
- D. Moisture-Resistant Paperless Glass-Mat Gypsum Board:

1. Material Quality Standard: ASTM C1658, Type X.
2. Description: Mold- and moisture-resistant, noncombustible gypsum core with inorganic, embedded fiberglass mat on face, back and long edges.
3. Thickness: 5/8 inch.
4. Long Edges: Tapered.
5. Mold Resistance: ASTM D3273; score of 10 as rated according to ASTM D3274.
6. Basis of Design: National Gypsum Co.; Gold Bond Brand eXP Interior Extreme Gypsum Panels.

E. Paper-Faced Type X Shaftwall Liner Gypsum Board:

1. Material Quality Standard: ASTM C1396, Type X.
2. Description: Noncombustible gypsum core with mold/mildew resistant paper surfacing on face, back and long edges.
3. Thickness: 1 inch.
4. Long Edges: Double beveled.
5. Acceptable Manufacturers and Products:
 - a. CertainTeed Corp.; M2Tech Shaftliner Type X Gypsum Board.
 - b. G-P Gypsum Corp.; ToughRock Shaftliner.
 - c. National Gypsum Co.; Gold Bond Brand Fire-Shield Shaftliner.
 - d. USG Corp.; Sheetrock Liner Panels.

2.4 TILE BACKING WALLBOARD PANELS

A. Water-Resistant Glass-Mat Gypsum Board:

1. Material Quality Standard: ASTM C1178, Type X.
2. Description: Mold- and moisture-resistant, noncombustible gypsum core with inorganic, embedded fiberglass mat on face, back and long edges; acrylic-coated water barrier on one face.
3. Thickness: 5/8 inch.
4. Edges: Square.
5. Mold Resistance: ASTM D3273; score of 10 as rated according to ASTM D3274.
6. Acceptable Manufacturers and Products:
 - a. CertainTeed Corp.; GlasRoc Diamondback Tile Backer.
 - b. G-P Gypsum Corp.; DensShield Tile Backer.
 - c. National Gypsum Co.; Gold Bond Brand eXP Tile Backer Fire Shield X.
 - d. USG Corp.; Durock Brand Glass-Mat Tile Backerboard.

B. Cementitious Backer Board:

1. Material Quality Standard: ANSI A118.9 or ASTM C1325.
2. Description: Cementitious panels composed of portland cement, aggregates, glass mesh on both faces, and manufacturer's proprietary ingredients; capable of remaining unaffected by prolonged exposure to water.
3. Thickness: 5/8 inch.
4. Acceptable Manufacturers and Products:
 - a. CertainTeed; GlasRoc Tile Backer.
 - b. Custom Building Products; WonderBoard.
 - c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - d. National Gypsum Co.; PermaBase Cement Board.
 - e. USG Corp.; DUROCK Interior Cement Board.

2.5 TRIM ACCESSORIES

A. Typical Drywall Trim Accessories:

1. Material Quality Standard: ASTM C1047.
2. Description: Trim profile fabricated of steel sheet with ASTM A653, minimum G40 hot-dip galvanized coating; of size suitable for wallboard thickness; with recessed, perforated flange formed to receive joint compound.
3. Trim Products:
 - a. Cornerbead:
 - 1) Purpose: For protecting outside (external) corners.
 - 2) Basis of Design: USG Corp.; Dur-A-Bead Corner Bead, 103.
 - b. LC-Bead (J-Bead):
 - 1) Purpose: For protecting exposed edges of wallboard where back flange can be used.
 - 2) Basis of Design: USG Corp.; J-Trim, 200-A.
 - c. L-Bead:
 - 1) Purpose: For protecting exposed edges of wallboard where back flange cannot be used.
 - 2) Basis of Design: USG Corp.; L-Trim, 200-B.
 - d. J-Stop:
 - 1) Purpose: For protecting edges of wallboard that does not require finishing.
 - 2) Basis of Design: USG Corp.; J-Stop, 402.
 - e. Control Joint:
 - 1) Description: One-piece trim formed with V-shaped slot, with removable strip covering slot opening.
 - 2) Purpose: For conditions requiring expansion and contraction stresses of large areas of wallboard to be relieved.
 - 3) Basis of Design: USG Corp.; Control Joint, 093.
 - f. Other Trim or Special Shapes: Product as required by condition.
4. Acceptable Manufacturers:
 - a. ClarkDietrich Building Systems.
 - b. Fry Reglet Architectural Metals.
 - c. Marino Ware.
 - d. Niles Building Products Co.
 - e. Superior Metal Trim.
 - f. USG Corp.

2.6 FASTENERS

A. Gypsum Wallboard Screws:

1. Material Quality Standards:

- a. Metal Framing Members less than 0.03 inch Thick: ASTM C1002, Type S.
- b. Metal Framing Members from 0.033 inch to 0.112 inch Thick: ASTM C954, Type S-12.

2. Description: Bugle head, self-drilling, self-tapping, steel screws with Phillips-head recess of size, holding power, and other properties recommended by respective wallboard manufacturer; non-corrosive and non-oxidizing for shower and tub applications.

- B. Other Fasteners: For conditions not indicated, fasteners shall be type, finish, size, and holding power recommended by USG's "The Gypsum Construction Handbook" for conditions encountered.

2.7 WALL LABELS FOR RATED PARTITIONS

- A. General: Permanently identify the following interior walls and partitions containing protected openings or penetrations, including, but not limited to the following:

- 1. Fire walls, barriers, or partitions.
- 2. Smoke barriers or partitions.

- B. Wall Labels: Plastic plates, aluminum plates, or vinyl film with an adhesive back; not less than 7 by 10 inches; with primary words not less than 2 inches high, that identifies a wall as a fire-rated or smoke-rated wall in red lettering.

- C. Acceptable Manufacturers:

- 1. Fire Wall Signs, Inc.
- 2. MySafetySign.com
- 3. Seton Signs, Labels and Safety Solutions.

2.8 RELATED MATERIALS

- A. General: Provide auxiliary materials for gypsum board construction that comply with referenced quality standards and recommendations of gypsum board manufacturer.

- B. Fiberglass Sound Attenuation Blankets:

- 1. Material Quality Standard: ASTM C665, Type I.
- 2. Description: Unfaced blankets produced by bonding inorganic glass fibers with a thermosetting binder; free of formaldehyde.
- 3. Surface Burning Characteristics: According to ASTM E84/NFPA 255/UL 723:

- a. Flame Spread: Class A – no greater than 25.
- b. Smoke Developed: No greater than 50.

4. Thickness:

- a. If not indicated: Not less than 2-1/2 inch.
- b. Interior walls surrounding mechanical and electrical rooms, pool pump room, trash chutes, demising walls between units (each stud cavity), and walls between units and corridors and other adjacent spaces: Not less than 3-1/2 inches.

5. Acceptable Manufacturers and Products:

- a. CertainTeed Corp.; CertaPro AcoustaTherm Batts.
- b. Johns Manville Building Insulation Div.; Sound Control Batts.
- c. Knauf Fiber Glass; QuietTherm.
- d. Owens Corning; Sound Attenuation Batts.

C. Acoustical Sealant:

- 1. Description: Non-skinning, non-hardening, permanently flexible, gun-grade sealant that is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E90.
- 2. Acceptable Manufacturers and Products:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Certainteed Saint-Gobain; SilentFX Noiseproofing Sealant.
 - c. Franklin International; Titebond GreenChoice Professional Acoustical Smoke and Sound Sealant.
 - d. Grabber Construction Products; Acoustical Sealant GSC
 - e. Pecora Corp.:
 - 1) Fire-Rated Joints: AC-20 FTR Acoustical and Insulation Sealant.
 - 2) Non-Fire-Rated Joints: Pecora Corp.; BA-98.
 - f. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - g. USG Corp.; Sheetrock Brand Acoustical Sealant.

D. Isolation Strips: Adhesive-backed, closed cell neoprene or vinyl foam strips that allow fastener penetration with foam displacement, size as indicated, compressed 50 percent.

E. Water Resistant Sealants: Silicone mildew resistant sealant as specified in Division 07 Section "Joint Sealants".

F. Firestopping Products at Penetrations: As specified in Division 07 Section "Penetration Firestopping."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

- 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- 2. Proceed only when unsatisfactory conditions have been corrected.
- 3. Starting work within a particular area will be construed as acceptance of conditions.

3.2 PREPARATION

A. Cleaning: Ensure ceiling and wall cavities are dry, clean and free of construction debris.

3.3 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform gypsum board assemblies work according to following, unless otherwise specified in this Section:

- 1. Respective manufacturer's installation written instructions.

2. GA 216 for application of gypsum board.
 3. GA 600 for fire and sound rated assemblies.
 4. ASTM C 840 for installation of gypsum board.
 5. ANSI A108.11 for cement backer boards.
- B. Resistance Rated Partitions: Construct fire resistance rated, smoke resistance rated, and sound resistance rated partitions according to respective assembly test reports. Ensure every material used within an assembly shall comply with manufacturers listed and product qualities indicated in respective assembly test report.
- C. Penetrations and Openings: Construct within gypsum board assemblies work as required to properly form penetration or opening to receive firestopping materials specified in Division 07 Section "Penetration Firestopping".
- D. Control Joints: Form stress relieving joints, spaced not more than 24 feet in either direction for uninterrupted straight planes of ceilings, walls and partitions, to eliminate cracking of gypsum board assemblies, or finish, according to following:
1. Where ceiling, wall or partition framing changes direction within same plane.
 2. Where wallboard of ceilings, walls or partitions abutting inside face of exterior walls.
 3. Where wallboard of walls and partitions of differing fire ratings abut or align in same plane.
 4. Where wings of L, U, or T shaped ceiling configurations are joined.
 5. Less than ceiling height door frames and windows extending from both corners to ceiling.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: Fasten trim accessories continuously according to accessory manufacturer's instructions using fasteners; installation by clinch-on tool and staples not permitted.
- B. Typical Trim Accessories:
1. Corner Beads: Install trim at external corners; use fasteners at each flange at 9 inches on centers, opposite each other.
 2. Edge Trim: Install trim where wallboards abut dissimilar material, and where edge of wallboards would otherwise be exposed; use fasteners screws at flange at 9 inches on centers.
 - a. LC-Bead (J-Bead): Install trim at exposed conditions where back flange can be attached to framing or supporting substrate before wallboard installation.
 - b. L-Bead: Install trim at exposed conditions where trim can only be installed after wallboard installation.
 - c. J-Stop: Install trim at concealed conditions where trim can only be installed after wallboard installation.
 3. Control Joints: Install trim at appropriate locations, ensuring wallboard is not continuous over joint; use fasteners at each flange at 6 inches on centers.
- C. Accent Trim Accessories: Install at locations indicated, mitering corners and intersections to form tight, flush and uniform joints; use fasteners at each flange at 9 inches on centers.
- D. Trim Accessories at Exterior Windows: Install at locations indicated, mitering corners and intersections to form tight, flush and uniform joints; use fasteners at each flange at 9 inches on centers.

3.5 INSTALLING WALLBOARDS

A. General Requirements:

1. Install type of wallboard at location indicated by wallboard schedule at end of this Section.
2. Avoid installing imperfect, damaged, wet, or damp wallboards.
3. Install ceiling wallboards before wall and partition wallboards.
4. Install wallboards with finishable face side out.
5. Butt wallboards together for a light contact at edges and ends with not more than 1/16 in of open space between panels.
6. Avoid forcing wallboards into place.
7. Avoid placing tapered edges against cut edges or ends.

B. Single-Layer Board Assemblies:

1. At typical conditions, install wallboard vertically (long dimension parallel to stud framing), to minimize short end-to-short end joints unless otherwise indicated or required by assembly fire test reports.
2. At interior of stairwells and other high walls, install wallboards horizontally, unless otherwise indicated or required by assembly fire test reports. Stagger abutting end joints not less than one framing member in alternate courses of wallboards.

C. Multilayer Board Assemblies: Apply base layers and face layers vertically (long dimension parallel to framing) with joints of base layers located over stud or furring member and face layer joints offset at least one stud space (16 inches) with base layer joints, unless otherwise indicated or required by assembly fire test reports. Stagger joints on opposite sides of partitions.

D. Ceiling Applications:

1. Apply wallboard at right angles to main beams of suspension framing to minimize number of abutting end joints and avoid abutting end joints in central area of each ceiling.
2. Stagger abutting end joints of adjacent panels not less than one framing member.
3. Locate both edge or end joints of wallboards over intermediate supports or gypsum board back-blocking where framing is not present.

E. Typical Wall Applications:

1. Attach wallboards to studs so that leading edge or end of each board is attached to open (unsupported) edges of stud flanges first.
2. Stagger vertical joints on opposite sides of partitions.
3. Do not make joints other than control joints at corners of framed openings.
4. Attach wallboards to framing provided at doors, openings and cutouts. Install wallboards over door heads and extend to not less than one stud space (16 inches) at each side of door or opening.
5. Cover both faces of framing with wallboards as indicated, except in chase walls that are braced internally.
6. Cut and fit wallboards around ducts, pipes, conduits, and other penetrations to form proper annular joint to receive firestopping.
7. Where partitions intersect open building structure members projecting below underside of floor slabs and roof decks, cut to fit profile formed by coffers, joists, beams, and other structural members; form proper annular joint to receive firestopping.
8. Support both edge and end joints of wallboards over framing.

F. Screw Fastening:

1. Attach wallboard to metal framing with screw fasteners for wallboard being installed:

- a. Type shall be appropriate for material and conditions.
 - b. Length shall be as required by condition and penetrating metal framing not less than 1/2 inches.
 - c. Spacing shall be as recommended by installation quality standard, wallboard manufacturer or respective assembly test report.
 - d. Use properly adjusted, positive-clutch electric power tool equipped with adjustable screw-depth head and a Phillips bit. Nails and staples are not permitted.
- 2. Drive screws to slightly dimple surface without breaking face paper, fracturing core, or stripping metal framing member around screw shank.
- 3. Space screws for non-fire resistance rated partitions and ceilings as recommended by installation quality standards.
- 4. Space screws for fire resistance rated partitions as required by assembly fire test reports.
- 5. Start field screwing near center and work towards edges.
- 6. Space screws not less than 3/8 inches from wallboards edges.
- 7. Do not attach wallboards to top runner where wall or partition extends to building structure unless required by fire test reports.
- G. Control Joints: Form control joints and expansion joints at locations indicated with required space between edges of adjoining wallboards.
- H. Sound Attenuation Blankets: Install blankets within stud cavities set so that they are held in place by friction with studs; ensure blankets are secure within cavity and will not become displaced when second wallboard side is closed.
- I. Sealant:
 - 1. Comply with ASTM C 919 and manufacturers written recommendations for closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
 - 2. Seal wall assemblies at perimeters, behind control joints, and at openings and penetrations with a continuous bead of sealant material according to following:
 - a. Fire Resistance Sealant: Joints within fire resistance rated assemblies.
 - b. Water Resistance Sealant: Joints within non-fire resistance rated assemblies exposed to possible water infiltration.
 - c. Acoustical Sealant: All other joints.

3.6 INSTALLING WALL LABELS

- A. Permanently identify both sides of each fire and smoke assembly.
- B. Adhere wall labels identifying rating at 12 inches above the ceiling and at intervals not less than 15 feet on centers.
- C. Locate labels where they will be seen and not obstructed by other construction.

3.7 PROTECTION

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

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.

C. Repair of Gypsum Board:

1. Patch holes and voids in gypsum board utilizing mesh and bonding primer – hot patching is not acceptable.
2. Patch and Repair fire resistance rated gypsum board assemblies in accordance with Gypsum Association GA-225.

3.8 ADJUSTMENTS

- A. Wet Materials: Materials and products that are wet or have been wet at any time during construction shall be replaced with new and dry materials and products.

3.9 SCHEDULE

- A. Wallboard Schedule: Install gypsum board products as indicated in following Schedule unless otherwise indicated on Drawings:
1. Paper-Faced Type X Shaftwall Liner Gypsum Board: Liner at vertical shafts and shere indicated.
 2. Cementitious Backer Boards: Surfaces finished with wall tile and behind plumbing fixtures.
 3. Water-Resistant Glass-Mat Gypsum Board: Surfaces finished with wall tile and beside plumbing fixtures.
 4. Moisture-Resistant Paperless Glass-Mat Gypsum Board:
 - a. Wall and ceiling surfaces in toilets and bathrooms not otherwise finished with wall tile.
 - b. Wall and ceiling surfaces within Mechanical Rooms and Janitor Closets.
 5. Typical Paper-Faced Type C Gypsum Board: Ceilings.
 6. Typical Paper-Faced Type X Gypsum Board: All other locations.

END OF SECTION

SECTION 09 29 20
FINISHING GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Finishing of gypsum board (taping and bedding).
2. Accessories indicated, specified, or required to complete installation.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each product.

1.3 QUALITY ASSURANCE

- A. Comply with requirements of GA 216 and ASTM C840.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.5 FIELD CONDITIONS

- A. Environmental Conditions: Establish and maintain environmental conditions for finishing gypsum board to comply with ASTM C840 and with gypsum board manufacturer's recommendations.
- B. Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 JOINT TREATMENT MATERIALS

- A. Material Quality Standard: ASTM C475.

B. Joint Tape:

1. Paper Tape: Nominal 2 inch wide cross-fibered paper tape with finish suitable for bonding, creased in center for easy folding, and compatible with joint compound.
2. Mesh Tape: Nominal 2 inch wide self-adhering 10-by-10 fiberglass mesh tape.

C. Joint Compound:

1. Setting-Type: Job-mixed powder for mixing with water, chemical-hardening compound; includes taping types.
2. Drying-Type: Ready-mixed or job-mixed powder for mixing with water, air-drying, vinyl based compounds; includes taping, topping, and all-purpose types.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 JOINT TREATMENT FINISHING GYPSUM BOARD

- A. Treat gypsum board joints, interior and exterior angles, flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated.
- B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
- C. Gypsum Board: Finish gypsum board to levels indicated below according to ASTM C840 and GA-214:
1. Level 1: Plenum areas above ceilings.
 2. Level 2: Moisture resistant gypsum board used as substrate for ceramic tile.
 3. Level 3: Not Used.
 4. Level 4: Surfaces to receive paint.
 5. Level 5: Not Used.

END OF SECTION

SECTION 09 30 00
TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor, base, and wall tile.
2. Waterproof membrane underlayments.
3. Setting and grouting materials.
4. Accessories indicated, specified, or required to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical product literature for each product indicated.

B. Shop Drawings: Detailed and dimensioned plans and large-scale details indicating locations of movement joints.

C. Samples for Initial Selection: For grout and accessories involving color selection.

D. Samples for Verification:

1. Tile: Full-size units of each type and composition of tile and for each color and finish required.
2. Membranes: 6 inch square.
3. Metal Edge Strips: 6 inch lengths.
4. Assembled Samples: Tile, setting materials, and membranes (if any) mounted on a rigid panel for each type, composition, color, and finish of tile.

E. Certification: Manufacturer's written certification that specified products and materials are suitable for Project applications required.

F. Maintenance Data: For inclusion in maintenance manual required by appropriate Division 01 Section.

1. Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

A. Tile Installer Qualifications:

1. Experience: Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America with minimum 10 years' specialized experience installing work similar to scope of this project and having record of successful in-service performance and completion of projects.
2. Field Supervision: Installer shall maintain a full time supervisor on job site during times specified work is in progress who holds an International Masonry Institute's Foreman Certification and has minimum 10 years' experience similar to type and scope required for this project.

- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of each type of floor tile installation.
 - 2. Build mockup of each type of wall tile installation.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Pre-Installation Conference: Before beginning work of this Section, conduct conference at Project site to comply with requirements of Division 01 Sections.
 - 1. Required Attendees:
 - a. Owner.
 - b. Architect.
 - c. Contractor, including superintendent.
 - d. Tile installer, including supervisor.
 - e. Manufacturer's technical representative.
 - f. Installers of adjacent work, including supervisors.
 - 2. Minimum Agenda: Installer shall demonstrate understanding of Work required by reviewing and discussing procedures for, but not limited to, following:
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Tour representative areas of required Work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of installation and other preparatory Work performed by other installers.
 - c. Review Contract Document requirements.
 - d. Review approved submittals.
 - e. Review mock-up.
 - f. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.
 - g. Review installation procedures, including, but not limited to:
 - 1) Handling, storing and protecting products and materials.
 - 2) Evaluation of substrates on which products will be installed.
 - 3) Review methods and procedures related to installation.
 - h. Review required inspection, testing, certifying, and material usage accounting procedures.
 - i. Review forecasted weather conditions and procedures for coping with unfavorable conditions.
 - 3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.4 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 liquid materials in unopened containers and protected from freezing.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Install tile only when construction in room is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.6 WARRANTY

- A. Special Manufacturer's Warranty for Membranes: Manufacturer's standard form in which manufacturer agrees to repair or replace membranes that fail in materials or workmanship within life of installation from date of Substantial Completion.

1.7 MAINTENANCE

- A. Extra Materials: Furnish that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below and on the Drawings to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."

2.2 TILE PRODUCTS

- A. General: Products that are equivalent to color, texture, pattern, finish, appearance, and material quality characteristics indicated by basis of design selection.
- B. ANSI Ceramic Tile Standard: Provide Standard Grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.3 WATERPROOFING MEMBRANE UNDERLAYMENTS

- A. Product Quality Standard: ANSI A118.10.
- B. Sheet Waterproofing Underlayments for Thin-Set Tile Installations:

1. Chlorinated-Polyethylene-Sheet (CPE) Sheet:
 - a. Sheet: Composite sheet membrane made from an alloy of non-plasticized chlorinated polyethylene sheet with non-woven fiber laminated to both sides.
 - 1) Basis of Design: The Noble Company; Nobleseal TS.
 - b. Adhesive: Wet-set, non-flammable, moisture resistant, inhibits growth of mildew and bacteria.
 - 1) Basis of Design: The Noble Company; NobleBond EXT.
2. Polyethylene Sheet:
 - a. Sheet: Polyethylene sheet with nonwoven, polypropylene fabric on both sides.
 - 1) Basis of Design: Mapei Corporation; Mapeguard WP 200.
 - b. Adhesive: Same thin-set mortar as used for setting tile.
3. Uncoupling Sheet:
 - a. Sheet: Polyethylene sheet with a grid structure of square cavities, each cut back in a dovetail configuration and an anchoring fleece laminate to underside.
 - 1) Basis of Design: Schluter Systems L.P.; Ditra.
 - b. Adhesive: Same thin-set mortar as used for setting tile.
- C. Liquid-Applied Waterproofing Membrane for Thin-Set Tile Installations:
 1. Description: Premixed, quick-drying, liquid rubber.
 2. Basis of Design: Mapei Corporation; Mapelastic AquaDefense.
- D. Accessories: Primers, pre-fabricated corners, seaming cement, sealant and other products as required by application provided by membrane manufacturer.

2.4 SETTING AND GROUTING MATERIALS

- A. Large Heavy Tile (LHT) Cementitious Mortar:
 1. Product Quality Standard: ANSI A118.4HTE, ANSI A118.11, and ANSI A118.15HTE.
 2. Description: Premium polymer modified product.
 - a. For large and heavy tiles (dimension 15 in in any one direction).
 - b. Non-sag capability for wall applications.
 - c. Non-slump capability for floor applications.
 - d. Suitable for bond coats from 3/32 in up to 3/4 in thick.
 3. Basis of Design: Mapei Corporation; Ultraflex LFT.
- B. Thin-Set Cementitious Mortar:
 1. Product Quality Standard: ANSI A118.4 and ANSI A118.11.

2. Description: Professional-grade, single-component, polymer-modified product (no dimension in excess of 15 in in any direction).
3. Basis of Design: Mapei Corporation; Ultraflex 2.

C. Epoxy Grout:

1. Material Quality Standard: ANSI A118.3.
2. Description: Premium product.
 - a. Two component, water-cleanable, 100 percent solids.
 - b. Non-shrink and non-sag capability.
 - c. Efflorescence free.
 - d. Chemical and stain resistant.
 - e. Mold and mildew resistant.
3. Basis of Design: Mapei Corporation; Kerapoxy CQ.

D. Acceptable Manufacturers:

1. Ardex Americas.
2. Bostik, Inc.
3. Custom Building Products.
4. Laticrete International Inc.
5. Mapei Corporation.
6. Merkrete Systems.
7. TEC Specialty Products Inc.

2.5 ACCESSORY MATERIALS

A. Metal Trim:

1. Description: Metal profiles suitable for thin-set application.
2. Basis of Design:
 - a. Wall Outside Corner: Schluter Systems LP; Rondec.
 - b. Wall Inside Corner: Schluter Systems LP; Dilex-AHK.
 - c. Wall Top of Tile: Schluter Systems LP; Rondec.
 - d. Floor to Wall: Schluter Systems LP; Dilex-AHK.
 - e. Flooring Transition to Concrete: Schluter Systems LP; Reno-Ramp.
 - f. Flooring Transition Edge (same thickness): Schluter Systems LP; Schiene.
 - g. Flooring Transition to Carpet: Schluter Systems LP; Reno-TK.
 - h. Flooring Transition to Resilient Floor: Schluter Systems LP; Reno-U.
3. Other Acceptable Manufacturers:
 - a. Blanke Corporation.
 - b. Ceramic Tool Co.
 - c. Custom Building Products.
 - d. Genesis APS International, Inc.
 - e. Laticrete.
 - f. Schluter Systems LP.

B. Movement Joint Materials:

1. Sealant:

- a. Product Quality Standard: ASTM C 920; Type S; Grade NS; Class 25; Uses T1, T2, NT, I, M, G, A, and O.
- b. Generic Type: Mildew-resistant silicone.
- c. Basis of Design: Mapei Corporation; Mapesil T.
- d. Color: As selected by Architect from manufacturer's full range.

2. Foam Backer Rod:

- a. Product Quality Standard: ASTM C 1330, Type B.
- b. Description: As defined by ASTM Terminology C 717, extruded polyethylene, polyurethane, or polyolefin.
- c. Size: Diameter approximately 25 percent larger than joint width, unless otherwise directed by manufacturer.

C. Trowelable Patching Compounds:

- 1. Description: Latex-modified, portland cement-based formulation.
- 2. Basis of Design: Mapei Corporation; Mapecem Quickpatch.

D. Tile Cleaner:

- 1. Description: Neutral cleaner capable of removing soil and residue without harming tile and grout surfaces.
- 2. Basis of Design: Mapei Corporation; UltraCare Concentrated Tile and Grout Cleaner.

2.6 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

- 1. Examine substrates, areas, and conditions to verify actual locations, dimensions, and other conditions affecting performance of the Work.
 - a. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - b. Verify that concrete substrates for tile floors installed with thin set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - 1) Verify that surfaces that received a steel trowel finish have been mechanically scarified.

- 2) Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - c. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - d. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
2. Proceed with installation only after unsatisfactory conditions have been corrected.
 3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Fill cracks, holes, and depressions with trowelable patching compound according to tile-setting material manufacturer's written instructions.
- C. Remove protrusions, bumps, and ridges by sanding or grinding.
- D. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

- A. General: Install underlayment products and setting materials according to manufacturer's written installation instructions.

3.4 WATERPROOFING UNDERLAYMENT INSTALLATION

- A. Installation Quality Standard: ANSI A108.13.
- B. General Requirements:
 1. If required by manufacturer, prime concrete substrate.
 2. Install to produce a continuous waterproof membrane of uniform thickness bonded securely to substrate, without wrinkles, bubbles, buckles or kinks.
 3. Install prefabricated inside and outside corners.
 4. Overlap and seal seams.
 5. Turn membrane up wall at locations where tile is scheduled for wall or base.
 6. Roll installed sheet if required by manufacturer.

3.5 INSTALLATION OF TILE

- A. Installation Standards:
 1. Parts of ANSI A108 Series that apply to types of setting and grouting materials and to methods indicated in installation schedules.
 2. TCNA's "Handbook for Ceramic Tile Installation." Comply with TCNA installation methods indicated in installation schedules.
- B. Tiling Edges:

1. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated.
2. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Lay out tile wainscots to next full tile beyond dimensions indicated.

C. Intersections and Returns:

1. Accurately form.
2. Perform cutting and drilling of tile without marring visible surfaces. Grind cut edges of tile abutting trim, finish, or built-in items.
3. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern:

1. Lay tile in grid pattern, unless otherwise indicated.
2. Align joints when adjoining tiles on floor, base, walls, and trim are same size.
3. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting.
4. Provide uniform joint widths, unless otherwise indicated.

E. Joint Widths: Install tile with joint width as recommended by tile manufacturer.

F. Metal Edge Strips: Install at locations indicated and where exposed edge of tile flooring meets other floor coverings.

G. Movement Joints: Comply with TCNA EJ171 guidelines.

1. Locate movement joints and other sealant-filled joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
2. Locate joints in tile surfaces directly above joints in concrete substrates.
3. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
4. Installation Schedule:
 - a. Expansion Joint: TCNA EJ171C.
 - b. Contraction Joint: TCNA EJ171B.
 - c. Construction Joint: TCNA EJ171A.
 - d. Perimeter Joint: TCNA EJ171G,

H. Tile Cleaner: Clean tile according to manufacturer's written instructions.

3.6 ADJUSTING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

3.7 CLEANING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.9 INSTALLATION SCHEDULE

- A. Concrete Floors of Restrooms and Other Wet Locations:
 1. TCNA F122: Over on-ground concrete floors.
 - a. Epoxy grout.
 - b. Tile and thin-set cementitious mortar.
 - c. Waterproof membrane underlayment.
- B. Walls of Restrooms, Kitchens and Other Wet Locations:
 1. TCNA W244C: Over cement backer board.
 - a. Epoxy grout.
 - b. Tile and thin-set cementitious mortar.
 2. TCNA W245: Over water-resistant glass-mat gypsum board.
 - a. Epoxy grout.
 - b. Tile and thin-set cementitious mortar.

END OF SECTION

SECTION 09 61 39
SEALING CONCRETE FLOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Sealing of interior concrete floors.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for concrete sealer.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

1. Manufacturer: The Euclid Chemical Co.
2. Product: Euco Diamond Hard.

- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."

1. Dayton Superior.
2. The Euclid Chemical Co.
3. Laticrete.
4. W. R. Meadows, Inc.
5. Sika Corp.

2.2 MATERIALS

- A. Concrete Sealer: Clear, water-based liquid consisting of proprietary blend of silicates and silicate polymers that penetrates concrete surfaces and chemically reacts to increase surface density, durability, and abrasion resistance; dust-proofs concrete; USDA compliant.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:

1. Examine substrates to which sealing concrete floors will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 APPLICATION

- A. Apply sealer according to manufacturer's written instructions.

END OF SECTION

SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.
3. Related materials necessary to complete installation.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each type of product indicated, specified, or required.
- B. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.
- C. Maintenance Data: For inclusion in maintenance manual required by appropriate Division 01 Section.
 1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
 2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 1. Critical Radiant Flux Classification: Class I, not less than 0.45 Watt per square centimeter.

1.4 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other manufacturers with products having equivalent

characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

2.2 RESILIENT BASE

- A. Resilient Base Standard: ASTM F1861.
 - 1. Material Requirement: Type TP (rubber, thermoplastic).
 - 2. Manufacturing Method: Group I (solid, homogeneous).
 - 3. Inside and Outside Corners: Job formed.
 - 4. Rolled/coiling products.
- B. Minimum Thickness: 0.125 inch.

2.3 RESILIENT MOLDING ACCESSORY

- A. Material: Rubber.
- B. Profile and Dimensions: As indicated.
- C. Colors and Patterns: Same as resilient base.

2.4 INSTALLATION MATERIALS

- A. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

END OF SECTION

SECTION 09 65 21
RESILIENT PLANK FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luxury vinyl floor tile (planks).
2. Related materials necessary to complete installation.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each type of product indicated, specified, or required.
- B. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- C. Maintenance Data: For inclusion in maintenance manual required by appropriate Division 01 Section.
1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
 2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed tile flooring installations similar in material, design, and extent to that indicated for this Project, who is acceptable to manufacturer, and whose work has resulted in installations with a record of successful in-service performance.
- B. Mock-Ups: Before beginning Work of this Section, build as many mock-ups as required to verify selections made under submittals, to demonstrate constructed product and material qualities, to demonstrate execution of work qualities, and to verify compliance with Contract Documents.
1. Build mock-up approximately 100 sq. ft. for each type, color, and pattern.
 2. Use same Subcontractors, including supervisors, which will perform work on Project.
 3. Install products and materials according to specified requirements of respective Specification Sections.
 4. Work results shall be representative of those to be expected for Work.
 5. Obtain approval from Architect before starting Work of this Section.
 6. Approval does not constitute approval of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.
 7. Subject to compliance with requirements, approved mock-up may become part of the completed Work if undisturbed at time of Substantial Completion. Otherwise, demolish and remove mock-up from Project when directed by Architect.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

1.6 MAINTENANCE

- A. Extra Materials: Furnish extra materials that match products installed and that are packaged with protective coverings for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace floor tile that fails in materials or workmanship within 10 years' from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

2.2 LUXURY VINYL FLOOR TILE

- A. Description: Click-and-lock style plank with AMP polyurethane finish coating, high performance core, and cork granule backing; embossed surface texture; microbeveled.
- B. Product Standard: ASTM F3261, Class I, Type B, Grade 1, Backing Class B.
- C. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- D. Wear Layer Thickness: 20 mils.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

- A. Prepare substrates according to following:
 - 1. ASTM F710.
 - 2. Manufacturer's written installation instructions.
- B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
- C. Prepare substrates to comply with flatness tolerance of 1/4 inch in 10 foot as follows:
 - 1. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
 - 2. Remove concrete protrusions, bumps, and ridges by sanding or grinding.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's installation instructions for installing floor tile.

- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor 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 floor tiles parallel with room axis.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged if so numbered.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Do not wash floor until after waiting period recommended in writing by flooring manufacturer.
 - 4. Damp mop floor to remove marks and soil using method and cleaner recommended in writing by flooring manufacturer.

3.5 PROTECTION

- A. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- B. Do not move heavy or sharp objects directly over floor surfaces. Place hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- C. Cover floor tile until Substantial Completion.

END OF SECTION

SECTION 09 68 13
TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modular carpet tile.
2. Related materials necessary to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

1. Include manufacturer's written installation instructions.

B. Samples for Verification: Full size Sample for each color and pattern of carpet tile required.

C. Maintenance Data: For inclusion in maintenance manual required by Division 01.

1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Certified by Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104.

1.5 PROJECT CONDITIONS

A. General: Comply with CRI 104.

1.6 WARRANTY

A. Special Manufacturer's Warranty: Standard form in which manufacturer agrees to replace carpet tile that does not comply with requirements or that fails within 10 years from date of substantial completion. Warranty does not include deterioration or failure of carpet tile from unusual traffic, failure of substrate, vandalism, or abuse.

B. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

1.7 MAINTENANCE

A. Extra Materials: Furnish extra materials equal to 5 percent of amount installed for each type

indicated, but not less than 5 sq yd that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and does not change concept expressed in Contract Documents as judged by Architect.

2.2 RELATED MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Manufacturer's standard, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine substrates to which carpet tile will be applied for compliance with requirements and other conditions affecting performance.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting Work within a particular area will be construed as acceptance of surface conditions.
- B. Verify that finishes of substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.

3.2 PREPARATION

- A. Moisture Vapor Emission Control: Evaluate concrete floors according to Division 09 Section "Moisture Vapor Emission Control" and apply MVE-control system on areas that do not comply with specified requirements.
- B. Prepare substrates according to manufacturer's written instructions.
- C. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

- D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- E. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.3 INSTALLATION

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
 - 1. CRI 104.
 - 2. Respective manufacturer's installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by manufacturer.
- E. Extend into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

3.4 CLEANING

- A. Comply with manufacturer's written instructions for cleaning and protection.
- B. Perform following operations immediately after completing installation:
 - 1. Remove adhesive and other blemishes.
 - 2. Sweep and vacuum thoroughly.

3.5 PROTECTION

- A. Protect from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- B. Cover until substantial completion.

END OF SECTION

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Surface preparation and field painting of exposed exterior and interior surfaces.

1.2 SUBMITTALS

- A. Product Data: Manufacturers technical literature for each paint system indicated, specified, or required.
1. Indicate each material and cross-reference specific coating, finish system, and application.
 2. Identify each material by manufacturer's catalog number and general classification.
 3. Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. Detailed Painting Schedule:
1. Furnish "Detailed Painting Schedule" indicating type of surface, type of paint material, and number of coats required, as set forth in "Painting Requirements".
 2. Submit brand designation and grade of indicated type produced by approved manufacturer for each application listed or required.
- C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate, 8 by 10 inches.
1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review.
 2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.

1.3 QUALITY ASSURANCE

- A. Applicator Qualifications: Company with not less than 5 years' experience in performing specified work similar in design, products, and extent indicated for this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.
- B. Mockups: Before work of this Section begins, apply coatings to demonstrate product and material qualities, to demonstrate execution of work qualities, and to verify compliance with Contract Documents. Duplicate finish of approved Sample Submittals.
1. Apply paint to following substrates:
 - a. Wall Surfaces: Apply coating on approximately 48 inch square substrate.
 - b. Linear Items: Apply coating on approximately 48 inch long substrate.
 2. Use same Subcontractors, including supervisors, which will perform work on Project.
 3. Install products according to specified requirements.
 4. Work shall be representative of those to be expected for work.
 5. Obtain approval from Architect before starting work of this Section.

6. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-up unless Architect specifically approves such deviations in writing.
7. Subject to compliance with requirements, approved mock-up may become part of the completed Work if undisturbed at time of Substantial Completion.
8. Final approval of colors will be from mockups.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature recommended by manufacturer. Maintain storage containers in a clean condition, free of foreign materials and residue.

1.5 FIELD CONDITIONS

- A. Apply paints only when temperatures of surfaces to be painted and surrounding air are between minimum and maximum range recommended by manufacturer.
- B. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces unless otherwise permitted by manufacturer's printed instructions.
- C. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature and humidity limits specified by manufacturer during application and drying periods.

1.6 MAINTENANCE

- A. Extra Materials: Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
 1. Quantity: Furnish the Owner with an additional 3 percent, but not less than 1 gallon or 1 case, as appropriate, of each material and color applied.
 2. Label each container with color, color number, and texture in addition to manufacturer's label.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products manufactured by Sherwin-Williams Co. listed under PART 3 below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 1. Benjamin Moore & Co.
 2. PPG Paints.

3. Sherwin-Williams.

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other listed acceptable manufacturers.
- C. Colors: As indicated on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 1. Examine substrates to receive paint and associated Work for compliance with requirements and other conditions affecting performance.
 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 3. Starting Work within a particular area will be construed as acceptance of surface conditions.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to shop applicators to ensure use of compatible primers.

3.2 PREPARATION

- A. General:
 1. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted.
 2. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
 3. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Surface Preparation: Prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition. Clean substrates of substances that could impair the bond of the various coatings.
 1. Gypsum Board: Comply with Gypsum Association Publication GA 232.
 - a. Fill remaining cracks, depressions, holes and other irregularities with spackling compound.
 - b. Sand rough or high spots left by joint cement or spackling compound without damaging paper face.
 - c. Remove dust by wiping with damp cloths or vacuuming.

2. Ungalvanized Metal Surfaces:

- a. Clean surfaces that have not been shop coated to remove foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
- b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

3. Galvanized Metal Surfaces:

- a. Clean galvanized surfaces free of oil and surface contaminants.
- b. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

3.3 MATERIAL PREPARATION

- A. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Use only thinners approved by paint manufacturer and only within manufacturer's recommended limits.
- B. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.4 APPLICATION, GENERAL

- A. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 1. Prefinished items include the following factory-finished components:
 - a. Prefinished wood doors.
 - b. Acoustical materials.
 - c. Prefinished architectural woodwork and cabinets.
 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Furred areas.
 - b. Ceiling plenums.
 - c. Pipe spaces.
 3. Finished metal surfaces.

4. Finished mechanical and electrical operating equipment.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

3.5 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces.
 5. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 9. Sand lightly between each succeeding enamel coat on metals.
 10. Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation.
 11. Number of coats and film thickness required are the same regardless of application method.
 12. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
 13. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 14. Omit primer over metal surfaces that have been shop primed and touchup painted.
 15. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
 16. Ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 17. Allow sufficient time between successive coats to permit proper drying.
- B. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve total dry film thickness of the entire system as recommended by manufacturer.
- C. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- D. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- E. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.6 ADJUSTING

- A. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 CLEANING

- A. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.8 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repainting, repairing or replacing. Coordinate corrections with other trades involved.

3.9 INTERIOR PAINT SCHEDULE

- A. Gypsum Board Walls - Latex - Eg-shel:

1. 1st Coat: Sherwin Williams; ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
2. 2nd Coat: Sherwin Williams; ProMar 200 Zero VOC Interior Latex - Low Gloss Eg-Shel, B41-2600.
3. 3rd Coat: Sherwin Williams; ProMar 200 Zero VOC Interior Latex - Low Gloss Eg-Shel, B41-2600.

- B. Gypsum Board Ceilings - Latex - Flat:

1. 1st Coat: Sherwin Williams; ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
2. 2nd Coat: Sherwin Williams; ProMar 200 Zero VOC Latex Flat, B30-2600.
3. 3rd Coat: Sherwin Williams; ProMar 200 Zero VOC Latex Flat, B30-2600.

- C. Ferrous Metal - Acrylic - Semi-Gloss:

1. 1st Coat: Sherwin Williams; ProCryl Universal Metal Primer, B66-1300.
2. 2nd Coat: Sherwin Williams; Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650.
3. 3rd Coat: Sherwin Williams; Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650.

- D. Primed Overhead Ferrous Metal Structure - Acrylic Dryfall - Flat:

1. First Coat: Primer applied in fabrications shop.
2. Second Coat: Sherwin Williams; Pro Industrial Waterborne Acrylic Dryfall Flat, B42W82.
3. Third Coat: Sherwin Williams; Pro Industrial Waterborne Acrylic Dryfall Flat, B42W82.

3.10 EXTERIOR PAINT SCHEDULE

- A. As specified in Division 09 Section "Exterior Steel Coatings."

END OF SECTION

SECTION 09 97 13
EXTERIOR STEEL COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Surface preparation and field application of high performance coatings to exterior metal surfaces.

1.2 SUBMITTALS

- A. Product Data: Manufacturers technical literature for each paint system indicated, specified, or required.
1. Indicate each material and cross-reference specific coating, finish system, and application.
 2. Identify each material by manufacturer's catalog number and general classification.
 3. Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- A. Samples for Verification: For each color on representative samples of the actual substrate, 8 by 10 inches.
1. Provide stepped Samples, defining each separate coat, including primers. Use representative colors when preparing Samples for review.
 2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.

1.3 QUALITY ASSURANCE

- A. Applicator Qualifications: Company with not less than 5 years' experience in performing specified work similar in design, products, and extent indicated for this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.
- B. Mockup: Before work of this Section begins, apply coatings to demonstrate product and material qualities, to demonstrate execution of work qualities, and to verify compliance with Contract Documents. Duplicate finish of approved Sample Submittals.
1. Apply coating on approximately 48 inch square or 48 inch long substrate.
 2. Use same Subcontractors, including supervisors, which will perform work on Project.
 3. Install products according to specified requirements.
 4. Work shall be representative of those to be expected for work.
 5. Obtain approval from Architect before starting work of this Section.
 6. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-up unless Architect specifically approves such deviations in writing.
 7. Subject to compliance with requirements, approved mock-up may become part of the completed Work if undisturbed at time of Substantial Completion.
 8. Final approval of colors will be from mockups.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature recommended by manufacturer. Maintain storage containers in a clean condition, free of foreign materials and residue.

1.5 FIELD CONDITIONS

- A. Apply coatings only when temperatures of surfaces to be coated and surrounding air are between minimum and maximum range recommended by manufacturer.
- B. Do not apply coatings in snow, rain, fog or mist, or when the relative humidity exceeds 85 percent, or at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

1.6 MAINTENANCE

- A. Extra Materials: Furnish extra elastomeric coating materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
 - 1. Quantity: Furnish an additional 3 percent, but not less than 1 gallon or 1 case, as appropriate, of each material and color applied.
 - 2. Label each container with color, color number, texture, in addition to manufacturer's label.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products manufactured by Sherwin-Williams Protective and Marine Coatings listed under PART 3 below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 - 1. Carboline Company.
 - 2. PPG Protective and Marine Coatings.
 - 3. Sherwin-Williams Protective and Marine Coatings.
 - 4. Tnemec Company.

2.2 COATING MATERIALS, GENERAL

- A. Colors: As indicated on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces:
 - 1. Examine substrates to receive coatings and associated Work for compliance with requirements and other conditions affecting performance.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying

with Contract Documents.

3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 SHOP PREPARATION

- A. Comply with manufacturer's written instructions and recommendations for surface preparation.
- B. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."

3.3 FIELD PREPARATION

- A. Comply with manufacturer's written instructions and recommendations for surface preparation.
- B. Clean substrates of substances that could impair bond of coating, including dirt, oil, grease, and encapsulants.
- C. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- D. Galvanized-Steel Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.4 MATERIAL PREPARATION

- A. Material Preparation: Mix and prepare coating materials according to manufacturer's written instructions.
 1. Maintain containers used in mixing and applying coating in a clean condition, free of foreign materials and residue.
 2. Use only thinners approved by coating manufacturer and only within manufacturer's recommended limits.
- B. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.5 APPLICATION

- A. Application Procedures:
 1. Apply coatings by brush, roller, or spray according to manufacturer's directions. Wherever spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up film thickness of 2 coats in one pass, unless recommended by manufacturer.
 2. Number of coats and film thickness required is same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with manufacturer's directions.
 3. Apply each coating at not thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of entire system as recommended by the manufacturer.

4. Do not coat over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 5. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, ridges, waves, bubbles, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- B. Base Coat: Steel fabrication shop apply to thickness recommended by manufacturer.
- C. Second Coat: Field apply to thickness recommended by manufacturer.
- D. Top Coat: Field apply to thickness recommended by manufacturer matching approved samples for color, texture and coverage. Remove, refinish or re-coat work not in compliance with specified requirements.
- 3.6 ADJUSTING
- A. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.
- 3.7 CLEANING
- A. After completing coating application, clean spattered surfaces. Remove spattered coating by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- 3.8 PROTECTION
- A. Protect work of other trades against damage from coating application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition. Coordinate corrections with other trades involved.
- 3.9 EXTERIOR COATING SCHEDULE
- A. Galvanized Ferrous Metal - Acrylic Polyurethane - Semi-Gloss:
1. Base Coat: Sherwin Williams; Macropoxy 646 Fast Cure Epoxy, B58B600; applied at steel fabrication shop.
 2. Second Coat: Sherwin Williams; Acrolon 218 HS Acrylic Polyurethane, B65-650.
 3. Third Coat: Sherwin Williams; Acrolon 218 HS Acrylic Polyurethane, B65-650.
- B. Ferrous Metal - Acrylic Polyurethane - Semi-Gloss:
1. Base Coat: Sherwin Williams; Macropoxy 646 Fast Cure Epoxy, B58B600; applied at steel fabrication shop.
 2. Second Coat: Sherwin Williams; Acrolon 218 HS Acrylic Polyurethane, B65-650.
 3. Third Coat: Sherwin Williams; Acrolon 218 HS Acrylic Polyurethane, B65-650.

END OF SECTION

SECTION 10 21 16
SHOWER ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured acrylic / glass fiber shower units.
2. Related materials necessary to complete the installation.

0.1 SUBMITTALS

- . Product Data: Manufacturer's technical product literature for each type of product indicated, required, or specified.

1. Include manufacturer's standard details, dimensions of shower units.
2. Include locations of accessories.
4. Include methods of installation and support, relation to work of other trades.

- A. Samples for Verification Purposes: Submit in form of 12 inch square sample showing color of cast acrylic material selected.

- B. Maintenance Data: For inclusion in operation and maintenance manual required by Division 01, submit in the form of manufacturer's printed instructions for cleaning and maintaining solid surfacing material.

0.2 WARRANTY

- A. Manufacturer's Extended Warranty: Submit written warranty on labor and material executed by manufacturer, covering failure of solid surfacing material within 5 years of date of substantial completion.

PART 1 - PRODUCTS

1.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

1. Manufacturer: Aquatic / Lasco Bathware.
2. Product: 1363BFSCST.

2.3 SHOWER UNIT MATERIALS AND COMPONENTS

- A. Description: Unit manufactured with an acrylic exposed face surfaces and glass fiber reinforcing shell on concealed faces surfaces, with predrilled and factory installed accessories.

1. Exposed Face: Single sheet of cast acrylic, nominal 0.060 inch thickness, vacuum formed into the required shape and configuration in full surface contact molds; seams and joints are not permitted; acrylic material shall be monolithic color and shall contain an antibacterial additive; with following features:

- a. Floor edge complying with accessibility requirements; no interior curb.
 - b. Molded soap shelf.
 - c. Center floor drain location.
 - d. Slip resistant, textured floor bottom.
- 2. Concealed Face: Reinforce entire back surface of acrylic with factory-applied chopped strand sprayed glass fiber laminate, nominal 0.125 inch thickness; also, include additional wood material at accessory locations to provide reinforcement for attachment of accessories.
- 3. Accessories:
 - a. Curtain Rod: One inch diameter stainless steel tube.
 - b. Grab Bar: 1-1/2 inch diameter, horizontal L-shaped with peened finish, and with concealed flanges.
 - c. Plumbing Fittings: Packaged assembly composed of the following:
 - 1) Lever style handle shower valve with temperature indicator; adjustable hot water limit stop; pressure balancing mechanism to maintain discharge temperature; nonferrous/nonmetallic and stainless steel internal components.
 - 2) Removable hand-held shower head attached to flexible hose mounted to a 30 inch long vertical slide bar; chrome plated metal construction; pressure balancing cycle valve design; drop ell, wall bracket, vacuum breaker.
 - 3) Vandal resistant and corrosion resistant exposed fasteners.
 - d. Drain: Removable stainless steel strainer, caulkless brass compression fitting body.

2.3 RELATED MATERIALS

- A. Fasteners and Anchors: Corrosion resistant metal screws selected for type and size suitable for conditions.

PART 2 - EXECUTION

2.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

2.2 PREPARATION

- A. Prepare substrate surfaces and plumbing service to insure proper and adequate installation in accordance with manufacturer's requirements.

2.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Set shower units in place and anchor to adjacent walls.

3.4 PROTECTION

- A. Protect shower units against mars, marks, indentations, and other damage from construction operations during remainder of construction period. Use protection methods recommended by manufacturer.

END OF SECTION

SECTION 10 22 13
WIRE MESH PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Standard duty woven wire mesh partitions and supplementary items necessary to complete their installation.
- B. Lock cylinders are specified in Division 08 Section "Door Hardware."

1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wire mesh items.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: 12 by 12 inch panel constructed of specified frame members and wire mesh. Show color and method of finishing members at intersections.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company with not less than 10 years' experience in producing products and materials similar in design and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.
- B. Installer Qualifications: Entity with not less than 5 years' experience in performing specified work similar in design, products, and extent indicated for this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.

1.4 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of construction contiguous with wire mesh items by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish location dimensions and proceed with fabricating wire mesh items without field measurements. Coordinate construction to ensure that actual location dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 - 1. Acorn Wire and Iron Works, Inc.
 - 2. California Wire Products Corp.

3. The G-S Company.
4. Indiana Wire Products, Inc.
5. Kentucky Metal Products Co.
6. Lakeside Wire and Iron Co.
7. Miller Wire Works, Inc.
8. Wire and Iron Products, Inc.

2.2 MATERIALS

- A. Steel Wire: ASTM A510.
- B. Steel Plates, Channels, Angles, and Bars: ASTM A36.
- C. Cold-Rolled Steel Sheet: ASTM A1008, Commercial Steel (CS), Type B.
- D. Steel Pipe: ASTM A53, Schedule 40, unless another weight is indicated or required by structural loads.
- E. Square Steel Tubing: Cold-formed structural-steel tubing, ASTM A500.
- F. Metallic-Coated Steel Sheet: ASTM A653, Commercial Steel (CS), Type B; with G60 zinc (galvanized) or A60 zinc-iron-alloy (galvannealed) coating designation.
- G. Panel-to-Panel Fasteners: Manufacturer's standard steel bolts.
- H. Postinstalled Expansion Anchors in Concrete: With capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.
 1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5 for Class SC 1 service condition (mild).
 2. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
 3. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.3 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.4 STANDARD-DUTY WIRE MESH PARTITIONS

- A. Mesh: 0.135 inch diameter, intermediate-crimp steel wire woven into 1-1/2 inch diamond mesh.
- B. Vertical Panel Framing: 1-1/4 by 5/8 by 0.0966 inch cold-rolled, C-shaped steel channels with 1/4 inch diameter bolt holes spaced not more than 18 inches o.c. along center of framing.
- C. Horizontal Panel Framing: 1 by 1/2 by 1/8 inch cold-rolled steel channels.
- D. Horizontal Panel Stiffeners: 1 by 1/2 by 1/8 inch cold-rolled steel channels with wire woven through, or two 1 by 3/8 by 1/8 inch cold-rolled steel channels bolted or riveted toe to toe through mesh.

- E. Top Capping Bars: 2-1/4 by 1 inch cold-rolled steel channels.
- F. Posts for 90-Degree Corners: 1-1/4 by 1-1/4 by 1/8 inch steel angles with 1/4 inch diameter bolt holes aligning with bolt holes in vertical framing; with floor anchor clips.
- G. Posts for Other Than 90 Degree Corners: Manufacturer's standard steel pipe or tubing with 1/4 inch diameter bolt holes aligning with bolt holes in vertical framing.
 - 1. Partitions Up to 12 Feet High: 1-1/4 inch OD.
 - 2. Partitions Up to 20 Feet High: 2-1/2 inch OD.
- H. Adjustable Corner Posts: Two, manufacturer's standard steel pipe or tubing posts connected by steel hinges at 36 inches o.c. attached to posts; with 1/4 inch diameter bolt holes aligning with bolt holes in vertical framing.
- I. Line Posts: 3 inch by 4.1 lb or 3-1/2 by 1-1/4 by 0.1265-inch steel channels; with 5 by 18 by 1/4 inch steel base plates punched for attachment to floor.
- J. Three- and Four-Way Intersection Posts: 1-1/4 by 1-1/4 inch tubular steel, with 1/4 inch diameter bolt holes aligned for bolting to adjacent panels.
- K. Floor Shoes: Steel, cast iron, or cast aluminum, 2 inches high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.
- L. Swinging Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/4 by 1/2 by 1/8 inch steel channels or C-channels, banded with 1-1/4 by 1/8 inch flat steel bar cover plates on 3 sides, and with 1/8 inch thick angle strike bar and cover on strike jamb.
 - 1. Hinges: Full-surface type, 3 by 3 inch steel, 1-1/2 pairs per door; bolted, riveted, or welded to door and jamb framing.
 - 2. Cylinder Lock: Mortise type with cylinder specified in Division 08 Section "Door Hardware" operated by key outside and recessed knob inside.
- M. Accessories:
 - 1. Sheet Metal Wainscot: 0.0598 inch thick, cold-rolled steel sheet.
 - 2. Adjustable Filler Panels: 0.0598 inch thick, cold-rolled steel sheet; capable of filling openings from 2 to 12 inches.
 - 3. Wall Clips: Manufacturer's standard, cold-rolled steel sheet; allowing up to 1 inch of adjustment.
- N. Finishes for Interior Locations: Shop primed with shop coat enamel finish.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.5 FABRICATION

- A. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-size components as recommended by wire mesh item manufacturer. Provide bolts, hardware, and accessories as required for complete installation.
 - 1. Fabricate wire mesh items to be readily disassembled.
 - 2. Welding: Weld corner joints of framing and grind smooth, leaving no evidence of joint.

- B. Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.
 - 1. Mesh: Securely clinch mesh to framing.
 - 2. Framing: Fabricate framing with mortise and tenon corner construction.
 - a. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.
 - b. Fabricate intersections using intersection posts or manufacturer's standard connecting clips and fasteners.
 - c. Fabricate partition and door framing with slotted holes for connecting adjacent panels.
 - 3. Fabricate wire mesh partitions with 3 inches of clear space between finished floor and bottom horizontal framing.
 - 4. Doors: Align bottom of door with bottom of adjacent panels.
 - a. For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.
 - 5. Hardware Preparation: Mortise, reinforce, drill, and tap doors and framing as required to install hardware.

2.6 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish wire mesh items after assembly.
 - 2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Galvanizing: Where indicated, hot-dip galvanize wire mesh items to comply with ASTM A 123. Hot-dip galvanize hardware for hot-dip galvanized wire mesh items to comply with ASTM A 153.
 - 1. Preparation for Shop Priming: After galvanizing, thoroughly clean wire mesh items of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.
- C. Preparation for Shop Priming Nongalvanized Surfaces: Prepare nongalvanized surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed wire mesh items:
 - 1. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to uncoated surfaces of wire mesh items, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
- E. Interior Shop Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard one-coat, shop-coat finish. Comply with paint manufacturer's written instructions for applying and curing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to which wire mesh partitions and associated work will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Anchor wire mesh partitions to floor with postinstalled expansion anchors through floor shoes located at each post and corner. Adjust wire mesh partition posts in floor shoes to achieve level and plumb installation.

1. Anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated on Shop Drawings.

B. Anchor wire mesh partitions to walls at 12 inches o.c. through back corner panel framing and as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

C. Secure top capping bars to top framing channels with 1/4 inch diameter "U" bolts spaced not more than 28 inches o.c.

D. Provide line posts at locations indicated or, if not indicated, as follows:

1. On each side of sliding door openings.
2. For partitions that are 7 to 9 feet high, spaced at 15 to 20 feet o.c.
3. For partitions that are 10 to 12 feet high, located between every other panel.
4. For partitions that are more than 12 feet high, located between each panel.

E. Accessories:

1. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.
2. Install doors complete with door hardware.
3. Weld or bolt sheet metal wainscot wire mesh partitions where indicated.
4. Bolt accessories to wire mesh partition framing.

3.3 ADJUSTING AND CLEANING

- A. Adjust doors to operate easily without binding.
- B. Check and readjust operating hardware items just before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work including doors and framing that are warped, bowed, or otherwise unacceptable.
- C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint; paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION

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SECTION 10 28 13
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Toilet accessories and other accessories necessary to complete installation.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product or component indicated, specified, or required.
1. Include construction details and dimensions.
 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 3. Include material and finish descriptions.
 4. Include manufacturer's warranty.
- B. Maintenance Data: For inclusion in maintenance manual required by the appropriate Division 01 Section.
1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
 2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.4 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
- B. Other Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Sections.

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031 inch minimum nominal thickness, unless otherwise indicated.
- B. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- C. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear glass mirrors, nominal 6.0 mm thick.
- D. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper- and theft-resistant where exposed, and of galvanized steel where concealed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer.
- B. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- C. Install grab bars to withstand a downward load of at least 250 lbf when tested according to ASTM F 446.
- D. Install accessories tight to the wall and seal with sealant.

3.3 ADJUSTING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.

3.4 CLEANING

- A. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 10 43 13 DEFIBRILLATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Automated external defibrillator cabinets.
2. Automated external defibrillators (AED).
3. Related materials necessary to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical product literature for each type of product indicated, specified, or required.

1. Cabinets: Show door hardware, cabinet type, trim style, and panel style.
2. Automated External Defibrillators: Manufacturer's technical literature.

B. Shop Drawings: For cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include roughing-in dimensions and details showing recessed mounting method and relationships of box and trim to surrounding construction.

C. Manufacturer's Special Warranty: Sample of unexecuted warranty stating obligations, remedies, limitations, and exclusions.

D. Maintenance Data: For cabinets and automated external defibrillators to include in maintenance manuals.

1.3 WARRANTY

A. Manufacturer's Special Warranty: Standard form in which manufacturer agrees to repair or replace automated external defibrillators that fail in materials or workmanship within specified warranty period from date of Substantial Completion.

1. Defibrillator Device: Not less than 7 years.
2. Battery Pack: Not less than 4 years.
3. Pads: Not less than 2 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."

1. Cardiac Science.
2. J. L. Industries, Inc.
3. Thomas Products.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:

1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. General: Install cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

3.3 ADJUSTING AND CLEANING

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

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire protection cabinets.
2. Portable fire extinguishers
3. Related materials necessary for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

1. Cabinets: Roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Fire Extinguishers: Rating and classification, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Manufacturer's Special Warranty: Sample of unexecuted warranty stating obligations, remedies, limitations, and exclusions.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10.

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

1.4 WARRANTY

A. Special Manufacturer's Warranty: Standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fails in materials or workmanship within 6 years from date of Substantial Completion.

B. Failures include, but are not limited to, the following:

1. Failure of hydrostatic test according to NFPA 10.
2. Faulty operation of valves or release levers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 - 1. Babcock Davis.
 - 2. JL Industries.
 - 3. Larsen's Manufacturing Company.
 - 4. Nystrom Building Products.
 - 5. Potter Roemer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.3 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. General: Type, size, and capacity for each fire protection cabinet indicated.
 - 1. Valves: Manufacturer's standard.
 - 2. Handles and Levers: Manufacturer's standard.
 - 3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- B. Located at Fire Protection Cabinets: Type and capacity indicated on the Drawings.

2.4 FIRE PROTECTION CABINETS

- A. Type: Nonrated, suitable for fire extinguisher and wall construction.
- B. Cabinet and Door Material: Stainless steel; ASTM A666, Type 304.
 - 1. Finish: ASTM A480 No. 4 directional satin finish.
- C. Cabinet and Door Material: Cold-rolled steel; ASTM A1008, Commercial Steel (CS), Type B.
 - 1. Factory Painted: AAMA 2603; baked enamel or powder-coat finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color of Tub: White.
 - b. Color of Door and Trim: As selected by Architect from manufacturer's standard colors.
 - 2. Factory Primed Door and Trim: Manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
- D. Recessed Mounted Cabinets: Tub fully recessed; one-piece combination steel flat trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall

return at outer edge (backbend) of 1/4 to 5/16 inch.

- E. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Projecting door pull and friction latch.
 - 2. Continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

2.5 FIRE PROTECTION CABINETS - EXTERIOR

- A. Type: Nonrated, weather resistant, suitable for fire extinguisher; removable cover.
- B. Material: Injection-molded ABS plastic; ultraviolet light resistant; red.
- C. Mounting: Surface.
- D. Door Hardware: Brass padlock with keys.

2.6 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated.

2.7 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Provide factory-drilled mounting holes.
 - 3. Prepare doors and frames to receive locks.
 - 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 1. Fabricate door frames with tubular stiles and rails and hollow metal design, minimum 1/2 inch thick.
 - 2. Fabricate door frames of one-piece construction with edges flanged.
 - 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine substrates to receive fire protection specialties and associated Work for compliance with requirements and other conditions affecting performance.

- a. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fasten cabinets to structure square, level and plumb.

3.3 ADJUSTING

- A. 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.

END OF SECTION

SECTION 10 44 63
FIREMAN'S KEY KEEPER

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.
 - 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on manufacturer and product named below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and does not change concept as expressed in Contract Documents as judged by Architect.
 - 1. Manufacturer: Knox Company.
 - 2. Product: 3200 Series Knox-Box.

2.2 COMPONENT CONSTRUCTION

- A. Key Cabinet: Recessed 1/4 inch thick steel plate housing with 1/2 inch thick steel plate hinged door with interior gasket seal and stainless steel door hinge; 1/8 inch thick stainless steel dust cover with tamper seal mounting capability; 4 inches high by 5 inches wide by 3-3/4 inches deep; UL listed double action lock with rotating tumblers and hardened steel pins accessed by a biased cut key; black powder coated finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine substrates to which fireman's key keeper will be installed for compliance with requirements, installation tolerances and other conditions affecting performance.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Set accurately in position and attach securely to supports with mechanical noncorrosive fasteners.

END OF SECTION

SECTION 10 56 23
STORAGE SHELVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Free-standing storage shelving units.
 - 2. Related materials necessary to complete installation.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each type of product indicated, specified, or required.
- B. Shop Drawings: Drawings prepared specifically for this project; show dimensions of shelving and attachment to substrates.
- C. Selection Samples: For each color selection required, submit color chips representing manufacturer's full range of available colors and finish.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.
- C. Store flat to prevent warpage and bending.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

PART 3- EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:

1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PROTECTION

- A. Touch-up, repair, or replace damaged products before Substantial Completion in a manner that eliminates evidence of replacement.

END OF SECTION

SECTION 10 73 19
ALUMINUM CANOPIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Design-build, pre-engineered, pre-finished exterior aluminum canopies that are suspended from building.
2. Related materials necessary to complete installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Document Concept: Drawings and Specifications express concept of aluminum canopies work, however, they may not indicate or specify total work that may be required, nor shall they be construed as engineered.
- B. Delegated Engineering Responsibility: Require manufacturer to employ a delegated engineering professional to provide engineering for each member and component of aluminum canopies work, including attachment to building structural frame, required to meet concept expressed in Contract Documents that includes, but is not limited to, following:
1. Comprehensive engineering analysis indicating location, type, magnitude, and direction of loads imposed on exterior wall and building structural frame.
 2. Preparation of engineering calculations, shop drawings, and other submittals.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product or component indicated, specified, or required.
- B. Shop Drawings: Detailed and dimensioned plans, elevations, sections, details, and attachment details; distinguish between shop- and field-assembled work.
- C. Samples for Verification: For each type of exposed finish required.
- D. Delegated Engineering Submittal: Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company with not less than 5 years' experience in performing specified work similar in design, products, and extent indicated for this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.
- B. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installations similar to this Project, and, that has a record of successful in-service performance.
- C. Product Quality Standard: ASTM E2950.

1.5 WARRANTY

- A. Special Manufacturer's Finish Warranty, Factory-Applied Spray Paint Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied spray paint finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 - 1. Architectural Fabrications.
 - 2. Avadek.
 - 3. Canopy Solutions.
 - 4. DAC Awnings.
 - 5. Dittmer.
 - 6. East Texas Canopies.
 - 7. Helios Aluminum Canopies.
 - 8. Mapes Architectural Canopies.
 - 9. Mitchell Metals.
 - 10. Perfection Architectural Systems, Inc.
 - 11. Porter Corp.
 - 12. Rusco Custom Canopies.
 - 13. Tudelu Holdings, LLC
 - 14. Upside Innovations, LLC.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extruded Shapes: ASTM B 221, 6063 alloy, T-6 temper.

2.3 COMPONENTS

- A. Hangers: Aluminum tube with aluminum mounting brackets.
- B. Beams: Open top aluminum tubular extrusions.
- C. Deck: Rigid-roll-lock extruded aluminum, self-flashing, interlocking sections.
 - 1. Provide welded endplate water dams where sections terminate at other than drainage channels.

- D. Fascia: Manufacturer's standard extruded aluminum fascia sections as shown on drawings and as required to complete the installation resulting in a neat finished appearance.

- 1. Include manufacturer's standard extruded aluminum gutters.

2.4 FASTENERS

- A. Fasteners: Stainless steel screws of type and size required, sufficient to properly attach or anchor specified item to substrate indicated without failure; concealed where possible.

- B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

- C. Post-Installed Anchors:

- 1. Type: Torque-controlled expansion anchors.
 - 2. Material: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 FABRICATION

- A. Where practical, fit and assemble devices in manufacturer's plant.

- B. Fabricate aluminum components that, when mechanically assembled, have the following characteristics:

- 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Fasteners that are concealed from view to greatest extent possible.

2.6 ALUMINUM FINISHES

- A. Finish Quality Standards: In addition to standards specified elsewhere, perform work according to following, unless otherwise specified:

- 1. NAAMM's Metal Finishes Manual.
 - 2. AA's DAF-45 Designation Systems for Aluminum Finishes.

- B. Appearance of Finished Work:

- 1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one half of range of approved submittal samples.
 - 2. Noticeable variations in same piece are not acceptable.
 - 3. Variations in appearance of other components are acceptable if they are within range of approved submittal samples and they are assembled or installed to minimize contrast as determined by Architect.

- C. Aluminum - Sprayed Fluoropolymer Aluminum Finish: AAMA 2605, AA-C12C42R1x.

- 1. Two Coat Opaque Finish: Fluoropolymer finish containing not less than 70 percent Kynar or Hylar polyvinylidene fluoride (PVDF) resin by weight in color coat.
 - 2. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3. Color: As selected by Architect from manufacturer's full range.
 - 4. Acceptable Resin Manufacturers and Products:

- a. AkzoNobel Coatings, Inc.; Trinar.
- b. Arkema Englebert Inc.; Kynar 500.
- c. Ausimont USA, Inc.; Hylar 5000.
- d. Morton International; Fluoroceram.
- e. PPG Industries Inc.; Duranar.
- f. Valspar Corporation; Fluoropon.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

- 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
- 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. General:

- 1. Comply with manufacturer's written instructions.
- 2. Do not install damaged components.
- 3. Fit joints to produce hairline joints free of burrs and distortion.
- 4. Rigidly secure joints.

B. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

C. Anchoring to In-Place Construction: Use fasteners, fittings, hardware, and installation accessories where necessary for securing aluminum canopies to building and for properly transferring load to in-place construction.

3.3 ADJUSTING

A. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 10 73 23
ALUMINUM CAR SHELTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Engineered, pre-finished aluminum car shelters.
2. Related materials necessary to complete installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Document Concept: Drawings and Specifications express concept of car shelter work, however, they may not indicate or specify total work that may be required, nor shall they be construed as engineered.
- B. Delegated Engineering Responsibility: Require manufacturer to employ a delegated engineering professional to provide engineering for each member and component of car shelter work, required to meet concept expressed in Contract Documents that includes, but is not limited to, following:
1. Comprehensive engineering analysis.
 2. Preparation of engineering calculations, shop drawings, and other submittals.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each product indicated, specified, or required.
- B. Shop Drawings: Detailed and dimensioned plans, elevations, large-scale details of exterior aluminum canopy. Distinguish between shop- and field-assembled work.
1. Include fully dimensioned layout, showing details of conditions, including connections to structure.
- C. Samples for Verification: Manufacturer's standard Samples for each type of exposed finish required.
- D. Delegated Engineering Submittal: Include analysis data signed and sealed by the engineering professional responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company with not less than 5 years' experience in performing specified work similar in design, products, and extent indicated for this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.
- B. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installations similar to this Project, and, that has a record of successful in-service performance.

1.5 WARRANTY

- A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 - 1. Childers Carports & Structures.
 - 2. Mapes Industries.
 - 3. MASA Architectural Canopies.
 - 4. Perfection Architectural Systems, Inc.
 - 5. Southeastern Architectural Systems.
 - 6. Upside Innovations.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extruded Shapes: ASTM B 221.
- B. Fasteners: Manufacturer's standard stainless steel of type and size required, sufficient to correctly attach or anchor specified item to substrate indicated without failure; compatible with adjacent materials.

2.3 COMPONENTS

- A. Columns: Radius-cornered aluminum tubular extrusion as required by structural engineering design.
- B. Beams: Open top aluminum tubular extrusions.
- C. Deck: Rigid-roll-lock extruded aluminum, self-flashing, interlocking sections.
 - 1. Provide welded endplate water dams where sections terminate at other than drainage channels.
- D. Fascia: Manufacturer's standard extruded aluminum fascia sections as shown on drawings and as required to complete the installation resulting in a neat finished appearance.

1. Include manufacturer's standard extruded aluminum gutters.

2.4 FABRICATION

- A. Where practical, fit and assemble devices in manufacturer's plant.
- B. Fabricate aluminum components that, when mechanically assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

2.5 FINISH

- A. Appearance of Finished Work:
 1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one half of range of approved submittal samples.
 2. Noticeable variations in same piece are not acceptable.
 3. Variations in appearance of other components are acceptable if they are within range of approved submittal samples and they are assembled or installed to minimize contrast as determined by Architect.
- B. Powder-Coat Finish: AAMA 2604.
 1. Two Coat Opaque Finish: Fluoropolymer finish containing not less than 50 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
 2. Basis of Design: Tiger Drylac Powder Coatings; Series 38 Super Durable Powder Coatings.
 3. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. General:
 1. Comply with manufacturer's written instructions.
 2. Do not install damaged components.
 3. Fit joints to produce hairline joints free of burrs and distortion.
 4. Rigidly secure joints.

- B. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- C. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing exterior aluminum canopy to structural support and for properly transferring load to in-place construction.

3.3 ADJUSTING

- A. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 10 75 16
GROUND-SET FLAGPOLE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Ground-set flagpoles made from aluminum.
 2. Related materials to complete installation.

- B. Owner-Furnished Material: Flags.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each type of product indicated, specified, or required.
1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Shop Drawings: Include plans, elevations, and attachment details.
1. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
 2. Include section, and details of foundation.
- C. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.
1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is as indicated on the Drawings.
 2. Base flagpole design on nylon or cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.2 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."

1. American Flagpole.
2. Baartol Company.
3. Concord Industries, Inc.
4. Ewing Flagpoles.
5. PoleTech Flagpole Manufacturer.
6. U.S. Flag & Flagpole Supply, LP.

2.3 ALUMINUM FLAGPOLES

- A. Aluminum Flagpoles: Entasis-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241, Alloy 6063, with a minimum wall thickness of 3/16 inch.
- B. Exposed Height: 40 feet.
- C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
 1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
 2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
- D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060 inch wall thickness with 3/16 inch steel bottom plate and support plate; 3/4-inch- (19-mm-) diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.
 1. Flashing Collar: Same material and finish as flagpole.
- E. Sleeve for Aluminum Flagpole: PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.
 1. Flashing Collar: Same material and finish as flagpole.

2.4 FITTINGS

- A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
 1. 0.063 inch spun aluminum, finished to match flagpole.
- B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.
 1. Halyard Flag Snaps: Stainless-steel swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.

2.5 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107.
- B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.
- C. Sand: ASTM C33, fine aggregate.

- D. Elastomeric Joint Sealant: Single-component neutral-curing silicone joint sealant complying with requirements in Section 079200 "Joint Sealants."
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

2.6 ALUMINUM FINISHES

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

- A. Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- B. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.
- C. Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.
- D. Locate and secure sleeves in forms by bracing to reinforcement and forms.
- E. Place concrete, as specified in Division 03 Section "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.
- F. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.3 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where indicated and according to manufacturer's written instructions.
- B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in

foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2 inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION

SECTION 11 31 13
RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Appliances.
2. Related materials necessary to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each type of product indicated, specified, or required.

1. Include manufacturer's written installation instructions.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Operation and Maintenance Data: For inclusion in operations and maintenance manual required by Division 01.

1. Include manufacturer's instructions for operation and maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance. Include name, address, and telephone number of manufacturers nearest authorized service representative.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled, as defined in NFPA 70, Article 100, by UL or another testing agency acceptable to authorities having jurisdiction; and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to receive appliances and associated Work for compliance with requirements and other conditions affecting performance.

2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Set appliances in final locations after finishes have been completed; verify clearances are adequate to properly operate equipment; connect to utilities.
- B. Do not set appliances if floor covering is not installed in the recess.

END OF SECTION

SECTION 11 46 83
ICE MACHINES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ice machines.
2. Related materials necessary to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each type of product indicated, specified, or required.

1. Include manufacturer's written installation instructions.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Operation and Maintenance Data: For inclusion in operations and maintenance manual required by Division 01.

1. Include manufacturer's instructions for operation and maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance. Include name, address, and telephone number of manufacturers nearest authorized service representative.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled, as defined in NFPA 70, Article 100, by UL or another testing agency acceptable to authorities having jurisdiction; and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to receive ice machines and associated Work for compliance with requirements and other conditions affecting performance.

2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Set ice machines in final locations after finishes have been completed; verify clearances are adequate to properly operate equipment; connect to utilities.
- B. Do not set ice machines if floor covering is not installed in the recess.

END OF SECTION

SECTION 11 52 33
TELEVISION MOUNTING BRACKETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Flat panel television mounting brackets and accessories indicated, specified, or required to complete installation.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.
1. Include manufacturer's written installation instructions.
 2. Include material descriptions, dimensions of individual components and profiles, and finishes.
 3. Include manufacturer's standard drawing details.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified on the Drawings to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Sections.
1. Bretford, Inc.
 2. Draper, Inc.
 3. Peerless Industries.
 4. Sanus Systems, Milestone AV Technologies.
 5. Samsung.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
1. Examine substrates to which television mounting brackets will be applied for compliance with requirements and other conditions affecting performance.
 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Install in locations and at mounting heights indicated, straight, level, and plumb.

END OF SECTION

SECTION 11 90 00
EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment as specified on the Drawings.
 - 2. Related materials necessary to complete installation.
- B. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment for installation by Contractor.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each type of product indicated, specified, or required.
 - 1. Include manufacturer's written installation instructions.
 - 2. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
 - 3. Include manufacturer's product number.
 - 4. Include accessories and components that will be included for Project.
 - 5. Include clearance requirements for access and maintenance.
 - 6. Include utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.
- B. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each factory-applied color finish required, in manufacturer's standard sizes.
- E. Operation and Maintenance Data: For inclusion in operations and maintenance manual required by Division 01.
 - 1. Include manufacturer's instructions for operation and maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
 - 2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.
 - 3. Include name, address, and telephone number of manufacturer's nearest authorized service representative.

1.3 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of construction contiguous with equipment by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Provide equipment specified on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine substrates, areas, and conditions to verify actual locations, dimensions, and other conditions affecting performance of the Work.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Install equipment level and plumb, according to manufacturer's written instructions.
 - 1. Connect equipment to utilities.
- B. Complete equipment assembly where field assembly is required.
- C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.

3.3 CLEANING AND PROTECTING

- A. After completing installation of equipment, repair damaged finishes.
- B. Clean and adjust equipment as required to produce ready-for-use condition.
- C. Protect equipment from damage during remainder of the construction period.

3.4 DEMONSTRATION

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

END OF SECTION

SECTION 12 31 36
STAINLESS STEEL CABINETS AND COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stainless steel cabinets and countertop fabrications.
2. Related materials necessary to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical product literature for each type of product indicated, specified or required.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
2. Show fabrication details, including types and locations of hardware.

C. Samples for Verification: For each type of casework, exposed-hardware, and countertop-material finish, in manufacturer's standard sizes.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Company with not less than 5 years' experience in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications: Fabricator of products.

C. Preinstallation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.5 FIELD CONDITIONS

A. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

B. Field Measurements: Where cabinets are indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

C. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before enclosing walls, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Stainless Steel: Mild, cold-rolled and leveled, ASTM A 666, Type 304; No. 4 satin finish.

2.2 CABINET HARDWARE

- A. Hinges: Stainless-steel, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two for doors 48 inches (1200 mm) high or less and three for doors more than 48 inches (1200 mm) high.
- B. Hinged-Door and Drawer Pulls: Stainless-steel, back-mounted pulls. Provide two pulls for drawers more than 24 inches (600 mm) wide.
 - 1. Design: Wire pulls.
 - 2. Overall Size: 1-1/4 by 4-1/2 inches.
- C. Door Catches: Nylon-roller spring catches. Provide two catches on doors more than 48 inches high.
- D. Drawer Slides: Side mounted, epoxy-coated steel, self-closing; designed to prevent rebound when drawers are closed; complying with BHMA A156.9, Type B05091.
 - 1. Heavy Duty Grade 1HD-100: Full-overtravel-extension, ball-bearing type.

2.3 FABRICATION

- A. General:
 - 1. Assemble and finish units at point of manufacture.
 - 2. Perform assembly on precision jigs to provide units that are square.
 - 3. Reinforce units with angles, gussets, and channels as required.
- B. Welding: Electrically weld using stainless steel electrodes; make welds free of pits and flaws.
- C. Cabinets: Provide units with smooth surfaces in uniform plane free of defects. Make exposed edges and corners straight and uniformly beveled.
 - 1. Sides, Ends, Fixed Backs, Bottoms, Tops, Soffits, and Items Not Otherwise Indicated: 0.050 inch (18 gauge).
 - 2. Back Panels, Doors, Drawer Fronts and Bodies, and Shelves: 0.038 inch (20 gauge).
 - 3. Intermediate Horizontal Rails, Table Aprons and Cross Rails, Center Posts, and Top Gussets: 0.063 inch (16 gauge).
 - 4. Drawer Runners, Sink Supports, and Hinge Reinforcements: 0.078 inch (14 gauge).
- D. Countertops: Provide units with smooth surfaces in uniform plane free of defects. Make exposed edges and corners straight and uniformly beveled. Made from stainless-steel sheet, not less than 0.063 inch (16 gauge).
 - 1. Extend top down 1 inch at edges with a 1/2 inch return flange under frame. Apply heavy coating of heat-resistant, sound-deadening mastic to undersurface.
 - 2. Factory punch holes for service fittings.
 - 3. Weld shop-made joints.

4. Where field-made joints are required, provide hairline butt joints mechanically bolted through continuous channels welded to underside at edges of joined ends. Keep field jointing to a minimum.
5. Reinforce underside of countertop with channels or use thicker metal sheet where necessary to insure rigidity without deflection.
6. Weld shop-made joints, and grind and polish surfaces to produce uniform, directionally textured finish, free of cross scratches. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Install cabinets and countertops level, plumb, true, and straight. Shim as required with concealed shims.
- B. Install cabinets without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
- C. Install countertops with flush welded joints. Grind and polish surfaces to produce uniform No. 4 finish free of cross scratches. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

3.3 INSTALLATION TOLERANCES

A. Tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet.
3. Variation of Faces of Casework from a True Plane: 1/8 inch in 10 feet.
4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

3.4 CLEANING

- A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish.

END OF SECTION

SECTION 13 34 19
PRE-ENGINEERED METAL BUILDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural-steel framing.
2. Metal roof panels.
3. Metal wall panels.
4. Windows.
5. Accessories.

1.2 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Delegated Engineering Responsibility: Require metal building fabricator to employ a delegated engineering professional to provide engineering for each member and component of metal building required to meet concept expressed in Contract Documents that includes, but is not limited to, following:

1. Preparation of engineering calculations, shop drawings, and other submittals with professional seal affixed according to respective jurisdictional licensing regulations.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Metal building shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."

1. Design Loads: As indicated on Drawings.
2. Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings." Lateral drift shall be no greater than 1/400 of the building height.

- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

- C. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
- D. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 or ASTM E 283 at the following test-pressure difference:
 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- E. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- F. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:
 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- G. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- H. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 1. Uplift Rating: UL 90.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 1. Review methods and procedures related to metal building systems including, but not limited to, the following:
 - a. Condition of foundations and other preparatory work performed by other trades.
 - b. Structural load limitations.
 - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Required tests, inspections, and certifications.
 - e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.
 2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
 - b. Structural limitations of purlins and rafters during and after roofing.
 - c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
 - d. Temporary protection requirements for metal roof panel assembly during and after installation.
 - e. Roof observation and repair after metal roof panel installation.

3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
 - b. Structural limitations of girts and columns during and after wall panel installation.
 - c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 - d. Temporary protection requirements for metal wall panel assembly during and after installation.
 - e. Wall observation and repair after metal wall panel installation.

1.6 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Metal roof panels.
 - b. Metal wall panels.
 - c. Windows.
- B. Shop Drawings: Include full building plans, elevations, sections, details and the following:
 1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
 3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
 5. Indicate components by others.
 6. Include engineer's seal.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For the following products:
 1. Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
 2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.

3. Windows: Full-size, nominal 12 inches long frame Samples showing typical profile.
 4. Accessories: Nominal 12 inches long Samples for each type of accessory.
- E. Delegated-Design Submittal: Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
1. Name and location of Project.
 2. Order number.
 3. Name of manufacturer.
 4. Name of Contractor.
 5. Building dimensions including width, length, height, and roof slope.
 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 7. Governing building code and year of edition.
 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- G. Warranties: Sample for special warranties.
- H. Maintenance Data: For metal panel finishes to include in maintenance manuals.
- 1.7 QUALITY ASSURANCE
- A. Manufacturer Qualifications: A qualified manufacturer.
1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1.
 2. AWS D1.3.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.9 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

- 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

- 2. Finish Warranty Period: 20 years from date of Substantial Completion.

- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.

- 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- B. Primary-Frame Type: Rigid clear span; solid-member, structural-framing system without interior columns.
- C. Secondary-Frame Type: Manufacturer's standard purlins and joists and girts.
- D. Roof System: Manufacturer's standard standing-seam, vertical-rib metal roof panels.
 - 1. Liner Panels: Tapered rib.
- E. Exterior Wall System: Manufacturer's standard exposed-fastener, tapered-rib metal wall panels.

2.3 STRUCTURAL-STEEL FRAMING

- A. Structural Steel: Comply with AISC 360.
- B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
 - 2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
 - 3. Exterior Column: Tapered.
 - 4. Rafter: Uniform depth.
- E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
 - 1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
 - 2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
- F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
 - 1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2 inch wide flanges.
 - a. Depth: As needed to comply with system performance requirements.
 - 2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2 inch wide flanges.
 - a. Depth: As required to comply with system performance requirements.
 - 3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
 - 4. Flange Bracing: Minimum 2 by 2 by 1/8 inch structural-steel angles or 1 inch diameter, cold-formed structural tubing to stiffen primary-frame flanges.

5. Sag Bracing: Minimum 1 by 1 by 1/8 inch structural-steel angles.
 6. Base or Sill Angles: Manufacturer's standard base angle, minimum 3 by 2 inch, fabricated from zinc-coated (galvanized) steel sheet.
 7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
 8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
 9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- G. Bracing Rods: ASTM A 36; ASTM A 572, Grade 50; or ASTM A 529, Grade 50; minimum 1/2 inch diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
- H. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.
- I. Materials:
1. W-Shapes: ASTM A 992; ASTM A 572, Grade 50 or 55; or ASTM A 529, Grade 50 or 55.
 2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36; ASTM A 572, Grade 50 or 55; or ASTM A 529, Grade 50 or 55.
 3. Plate and Bar: ASTM A 36; ASTM A 572, Grade 50 or 55; or ASTM A 529, Grade 50 or 55.
 4. Steel Pipe: ASTM A 53, Type E or S, Grade B.
 5. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.
 6. Structural-Steel Sheet: Hot-rolled, ASTM A 1011, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70; or cold-rolled, ASTM A 1008, Structural Steel (SS), Grades 25 through 80, or HSLAS, Grades 45 through 70.
 7. Metallic-Coated Steel Sheet: ASTM A 653, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G60 coating designation; mill phosphatized.
 8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
 - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G90 coating designation.
 9. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.
 - a. Finish: Plain.
 10. Structural Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563 heavy-hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - a. Finish: Plain.

11. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with spline ends; ASTM A 563 heavy-hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
 12. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with spline ends.
 - a. Finish: Plain.
 13. Unheaded Anchor Rods: ASTM A 36.
 - a. Configuration: Straight.
 - b. Nuts: ASTM A 563 hex carbon steel.
 - c. Plate Washers: ASTM A 36 carbon steel.
 - d. Washers: ASTM F 436 hardened carbon steel.
 - e. Finish: Plain.
 14. Threaded Rods: ASTM A 36.
 - a. Nuts: ASTM A 563 hex carbon steel.
 - b. Washers: ASTM F 436 hardened carbon steel.
 - c. Finish: Plain.
- J. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
1. Clean and prepare in accordance with SSPC-SP2.
 2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.
 - a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2.4 METAL ROOF PANELS

- A. Standing-Seam, Vertical-Rib, Metal Roof Panels <Insert drawing designation>: Formed with vertical ribs at panel edges and [intermediate stiffening ribs symmetrically spaced] [flat pan] between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024 inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755.
 - a. Exterior Finish: Two-coat.
 - b. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] <Insert color>.
 2. Clips: [One-piece fixed] [Two-piece floating] to accommodate thermal movement.
 3. Joint Type: [Panels snapped together] [Mechanically seamed].
 4. Panel Coverage: [16 inches (406 mm)] <Insert dimension>.
 5. Panel Height: [2 inches (51 mm)] <Insert dimension>.
- B. Finishes:
1. Exposed Coil-Coated Finish:

- a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.5 METAL WALL PANELS

- A. Exposed-Fastener, Tapered-Rib, Metal Wall Panels <Insert drawing designation>: Formed with raised, trapezoidal major ribs and [intermediate stiffening ribs symmetrically spaced] [flat pan] between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.018-inch (0.46-mm)] [0.024-inch (0.61-mm)] [0.030-inch (0.76-mm)] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: [Two-coat fluoropolymer] [Three-coat fluoropolymer] [Siliconized polyester].
 - b. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] <Insert color>.
 2. Major-Rib Spacing: [6 inches (152 mm)] [12 inches (305 mm)] <Insert dimension> o.c.
 3. Panel Coverage: [36 inches (914 mm)] <Insert dimension>.
 4. Panel Height: [0.75 inch (19 mm)] [1.125 inches (29 mm)] [1.188 inches (30 mm)] [1.25 inches (32 mm)] [1.5 inches (38 mm)] <Insert dimension>.
- B. Exposed-Fastener, Reverse-Rib, Metal Wall Panels <Insert drawing designation>: Formed with recessed, trapezoidal major valleys and [intermediate stiffening valleys symmetrically spaced] [flat pan] between major valleys; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.018-inch (0.46-mm)] [0.024-inch (0.61-mm)] [0.030-inch (0.76-mm)] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: [Fluoropolymer] [Siliconized polyester].
 - b. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] <Insert color>.
 2. Major-Rib Spacing: [12 inches (305 mm)] <Insert dimension> o.c.
 3. Panel Coverage: [36 inches (914 mm)] <Insert dimension>.
 4. Panel Height: [1.125 inches (29 mm)] [1.188 inches (30 mm)] [1.25 inches (32 mm)] [1.5 inches (38 mm)] <Insert dimension>.
- C. Concealed-Fastener, Flush-Profile, Metal Wall Panels <Insert drawing designation>: Formed with vertical panel edges and [a single wide recess, centered between panel edges] [flush surface]; with flush joint between panels; with 1-inch- (25-mm-) wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[and factory-applied sealant] in side laps.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.024-inch (0.61-mm)] [0.030-inch (0.76-mm)] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: [Fluoropolymer] [Siliconized polyester].
 - b. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] <Insert color>.
 2. Panel Coverage: [16 inches (406 mm)] <Insert dimension>.
 3. Panel Height: [3 inches (76 mm)] <Insert dimension>.
- D. Tapered-Rib, Metal Liner Panels <Insert drawing designation>: Formed with raised, trapezoidal major ribs and [intermediate stiffening ribs symmetrically spaced] [flat pan] between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.018-inch (0.46-mm)] [0.024-inch (0.61-mm)] [0.030-inch (0.76-mm)] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: [Siliconized polyester] [Acrylic enamel].
 - b. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] <Insert color>.
 2. Major-Rib Spacing: [6 inches (152 mm)] [12 inches (305 mm)] <Insert dimension> o.c.
 3. Panel Coverage: [36 inches (914 mm)] <Insert dimension>.
 4. Panel Height: [1.25 inches (32 mm)] [1.5 inches (38 mm)] <Insert dimension>.
- E. Finishes:
1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.6 METAL SOFFIT PANELS

- A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[and factory-applied sealant] in side laps. Include accessories required for weathertight installation.
- B. Metal Soffit Panels: Match profile and material of metal [roof] [wall] panels.
 1. Finish: [Match finish and color of metal roof panels] [Match finish and color of metal wall panels] [As indicated on Drawings].
- C. Exposed-Fastener, Tapered-Rib-Profile, Metal Soffit Panels <Insert drawing designation>: Formed with raised, trapezoidal major ribs and [intermediate stiffening ribs symmetrically

spaced] [flat pan] between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.018-inch (0.46-mm)] [0.024-inch (0.61-mm)] [0.030-inch (0.76-mm)] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: [Two-coat fluoropolymer] [Three-coat fluoropolymer] [Siliconized polyester].
 - b. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] <Insert color>.
 2. Major-Rib Spacing: [6 inches (152 mm)] [12 inches (305 mm)] <Insert dimension> o.c.
 3. Panel Coverage: [36 inches (914 mm)] <Insert dimension>.
 4. Panel Height: [0.75 inch (19 mm)] [1.125 inches (29 mm)] [1.188 inches (30 mm)] [1.25 inches (32 mm)] [1.5 inches (38 mm)] <Insert dimension>.
- D. Concealed-Fastener, Flush-Profile, Metal Soffit Panels <Insert drawing designation>: Formed with vertical panel edges and [a single wide recess, centered between panel edges] [flush surface]; with flush joint between panels; with 1-inch- (25-mm-) wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[and factory-applied sealant] in side laps.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.024-inch (0.61-mm)] [0.030-inch (0.76-mm)] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: [Fluoropolymer] [Siliconized polyester].
 - b. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] <Insert color>.
 2. Panel Coverage: [12 inches (305 mm)] [16 inches (406 mm)] <Insert dimension>.
 3. Panel Height: [1 inch (25 mm)] [1.5 inches (38 mm)] <Insert dimension>.

2.7 THERMAL INSULATION

- A. Faced Metal Building Insulation: ASTM C 991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (51-mm-) wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
- B. Unfaced Metal Building Insulation: ASTM C 991, Type I, or NAIMA 202, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (51-mm-) wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
- C. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I (foil facing), Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core. Provide units tested for interior exposure without an approved thermal barrier.
- D. Retainer Strips: For securing insulation between supports, 0.025-inch (0.64-mm) nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.

- E. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M, Desiccant Method.
1. Composition: White metallized-polypropylene film facing, fiberglass scrim reinforcement, and kraft-paper backing.
 2. Composition: Aluminum foil facing, elastomeric barrier coating, fiberglass scrim reinforcement, and kraft-paper backing.
 3. Composition: White [polypropylene] [vinyl] film facing, fiberglass scrim reinforcement, and metallized-polyester film backing.
 4. Composition: White polypropylene film facing and fiberglass-polyester-blend fabric backing.
- F. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.8 WINDOWS

- A. Aluminum Windows: Metal building system manufacturer's standard, with self-flashing mounting fins, and as follows:
1. Type, Performance Class, and Performance Grade: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 and as follows:
 - a. Horizontal-Sliding Units: [HS-LC25] [HS-CW30] <Insert designation>.
 - b. Single-Hung Units: [H-LC25] [H-CW30] <Insert designation>.
 - c. Fixed Units: [FW-LC25] [FW-CW30] [FW-AW40] <Insert designation>.
 2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 0.064-inch (1.63-mm) thickness at any location for main frame and sash members.
 - a. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
 3. Mullions: Between adjacent windows, fabricated of extruded aluminum matching finish of window units.
 4. Fasteners, Anchors, and Clips: Nonmagnetic stainless steel, aluminum, or other noncorrosive material, compatible with aluminum window members, trim, hardware, anchors, and other components of window units. Fasteners shall not be exposed, except for attaching hardware.
 - a. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.128 inch (3.26 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, spline grommet nuts.
 5. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:
 - a. Cam-action sweep sash lock and keeper at meeting rails.
 - b. Spring-loaded, snap-type lock at jambs.

- c. Pole-operated, cam-action locking device on meeting rail where rail is more than 72 inches (1830 mm) above floor.
 - d. Lift handles for single-hung units.
 - e. Nylon sash rollers for horizontal-sliding units.
 - f. Steel or bronze operating arms.
- 6. Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric; complying with AAMA 701/702.
- 7. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, and as follows:
 - a. Aluminum Wire Fabric: 18-by-18 (1.1-by-1.1-mm), 18-by-16 (1.1-by-1.3-mm), or 18-by-14 (1.1-by-1.5-mm) mesh of 0.013-inch- (0.3-mm-) diameter, coated aluminum wire; complying with FS RR-W-365, Type VII.
 - b. Glass-Fiber Mesh Fabric: 18-by-16 (1.1-by-1.3-mm) or 18-by-14 (1.1-by-1.5-mm) mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D 3656.
 - c. Fabric: Manufacturer's standard aluminum wire fabric or glass-fiber mesh fabric.
- B. Glazing: Comply with requirements specified in Section 088000 "Glazing."
- C. Glazing:
 - 1. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear), 3 mm thick.
 - 2. Heat-Treated Float Glass: ASTM C 1048, Type I, Quality-Q3, Class I (clear), Condition A, 3 mm thick.
 - 3. Tinted Float Glass: ASTM C 1036, Type I, Quality-Q3, Class 2, 3 mm thick.
 - a. Tint Color: [Blue] [Blue-green] [Bronze] [Green] [Gray] [Manufacturer's standard color] <Insert color>.
 - 4. Patterned Glass: ASTM C 1036, Type II, Quality-Q6, Class 1 (clear), Form 3, Pattern P3 (random), 3 mm thick.
 - 5. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of 2.5-mm-thick clear float glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 6. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.
 - a. Provide safety glazing labeling.
 - 7. Glazing Stops: Screw-applied or snap-on glazing stops coordinated with Section 088000 "Glazing" and with glazing system indicated. Match material and finish of window frames.
 - 8. Factory-Glazed Fabrication: Glaze window units in the factory to greatest extent possible and practical for applications indicated. Comply with requirements in Section 088000 "Glazing."
- D. Finish:
 - 1. Mill finish.
 - 2. Baked-Enamel Finish, Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 0.7 mil (0.02 mm), medium gloss.
 - a. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] <Insert color>.

2.9 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
 2. Clips: Manufacturer's standard, formed from [steel] [stainless-steel] sheet, designed to withstand negative-load requirements.
 3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from [steel] [stainless-steel sheet or nylon-coated aluminum] sheet.
 4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch (25-mm) standoff; fabricated from extruded polystyrene.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.
1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.

2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.018-inch (0.46-mm)] [0.030-inch (0.76-mm)] nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2438-mm-) long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters.
 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- (3-m-) long sections, complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.
1. Circular-Revolving Type: Minimum [20-inch- (508-mm-)] <Insert dimension> diameter throat opening; zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch (0.61-mm) nominal uncoated steel thickness, with coil coating; finished to match metal roof panels; with matching base and rain cap.
 - a. Type: [Directional] [Stationary] revolving.
 - b. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire; or aluminum, 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.6-mm) wire.
 - c. Dampers: Spring-loaded, butterfly type; pull-chain operation; with pull chain of length required to reach within 36 inches (914 mm) of floor.
 - d. Reinforce and brace units, with joints properly formed and edges beaded to be watertight under normal positive-pressure conditions.
 - e. Mount ventilators on square-to-round bases for ridge or on-slope mounting, designed to match roof pitch and roll formed to match metal roof panel profile.
 2. Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum 10-foot- (3-m-) long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.
 - a. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire; or aluminum, 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.6-mm) wire.
 - b. Dampers: Manually operated, spring-loaded, vertically rising type; chain and worm gear operator; with pull chain of length required to reach within 36 inches (914 mm) of floor.
 - c. Throat Size: [9 inches (229 mm)] [or] [12 inches (305 mm)], [as standard with manufacturer, and as required to comply with ventilation requirements].

- H. Louvers: Size and design indicated; self-framing and self-flashing. Fabricate welded frames from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch (1.21-mm) nominal uncoated steel thickness; finished to match metal wall panels. Form blades from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.036-inch (0.91-mm) nominal uncoated steel thickness; folded or beaded at edges, set at an angle that excludes driving rains, and secured to frames by riveting or welding. Fabricate louvers with equal blade spacing to produce uniform appearance.
1. Blades: Fixed.
 2. Blades: Adjustable type, with weather-stripped edges, and manually operated by hand crank or pull chain.
 3. Free Area: Not less than [7.0 sq. ft. (0.65 sq. m)] <Insert dimension> for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 4. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire; with rewirable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.
 - a. Mounting: [Interior] [Exterior] face of louvers.
 5. Vertical Mullions: Provide mullions at spacings recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
- I. Roof Curbs: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch (1.21-mm) nominal uncoated steel thickness prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.
1. Curb Subframing: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.060-inch (1.52-mm) nominal uncoated steel thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.
 2. Insulation: 1-inch- (25-mm-) thick, rigid type.
- J. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
- K. Materials:
1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - a. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
 - b. Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
 - c. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws[, with EPDM sealing washers bearing on weather side of metal panels].
 - d. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head[, with EPDM sealing washers bearing on weather side of metal panels].

- e. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - f. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
 3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
 4. Metal Panel Sealants:
 - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
 - b. Joint Sealant: ASTM C 920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.10 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
 1. Make shop connections by welding or by using high-strength bolts.
 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
 1. Make shop connections by welding or by using non-high-strength bolts.
 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
 - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
 - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 - 2. Locate and space wall girts to suit openings such as doors and windows.
 - 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
 - 1. Tighten rod and cable bracing to avoid sag.
 - 2. Locate interior end-bay bracing only where indicated.
- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.

1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Locate metal panel splices over structural supports with end laps in alignment.
 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Install ridge[and hip] caps as metal roof panel work proceeds.
 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
1. Install clips to supports with self-drilling or self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
 6. Provide metal closures at [peaks] [rake edges] [rake walls] [and] each side of ridge[and hip] caps.
- C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
 4. At metal panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- E. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 2. Shim or otherwise plumb substrates receiving metal wall panels.
 3. When two rows of metal panels are required, lap panels 4 inches (102 mm) minimum.
 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
 6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.

7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), noncumulative; level, plumb, and on location lines; and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.7 METAL SOFFIT PANEL INSTALLATION

A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.

B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.8 THERMAL INSULATION INSTALLATION

A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.

1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.
2. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
3. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
 - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

4. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.
 - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
 5. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
- C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
 2. Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.
- D. Board Wall Insulation: Extend board insulation in thickness indicated to cover entire wall. Hold in place by metal wall panels fastened to secondary framing. Comply with manufacturers' written instructions.
1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.9 WINDOW INSTALLATION

- A. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.
1. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440.
- B. Set sill members in bed of sealant or with gaskets, for weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Mount screens directly to frames with tapped screw clips.

3.10 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
1. Provide elbows at base of downspouts to direct water away from building.
 2. Tie downspouts to underground drainage system indicated.
- E. Circular Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Mount ventilators on flat level base. Install preformed filler strips at base to seal ventilator to metal roof panels.
- F. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.
- G. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
 2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
 3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.
 - H. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
 - I. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.
- 3.11 ADJUSTING
- A. Windows: Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and at weather stripping to ensure smooth operation and weathertight closure. Lubricate hardware and moving parts.
 - B. [Roof Ventilators] [and] [Adjustable Louvers]: After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily, free of warp, twist, or distortion as needed to provide fully functioning units.
 1. Adjust louver blades to be weathertight when in closed position.
- 3.12 CLEANING AND PROTECTION
- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
 - B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
 - C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing[, bearing plates,] and accessories.
 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
 - D. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 - E. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
 1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
 - F. Windows: Clean metal surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances. Clean factory-glazed glass immediately after installing windows.
 - G. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

1. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

**SECTION 21 00 00
FIRE PROTECTION**

INPART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

- A. The scope of the work shall include the furnishing and complete installation of the fire protection piping, valves, hose connections, and equipment covered by this Section, with all appurtenances, ready for owner's use.

1.3 RELATED WORK

- A. Section 21 02 01 - Coordination Drawings
- B. Section 21 05 29 - Hangers and Supports for Fire Suppression Piping and Equipment
- C. Section 21 13 13 - Wet Pipe Sprinkler System
- D. Section 21 13 16 - Dry Pipe Sprinkler Systems

1.4 REFERENCES

- A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- B. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe
- C. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
- D. FM Global Fire Protection Standards
- E. NFPA 13 - Standard for the Installation of Sprinkler Systems
- F. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems
- G. UL - Underwriters Laboratories

1.5 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.
- B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.
- C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer's name and country of origin.
- D. Domestic Manufacture: All valves, pipe, fittings, hose connections, and equipment shall be by a domestic manufacturer.

1.6 SUBMITTALS

- A. Submit shop drawings in accordance with Section 22 02 00 and as described below.
- B. Submit shop drawings of entire water-based building fire protection system with all standpipe, hose valve, and hose connection locations, including the accompanying hydraulic calculations to the Architect/Engineer for review. **A current and fully documented fire hydrant flow test must be included.**
- C. Submit complete product data for 21 31 13 - Fire Pumps, Electric Drive concurrently with the submittal for this Section, for all systems served by such equipment.

- D. Service Utility Diagram: Furnish Architect with an accurately marked print showing location of underground pipes and valves as installed upon completion of underground work.
- E. Submit product data to include pipe materials, pipe fittings, valves, hose connections, waterflow and alarm devices, and other appurtenances. Provide manufacturer's catalog information, product certifications, and **country of origin**. Indicate valve data and ratings.

1.7 REGULATORY REQUIREMENTS

- A. Work in accordance with:
 - 1. NFPA 13 - Standard for the Installation of Sprinkler Systems.
 - 2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems
 - 3. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances
 - 4. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
 - 5. Local codes that have jurisdiction.
- B. Products in accordance with:
 - 1. UL (Underwriters Laboratories) listed.
 - 2. FM (Factory Mutual) approved.
 - 3. Requirements of the local Authority Having Jurisdiction (AHJ).

1.8 CERTIFICATE OF TESTING

- A. Furnish Owner with test certificate certifying the system approved by:
 - 1. Fire Marshal.
 - 2. Insurance Services Officials.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Work included:
 - 1. The Drawings provide a preliminary layout with locations of water service entry/water supply, control valves, hose connections, and fire department connection(s). These are a guide for the subsequent preparation of the Licensed Fire Sprinkler Contractor's detailed working drawings.
 - 2. Coordinate work and installation with electrical and fire alarm contractors accordingly to interface system with the building fire and smoke alarm systems.
- B. Requirements:
 - 1. Materials and installation to meet or exceed the requirements of NFPA 13 and 14, (prevailing editions) and the local authority having jurisdiction (AHJ).
 - 2. All components of the system shall be UL listed for the intended service.
 - 3. Provide components with minimum pressure ratings as suited for system working pressure(s).
 - 4. All hose connections shall be provided with approved threads, caps, and chains.

2.2 FIRE HOSE VALVES, CONNECTIONS, AND EQUIPMENT

- A. General requirements: All hose valves shall be listed. All hose connections shall be provided complete with connections, caps and chains conforming to local Fire Department requirements.
- B. Acceptable Manufacturers:
 - 1. Potter-Roemer

2. Dixon
 3. Elkhart Brass
 4. Croker
- C. FIRE DEPARTMENT CONNECTIONS: No less than 4" and two-way type, with additional connections and in larger size in accordance with system demand per NFPA. Polished chrome plated brass with lettering consistent with system type and service. Back, top, or bottom outlet as required for placement and wall construction for building mounted variations. Provide complete with accessibly located, listed check valve with approved automatic drip valve. Potter-Roemer Model 5751 (building mounted), Model 5761 (free-standing) or similar model with features as required and as described above.

PART 3 - EXECUTION

3.1 DESIGN

- A. The Contractor shall conform to the requirements of NFPA 14 for standpipe and hose system design and installation. It shall be the Contractor's responsibility to determine if any deficiency or deviations exist, such as an inadequate water supply, or any other item which would materially affect the acceptability of the system.

3.2 INSTALLATION

- A. Install all items in accordance with applicable codes.
- B. Piping shall be protected accordingly where subject to mechanical damage and/or fire damage.
- C. Do not install risers or mains in MDF/IDF/Data closets or electrical rooms. Where sprinkler protection is provided, only the associated branch lines and sprinkler heads shall be allowed in such spaces.
- D. Piping (mains and standpipes) shall be protected accordingly from freezing temperature with the use of supervised and listed heat tracing with insulation and jacketing.
- E. In all locations subject to corrosive conditions, ensure to provide a suitable epoxy (spray) coating to all exposed surfaces of pipe and fittings. All job-applied protective coatings shall be provided as approved and only after verification that the proper piping has been installed, per the markings along the length of the pipe.
- F. Piping in finished spaces shall be routed concealed. This shall not include areas such as mechanical spaces, parking garages, and stairways. Exact routing of piping shall be approved by Architect or relocated as required at no additional cost to Owner.
- G. All standpipes shall be provided with a means of draining and shall be arranged to discharge water at an approved location.
- H. Identify all locations requiring coordination with the electrical and fire alarm contractors accordingly to ensure connectivity with the building fire and smoke alarm systems. This shall include, but is not necessarily limited to, the following: water flow switches, alarm bells, and tamper/supervisory switches at control valves.
- I. At building expansion joints provide approved system expansion joint fittings/assemblies accordingly and per manufacturer's recommendations and NFPA 13 requirements. Victaulic Style 155 carbon steel expansion joint for sizes up to and including 12" pipe.

3.3 PAINTING AND PIPE IDENTIFICATION

- A. Painting of fire protection piping and appurtenances shall be provided as follows:

1. Surfaces to be painted shall be cleaned as necessary to ensure they are free from dirt and oils.
 2. Unless directed otherwise by Architect, heat and water resistant, air-cured, high performance one-part epoxy paint shall be provided. Coating shall be high-gloss, lead-free, suited for indoor and outdoor use, and USDA approved. Armor-Poxy or similar.
 3. Fire sprinkler risers and associated alarm valves and related piping exposed in occupied spaces shall be painted red.
 4. Fire protection and sprinkler piping exposed in occupied spaces shall be painted as directed by Architect.
 5. Fire protection and sprinkler piping exposed in unoccupied accessory areas such as stairways shall be painted red unless directed otherwise by Architect.
- B. Identification of fire protection piping shall be provided as follows:
1. All interior visible piping located in accessible spaces shall be provided with pipe markers. Accessible spaces shall include, but not necessarily be limited to, the following: above accessible ceilings, inside equipment rooms and utility spaces, in attic spaces, in crawl spaces, and in chase spaces, etc. viewable via access panels.
 2. All exterior visible piping shall be provided with pipe markers.
 3. Peel-off, self-adhesive, sticker type labels shall not be acceptable.
 4. Pipe markers shall be manufactured with rigid vinyl PVC, printed with UV resistant ink, abrasion and chemical resistant, suited for indoor or outdoor use and for a service temperature of -40 degrees F to 160 degrees F.
 - a. For pipes up to 6" provide cylindrically pre-coiled markers that snap into place without the need for tape or adhesives.
 - b. For pipes 6" and larger provide flat snap-around markers installed using manufacturer's heavy-duty nylon ties or stainless steel strapping.
 - c. Markers shall indicate the pipe service, include flow directional arrows, and meet ASME A13.1.
 5. Acceptable manufacturers:
 - a. Seton Setmark Pipe Markers
 - b. Brimar Industries Pipemarker System 1 Pipe Markers
 - c. Brady Corporation
 6. Markers shall be provided after final insulating, painting, jacketing, etc. of piping and per manufacturer's installation instructions. Strapping (applies to large diameter markers only) shall be snug but shall not compromise any insulation. All such strapping shall also be cleanly trimmed of excess material.
 7. Markers shall be provided in accordance with ASME A13.1 requirements. **Specific items indicated below are not intended as a substitute for this complete standard.** Markers shall be provided:
 - a. On both sides of each floor or wall penetration.
 - b. On each side of each tee.
 - c. On each side of each valve and/or valve group.
 - d. On each side of each piece of equipment.
 - e. On straight pipe runs at equally spaced intervals not to exceed 50 feet.
 - f. In congested areas, on each pipe at the point it enters and exits the area.
 - g. At the point of connection to each piece of equipment and automatic control valve.
 - h. Where they are readily visible to personnel from the point of normal approach.
 - i. With letter height and length of color field according to the size of the pipe served.

8. Color scheme of markers shall be as indicated below and otherwise in accordance with ANSI/ASME color recommendations. Legend color indicates color of legend text and flow directional arrow:

SYSTEM	LABEL COLOR	LEGEND	LEGEND COLOR
Fire Protection	Red	Fire Protection	White
	Red	Fire Sprinkler	White

3.4 REPLACEMENT

- A. Upon receipt of written notice of failure of any part of the guaranteed equipment during the guaranteed period, the Contractor will replace the affected part or parts promptly at no additional cost.

3.5 TESTING

- A. Upon completion of the installation, test the system and obtain approval of the local fire insurance rating organization having jurisdiction.

3.6 TRAINING

- A. Owner's people shall be fully briefed in the normal start-up of the system, operation, normal and emergency shutdown, and maintenance of the system.
- B. Routine maintenance, yearly maintenance, winterization, and spring start-up shall be fully discussed and documented.
- C. Names of those instructed and dates, as well as a list of information handed over to the owner, shall be included in the final report.

END OF SECTION

**SECTION 21 02 01
COORDINATION DRAWINGS**

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions 01 31 00 and Supplementary Conditions apply to all Work herein.

1.2 COORDINATION DRAWINGS

- A. The Contractor shall take the lead in coordinating the Mechanical, Electrical, Plumbing, Communications, Electronic Safety/Security and Fire Protection systems within the building.
- B. The Contractor shall coordinate a three-dimensional (3D) model of the building which includes the Mechanical, Electrical, Plumbing, and Fire Protection systems. The Contractor will be provided with the REVIT model that was used to generate the contract documents and this file may be used as the background file. The Contractor shall replace the systems drawn with the actual shop drawing models. The Contractor is not limited to using REVIT and may use any 3-D software in generating and combining the coordination model.
- C. Submitting the contract drawings as coordination drawings will not be acceptable.
- D. The model shall include detailed and accurate representations of all equipment to be installed based upon the reviewed equipment submittals.
- E. The Contractor shall hold a 3-D coordination meeting with all sub-contractors present to review the model and discuss coordination of the installation of the building systems.
- F. Upon completion of the coordination meeting, the Contractor shall submit the 3-D model and 1/4" scale drawings for review.
- G. The model shall detail major elements, components, and systems in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
 - 1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
 - a. Wall and type locations.
 - b. Clearances for installing and maintaining insulation.
 - c. Locations of light fixtures and sprinkler heads.
 - d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - e. Equipment connections and support details.
 - f. Exterior wall and foundation penetrations.
 - g. Routing of storm and sanitary sewer piping.
 - h. Fire-rated wall and floor penetrations.
 - i. Sizes and location of required concrete pads and bases.
 - j. Valve stem movement.
 - k. Structural floor, wall and roof opening sizes and details.
 - 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
 - 3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling mounted items.
- H. Sequence of Coordination
 1. Below is hierarchy of model elements and the sequencing by which the models will be coordinated.
 - a. Structural and Architectural model
 - b. Miscellaneous steel
 - c. Perform preliminary space allocation
 - d. Identify hard constraints (locations of access panels, lights, A/V space requirements, etc.)
 - e. Main and medium pressure ducts from the shaft out
 - f. Main graded plumbing lines and vents
 - g. Sprinkler mains and branches
 - h. Cold and hot water mains and branches
 - i. Lighting fixtures and plumbing fixtures
 - j. Smaller sized ducts and flex ducts
 - k. Smaller size cold water and hot water piping, flex ducts, etc.
 - I. The Contractor shall not install any item until the coordination has been completed and reviewed by the Construction Manager, Owner, and A/E team.
 - J. The Contractor shall be responsible for coordination of all items that will affect the installation of the Work. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.
 - K. By submitting shop drawings on the project, the Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all trades.

END OF SECTION

SECTION 21 05 29
HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Pipe hangers, supports, and associated appurtenances.
- B. Sleeves and seals.

1.2 RELATED WORK

- A. Section 21 00 00 - Fire Protection
- B. Section 21 13 13 - Wet Pipe Sprinkler System
- C. Section 21 13 16 - Dry Pipe Sprinkler Systems

1.3 REFERENCES

- A. ASME B31.1 - Power Piping.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems.
- C. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

1.4 QUALITY ASSURANCE

- A. Supports for Sprinkler Piping: In conformance with NFPA 13.
- B. Supports for Standpipes: In conformance with NFPA 14.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division One.
- B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes up through 2 Inch: Carbon steel, adjustable swivel ring type with rounded edge design, UL listed and FM approved. Anvil International Figure 69.
- B. Hangers for Pipe Sizes 2-1/2 Inch and larger:
 - 1. Carbon steel, adjustable clevis type, UL listed and FM approved. Anvil International Figure 260.
 - 2. Carbon steel, adjustable swivel ring type, UL listed and FM approved. Anvil International Figure 69.
 - 3. Carbon steel, UL listed straps & hangers with beveled edge design and/or plastic coating for abrasion protection of and intended for use with CPVC piping (only where such pipe material is specified). Anvil International.
- C. Building structure attachments for hangers: Ductile iron, universal C-type clamps, UL listed and FM approved. Anvil International Figure 92, 93, 94.
- D. Vertical Piping Supports: Carbon steel riser clamp. Anvil International Figure 40.
- E. Floor Supports for pipe headers and similar horizontal runs of pipe: Steel pipe stand assembly.
 - 1. Cylindrical pipe stanchion assembly complete with malleable iron flange or welded steel flange base plate secured to the floor by an approved method with listed anchors.
 - 2. Each base plate shall be attached to the floor with a minimum of four (4) anchors no smaller than 1/2" diameter, per NFPA 13.

3. Provide pipe saddle support with steel U-bolt yoke and nuts to attach piping to each stand.
4. Anvil International Figure 63, Type P with Figure 259 saddle support.
- F. Equivalent UL listed, FM approved hanger and support products by Eaton B-Line shall also be acceptable.
- G. For installation of protective shields refer to Article 3.3.

2.2 HANGER RODS

- A. Galvanized or cadmium plated carbon steel hanger rods: Threaded both ends, threaded one end, or continuous threaded. Provide rod couplings in matching finish.

2.3 INSERTS/FASTENERS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
- B. Fasteners: For wood construction and for metal purlin and metal deck applications only, the use of appropriate self-drilling fasteners (UL listed, FM approved, manufactured in USA) provided in accordance with manufacturer's recommendations shall be acceptable. ITW Buildex "Sammys" products or pre-approved equal.

2.4 SLEEVES

- A. All pipe penetrations through walls, floors, floor-ceiling assemblies, etc. shall be sleeved to ensure no direct contact between the pipe and that which it passes through. All installations shall be provided consistent with the fire and smoke safeguards required by the building code per the fire-resistance rating as indicated on the architectural drawings and shall be provided consistent with the assemblies/methods indicated on the architectural drawings.
- B. Unless required otherwise (the most stringent requirement shall govern), sleeves for pipes:
 1. Through nonfire-resistance-rated floors shall be formed with 18 gage galvanized steel, tack welded to form a uniform sleeve.
 2. Through nonfire-resistance-rated walls, through grade beams and foundation walls, and through potentially wet floors shall be formed with schedule 40 steel pipe, galvanized.
 3. Through assemblies including but not limited to fire-resistance-rated walls-barriers-partitions, smoke barriers-partitions, etc. shall be schedule 40 steel pipe securely fastened to the rated assembly. All annular spaces shall be firestopped with an approved penetration firestop system (UL listed) compatible with the pipe material and installed per the manufacturer's recommendations.
- C. Fire Stopping Insulation: Glass fiber type, non-combustible, UL listed.
- D. Caulk: Paintable 25-year acrylic sealant.
- E. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.5 FABRICATION

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Design hangers without disengagement of supported pipe.

2.6 FINISH

- A. Exposed steel hangers, supports, and appurtenances shall be hot-dipped galvanized. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 INSERTS

- A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.
- B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.
- D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.2 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping with maximum distance between hangers and minimum hanger rod diameters as follows:

Pipe Size	Max. Hanger Spacing	Min. Rod Diameter
(Steel Pipe)		
1 to 1-1/4 inch	10'-0"	3/8"
1-1/2 to 3 inch	12'-0"	3/8"
4 to 6 inch	12'-0"	1/2"
8 to 10 inch	12'-0"	5/8"
12 to 14 inch	12'-0"	3/4"
(CPVC Pipe, only where specified)		
3/4 to 1 inch	4'-0"	3/8"
1-1/4 to 1-1/2 inch	4'-0"	3/8"
2 to 3 inch	6'-0"	3/8"

- B. Where a listed CPVC pipe manufacturer's maximum hanger spacing is more stringent than the spacing above, it shall be followed.
- C. Spacing of hangers for unbroken lengths of CPVC pipe shall be permitted to be increased to a maximum of 5'-6" for 3/4" piping and 6'-0" for 1" through 1-1/2" piping.
- D. Ensure to adequately secure sprinkler piping to restrict the movement of piping upon sprinkler operation. Where listed CPVC pipe is specified, supports must be provided as required in accordance with the pipe manufacturer's recommendations.
- E. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- F. Place a hanger within 12 inches of each horizontal elbow and at the vertical to horizontal transition.
- G. For piping 2 inches and larger, provide additional hangers at offsets and changes in horizontal direction of piping. Where the spacing of adjacent hangers for the piping does not exceed the distance limits in NFPA 13, such additional hangers shall still be provided.

- H. Use hangers with 1-1/2 inch minimum vertical adjustment.
- I. Ensure that hanger rods are only loaded axially (along the rod). Provide additional hangers or restraints as necessary to minimize non-axial loads
- J. Threaded sections of rod shall not be formed or bent, neither prior to nor as a result of installation.
- K. Support vertical piping at every floor. Distances between supports for risers shall not exceed 25 feet.
- L. In multi-story buildings (in addition to at every floor) riser supports shall be provided at the lowest level, above and below offsets, and at the top of the riser.
- M. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- N. Support riser piping independently of connected horizontal piping.
- O. Install hangers with a nut at the base and above the hanger; tighten upper nut to hanger after final installation adjustments.
- P. Where piping is subject to seismic activity, ensure to provide protection measures in accordance with NFPA 13 requirements.

3.3 INSULATED PIPING

- A. Comply with the following installation requirements.
- B. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
- C. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
- D. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

<u>Nominal Pipe Size</u>	<u>Length</u>	<u>Thickness</u>
1/4 through 3-1/2 inch	12 inch	0.048 inch
4 inch	12 inch	0.060 inch
5 through 6 inch	18 inch	0.060 inch
8 through 14 inch	24 inch	0.075 inch
16 through 24 inch	24 inch	0.105 inch

- E. Piping 2" and larger provide galvanized sheet metal shields with calcium silicate at hangers/supports.
- F. Insert material shall be at least as long as the protective shield.
- G. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.4 EQUIPMENT BASES AND SUPPORTS

- A. Provide equipment bases of concrete.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct support of steel members. Brace and fasten with flanges bolted to structure.

3.5 SEALS

- A. Provide flexible watertight sealant where piping penetrates waterproofed walls, floors, and roofs.

- B. Where dry sprinklers are connected to wet pipe sprinkler systems protecting areas subject to freezing temperatures (such as, but not necessarily limited to, insulated freezer structures) ensure that the clearance space around the sprinkler barrel is completely sealed in accordance with the manufacturer's recommendations.

3.6 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermafiber and 3M caulking and provide floor plate.
- C. Where piping penetrates a floor, ceiling, or wall, close off space between pipe and adjacent work with UL listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- D. Fire protection sleeves may be flush with floor of stairways.

END OF SECTION

SECTION 21 13 13
WET PIPE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.
- C. Refer to Section 21 00 00 for integral requirements.

1.2 SCOPE

- A. Scope of the work shall include the furnishing and complete installation of the fire protection piping, valves, sprinkler heads, and equipment covered by this Section, with all appurtenances, ready for owner's use.
- B. The scope of work shall include the painting and pipe marking of fire sprinkler system piping as described in Section 21 00 00.
- C. The scope of work shall include providing UL listed, FM approved factory-assembled automatic release air vents on sprinkler branch lines for the reduction of trapped air in the sprinkler system. Provide each complete with isolation valve, union or quick connect, wye strainer with valve, and drain line to drain in accordance with manufacturer's recommendations and local requirements.
- D. The provision of air vents shall be coordinated with any other systems or treatment for general corrosion or MIC (Microbiologically Influenced Corrosion) that may be specified.

1.3 RELATED WORK

- A. Section 21 00 00 - Fire Protection
- B. Section 21 02 01 - Coordination Drawings
- C. Section 21 05 29 - Hangers and Supports for Fire Suppression Piping and Equipment
- D. Section 21 13 16 - Dry Pipe Sprinkler Systems

1.4 REFERENCES

- A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- B. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe.
- C. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- D. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
- E. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.
- F. NFPA 13 - Standard for the Installation of Sprinkler Systems.
- G. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.
- H. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
- I. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

1.5 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.
- B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.
- C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer's name and **country of origin**.
- D. Domestic Manufacture: All valves, pipe, fittings, sprinkler heads, and equipment shall be by a domestic manufacturer.
- E. Welding Procedures and Performance:
 - 1. Meet or exceed the requirements of AWS B2.1/B2.1M "Welding and Brazing Qualifications"; as well as any local AHJ requirements.
 - 2. Maintain and be able to produce complete certified records, including, but not necessarily limited to, the following: Welding Procedure Specifications (WPS's), Procedure Qualification Records (PQR's), and welder qualification records.

1.6 SUBMITTALS

- A. Submit shop drawings in accordance with Section 22 02 00 and as described below.
- B. Submit product data with manufacturer's catalog information, product certifications, and **country of origin** identified. Indicate valve data and ratings. Product data to be submitted shall include, but not necessarily be limited to, the following:
 - 1. Pipe material
 - 2. Pipe fittings and couplings
 - 3. Sprinkler heads and guards
 - 4. Valves, air release vents, and backflow preventers
 - 5. Waterflow, supervisory and alarm devices
 - 6. Fire-stopping sealant and pipe marker products
 - 7. Spare sprinkler head box, signage, and other accessories
 - 8. Include a schedule of wall sleeves to be provided
- C. Product data for hangers and supports *may* be submitted under this section, although these items are specified under Section 21 05 29 – Hangers and Supports for Fire Suppression Piping and Equipment
- D. Submit shop drawings of entire sprinkler system with all head locations and including accompanying hydraulic calculations to the Architect/Engineer for review. **A current and fully documented fire hydrant flow test must be included.**
- E. Provide Architect with six complete sets of final approved shop drawings before starting the installation. Include details of the sprinkler system showing sections, light fixtures, ducts, and a plan indicating fire department connections, location of all exposed structures within twenty feet of this structure, and other equipment to be used. Drawings shall bear the stamp of review of the local fire insurance rating organization having jurisdiction.
- F. Service Utility Diagram: Furnish Architect with an accurately marked print showing location of underground pipes and valves as installed upon completion of underground work.
- G. Where a project is required to comply with FM Global requirements, ensure to submit a set of drawings, hydraulic calculations, and other required documentation to a designated representative of FM Global for review and acceptance prior to the start of any system installation.

1.7 REGULATORY REQUIREMENTS

- A. Work in accordance with:

1. NFPA 13
 2. NFPA 14
 3. NFPA 24
 4. NFPA 25
 5. Requirements of the local Authority Having Jurisdiction (AHJ).
 6. FM Global Datasheet 2-0.
- B. Products in accordance with:
1. UL listed.
 2. FM (Factory Mutual) approved.
 3. Requirements of the local Authority Having Jurisdiction (AHJ).

1.8 CERTIFICATE OF TESTING

- A. Furnish the Owner with test certificate certifying the system approved by:
1. Fire Marshal
 2. Insurance Services Officials

PART 2 - PRODUCTS

2.1 GENERAL

- A. Work included:
1. Design, coordination, furnishing, and installation of inside and outside piping, valves, sprinkler heads, hangers, supports, and sleeves.
 2. The sprinkler system is an automatic wet pipe type system and shall be designed to provide coverage for the entire building unless specifically indicated otherwise.
 - a. The Contract Drawings indicate the general extent and arrangement.
 - b. The Contract Drawings identify rooms and spaces, which may aid in the determination of the various occupancy hazard classifications.
 - c. Sprinkler heads are not shown.
 3. The Drawings provide a preliminary layout with locations of water service entry/water supply, control valves, riser assembly/zone valves, and fire department connection(s). These are a guide for the subsequent preparation of the Licensed Fire Sprinkler Contractor's detailed working drawings.
 4. Coordinate work and installation with electrical and fire alarm contractors accordingly. Ensure that power is provided at required locations. Ensure that system is interfaced with the building fire and smoke alarm systems. This shall include, but not necessarily be limited to:
 - a. Flow and tamper switches - including any remote locations such as backflow preventer vaults, water supply post indicating valves, etc.
 - b. Waterflow signals ensure the immediate shut down of associated HVLS fans per NFPA 13, 11.1.7.
 - c. Heat trace pipe freeze protection system.
- B. Requirements:
1. Materials and installation to meet or exceed the requirements of NFPA 13, prevailing edition and the local Authority Having Jurisdiction (AHJ).
 2. All components of the system shall be UL listed for the intended service.
 3. Provide components with minimum pressure ratings as suited for system working pressure(s).

2.2 VALVES

- A. General requirements:
1. Valves shall be rated for no less than 175 psi.

2. All valves controlling connections to water supplies and to supply pipes to sprinklers shall be listed indicating valves.
 3. Drain and test valves shall be approved.
 4. All control, drain, venting, and test connection valves shall be provided with permanently marked weatherproof metal identification signs.
 5. Provide as indicated on the Drawings and configured in accordance with the requirements of the local Authority Having Jurisdiction.
 6. A listed relief valve not less than 1/2" in size shall be provided on each wet pipe system, in accordance with NFPA 13 requirements. Provide a piped drain line to the outdoors for each such valve.
- B. Alarm Valves
1. Riser alarm valves shall be UL listed, FM approved alarm check valve type complete with pressure actuated switch or riser check valve type with a listed vane type waterflow alarm switch.
 - a. Approved pressure gauges shall be provided on both the supply and system sides of the valve.
 - b. Valve body shall include a removable cover for check clapper access.
 2. Local waterflow alarm devices shall be a listed water-motor operated device or an electrified bell type for outdoor installation. Additionally, provide an electrified bell for indoor installation. System Sensor, Potter, or Reliable.
 3. Provide connectivity to the building fire alarm system.
 4. Acceptable valve manufacturers:
 - a. Reliable
 - b. Viking
 - c. Tyco-Grinnell
 - d. Victaulic (acceptable for alarm check valve variations only)
- C. Control Valves (Gate)
1. Control valves shall be UL listed, FM approved bronze trimmed resilient wedge gate type.
 2. Provide bronze bodied, rising stem, inside screw type for sizes 2" and smaller. Provide ductile iron bodied, rising stem, outside screw and yoke type for sizes 2-1/2" and larger.
 3. Acceptable manufacturers:
 - a. Mueller Company
 - b. Kennedy Valve
 - c. Victaulic
 - d. Nibco
- D. Control Valves (Butterfly)
1. Control valves shall be UL listed, FM approved ductile iron bodied, gear operated with flag, butterfly type.
 2. Acceptable manufacturers:
 - a. Reliable
 - b. Kennedy Valve
 - c. Tyco-Grinnell
 - d. Victaulic
 - e. Nibco
- E. Check Valves
1. Check valves shall be UL listed, FM approved ductile or cast iron bodied, bronze fitted, non-slam type, suited for horizontal or vertical installation.
 2. Acceptable manufacturers:
 - a. Mueller Company

- b. Kennedy Valve
 - c. Victaulic
 - d. Nibco
 - e. Tyco-Grinnell
- F. Test and Drain Valve Assemblies shall be UL listed, FM approved bronze bodied ball valve type complete with tamper resistant test orifice and sight glasses. AGF Manufacturing, Inc.
- G. Automatic air release valve and vent assemblies shall be UL listed, FM approved and provided complete with brass or bronze bodied ball valves, stainless steel mesh strainers, and float operated air release valves. Acceptable manufacturers:
 - 1. Engineered Corrosion Solutions PAV-W.
 - 2. Tyco TAV-W.
 - 3. Potter PAAR-B.
- H. Backflow Preventers: Provide as indicated on the Drawings and in accordance with the requirements of the water supplier and public health authority having jurisdiction. All such devices shall be listed for fire protection service.

2.3 PIPE AND FITTINGS

- A. Underground service entry shall be: UL listed, FM approved, NFPA 24 compliant, type 304 stainless steel, pre-fabricated in-building riser. Acceptable manufacturers:
 - 1. Ames Fire & Waterworks
 - 2. Zurn Wilkins
- B. All sprinkler system piping above grade shall be (refer to 21 00 00 for **standpipe** system piping):
 - 1. ASTM A135/A135M / ASTM A53/A53M schedule 10 black steel pipe with roll-grooved ends, joined with mechanical couplings and with manufactured carbon steel grooved fittings with matching mechanical couplings for pipe 2-1/2" and larger. Fittings shall be fully metallicity formed type with an independent gasket and coupling at each pipe connection. All coupling assembly points shall have bolts and nuts.
 - 2. ASTM A135/A135M / ASTM A795/A795M schedule 40 black steel threaded pipe and cast iron or malleable iron fittings for pipe 2" and smaller.
 - 3. For gridded systems, the use of an approved grooved mechanical coupling shall be acceptable at one end of each branch line to facilitate the connection of such branch lines to a system main.
 - 4. Welding shall be acceptable only for providing ASTM A53/A53M shop welded, branch outlet fittings, UL Listed and FM Approved for use in fire sprinkler systems, in accordance with NFPA 13 and local AHJ requirements.
 - a. Merit Manufacturing Corporation or pre-approved equal.
 - b. In no case shall butt-welding of pipe ends be allowed.
- C. Acceptable manufacturers:
 - 1. Wheatland Tube Company
 - 2. Bull Moose Tube Company
 - 3. Tex-Tube
 - 4. Allied Tube
- D. Acceptable mechanical coupling manufacturers:
 - 1. Victaulic
 - 2. Tyco-Grinnell
 - 3. Anvil Gruvlok

- E. **Regardless of manufacturer, the use of pipe hole-cut, gasketed bolt-on branch outlets shall not be permitted. This prohibition includes, but is not necessarily limited to, the following: clamp-T, mechanical-T, outlet-T, strap-T, and U-bolt-T outlet connectors.**
- F. In all locations subject to corrosive conditions, ensure to provide a suitable epoxy (spray) coating to all exposed surfaces of pipe and fittings. Such locations shall include, but not necessarily be limited to, the following: natatoriums, pool equipment rooms, chemical and metal process areas, and animal pens. All job-applied protective coatings shall be provided as approved and only after verification that the proper piping has been installed, per the markings along the length of the pipe.

2.4 SPRINKLER HEADS

- A. Suspended Ceiling Type: Standard concealed pendent type with white cover plate.
- B. Exposed Area Type: Standard upright type with brass finish.
- C. Sidewall Type: Chrome plated finish with matching escutcheon.
- D. Where maximum ceiling temperatures exceed 100 degrees F, sprinklers with temperature ratings in accordance with maximum ceiling temperatures as tabulated in NFPA 13 shall be provided.
 - 1. Sprinkler heads within a given compartment must all be of the same temperature rating. Ambient ceiling temperatures expected in the vicinity of the sprinklers must be considered accordingly.
 - 2. Possible high ambient temperature areas may include, but are not necessarily limited to, the following: electrical equipment rooms, kiln rooms, sauna rooms, interior generator rooms, skylights, and manufacturing/process spaces.
- E. Sprinkler heads which utilize an "O"-ring type water seal within the sprinkler frame are not acceptable, in accordance with the latest UL requirements for sprinkler head design.
- F. In all locations subject to corrosive conditions provide heads entirely constructed of stainless steel or heads with polyester coated finish and dipped in wax. Such locations shall include, but not necessarily be limited to, the following: natatoriums, pool equipment rooms, chemical and metal process areas, and animal pens.
- G. In all locations subject to occupant abuse or vandalism provide institutional type sprinkler heads with tamper-resistant construction and suitable "break-away" weight test documentation from the manufacturer. Such locations shall include, but not necessarily be limited to, the following: patient areas of institutional mental health occupancies, prisoner areas (cells, etc.) of correctional facilities – jails, prisons, juvenile detention facilities.
- H. **Flexible type sprinkler head connections are not acceptable.**
- I. Acceptable manufacturers:
 - 1. Tyco-Grinnell
 - 2. Viking
 - 3. Victaulic
 - 4. Reliable
 - 5. Globe Fire Sprinkler Corporation

2.5 FIRE DEPARTMENT CONNECTIONS

- A. Refer to Section 21 00 00 for all such requirements.

2.6 INSULATION AND HEAT TRACING

- A. Provide a supervised, listed (UL 515A) pipe freeze protection system, complete with insulation, for all water-filled pipe, fittings, and valves subject to freezing conditions. The system shall be designed to maintain water temperature at a minimum of 40 degrees F.
- B. Heat trace cable shall be self-regulating type with a cross-linked polymer core, tinned copper braid, and a polyolefin outer jacket. Cable, power connections, splices/tees, end seals, temperature sensors, controllers, and other system appurtenances shall be the product of single heat trace system manufacturer and provided in strict accordance with the manufacturer's recommendations. nVent/Raychem XL-Trace Edge System or pre-approved equal.
- C. A UL listed closed cell flame-retardant thermal insulation protected with weatherproof cladding (aluminum jacketing with sealed joints) shall be provided. 1-1/2" phenolic foam with a density of no less than 2.5 pounds per cubic foot. Provide with factory applied ASJ vapor retarder jacket for indoor applications and zero perm vapor barrier for outdoors applications. Resolco, Inc. Insul-Phen or pre-approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.
- B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items as required by NFPA 13 and installed as per manufacturer's recommendations.
- C. For any area requiring sprinkler protection and where the piping will be subject to freezing, the expectation is that a dry pipe system will be provided. This shall apply whether or not such an area has been identified on the Drawings and whether or not such a system has been specified under a separate Section.

3.2 DESIGN

- A. Design spacing of sprinkler heads and selection sizes shall conform to the requirements of NFPA 13 for the occupancy hazard.
- B. Uniform discharge density design shall be based on hydraulic calculations utilizing the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.
- C. Friction losses in pipe will be based on a value of "C" =120 in the Hazen - Williams formula for steel pipe and "C" =150 for listed CPVC pipe (only if specified).
- D. Design and install the system so that no part will interfere with doors, windows, heating, plumbing, or electrical equipment. Do not locate sprinkler heads within 6 inches of lighting fixtures, HVAC diffusers and other obstructions. Sprinkler piping cannot penetrate ductwork, structural members, or lighting fixtures.
- E. The Contractor shall conform to NFPA 13, prevailing edition. Special attention shall be given to the Chapters on Plans and Calculations and on Systems Acceptance. It shall be the Licensed Fire Sprinkler Contractor's responsibility to determine if any deficiencies exist, such as an inadequate water supply, or any other item which would materially affect the acceptability of the system.

- F. Design sprinkler system piping accordingly and provide hose connections complete with valves, hoses, and cabinets where and as required by code. Adhere to the acceptable manufacturers listed in Section 21 00 00. Locations shall include, but are not necessarily limited to, the following: theatrical stages greater than 1,000 square feet.
- G. Reference the latest architectural reflected ceiling plans. Extend branch lines accordingly to provide sprinklers both above and below "cloud" ceilings, where present and as required.
- H. Ensure to provide sprinklers under fixed obstructions (such as ductwork) over 48 inches wide.

3.3 INSTALLATION - GENERAL

- A. Install all items in accordance with applicable codes.
- B. Install piping so that mains and branches are not located directly underneath HVAC equipment or other items needing access.
- C. Do not install risers or mains in MDF/IDF/Data closets or electrical rooms. Where sprinkler protection is provided, only the associated branch lines and sprinkler heads shall be allowed in such spaces.
- D. Furnish additional heads which may be required for coordinated ceiling patterns without added cost, even though number of heads may exceed minimum code requirements.
- E. All sprinkler heads shall be located as near the center of ceiling tiles as is practical ($\pm 1/2"$). Location shall present a uniform pattern with all heads aligned when completely installed.
- F. Run piping concealed above furred ceilings and in joist space to minimize obstructions. Expose only heads. Exact routing of piping shall be approved by Architect or relocated as required at no additional cost to Owner.
- G. Provide wire guards on all non-concealed pendent and upright sprinklers heads subject to damage, including, but not necessarily limited to, the following locations: mechanical rooms, gymnasiums, athletic areas, wood and metal shops.
- H. Locate outside alarms on wall of building adjacent to sprinkler riser room.
- I. Provide on wall near the sprinkler valve(s): a clearly labeled and suitably sized cabinet containing (a minimum of 5% but no less than four) spare sprinkler heads of each type and a wrench suitable for each head type.
- J. Provide one case of spare escutcheons for each type of sprinkler head.
- K. Provide 1 inch diameter nipple and 1 inch x 1/2 inch reducing fitting for each upright head.

3.4 INSTALLATION - DRAINAGE

- A. All sprinkler pipe and fittings shall be installed so that the system can be drained.
- B. Unless not practicable, all piping shall be arranged to drain to the main drain valve for each sprinkler system. Make provisions accordingly for any trapped piping and provide auxiliary drains as necessary, complete with signage, and in accordance with NFPA 13 requirements.
- C. Unless noted otherwise on the Drawings or in conflict with Owner requirements, all drains shall discharge to the outdoors at locations free from the possibility of causing water damage. Each such drain shall be provided with a chrome wall escutcheon and 45 degree galvanized ell turned down.

3.5 INSTALLATION - AIR VENTS

- A. Each system shall be provided with at least one (1) automatic air vent, however more than one (1) may be required on a given system in order to exhaust the trapped air.

- B. Each air vent shall be located near a high point in the system it serves. Provide each such vent where it will be most effective and locate it off the top of the horizontal piping in an accessible location and a level position.

3.6 SYSTEM IDENTIFICATION

- A. Provide a printed sheet giving brief instructions relative to all necessary aspects of sprinkler controls and emergency procedures next to sprinkler riser mains. Instruction sheet shall be laminated or protected by a transparent plastic cover.
- B. Provide laminated zone map(s) at the riser location(s) clearly indicating the geographical area protected by each zone valve/floor control assembly. Floor plan shall include the locations of all valves (marked and labeled).
- C. Provide an additional laminated map as described above at the fire alarm control panel.
- D. All hydraulic calculation plates must be engraved.
- E. Each system valve (indoor and outdoor) must be permanently labeled with the system information.
- F. Signage:
 - 1. Each riser room door must have a 2'-0" x 3'-0" sign provided on the outside with the wording "SPRINKLER RISER ROOM."
 - 2. Each fire department connection shall have a sign with the street address on it.
 - 3. Signage provided shall comply with NFPA and local AHJ requirements.

3.7 PAINTING AND PIPE IDENTIFICATION

- A. Refer to Section 21 00 00 for all such requirements.

3.8 REPLACEMENT

- A. Upon receipt of written notice of failure of any part of the guaranteed equipment during the guaranteed period, the Contractor will replace the affected part or parts promptly at no additional cost.

3.9 TESTING

- A. Prior to testing, the entire sprinkler system shall be thoroughly flushed clean.
- B. Upon completion of the installation and flushing, test the system and obtain approval of the local fire insurance rating organization having jurisdiction. Particular attention is called to the acceptance requirements of NFPA 13.
- C. Testing and acceptance must be provided for underground and aboveground piping per NFPA 13 and local AHJ requirements. Documentation of such shall be provided to the Owner.

3.10 TRAINING

- A. The Owner's maintenance staff shall be fully briefed in the normal start-up of the system, operation, normal and emergency shutdown, and maintenance of the system.
- B. Routine maintenance, yearly maintenance, and any seasonal requirements or considerations shall be fully discussed and documented.
- C. Names of those instructed and dates, as well as a list of information provided to the Owner shall be included in the final report.

END OF SECTION

SECTION 21 13 16
DRY PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.
- C. Refer to Section 21 00 00 for integral requirements.

1.2 SCOPE

- A. Scope of the work shall include the furnishing and complete installation of the the fire protection piping, valves, sprinkler heads, and equipment covered by this Section, with all appurtenances, ready for owner's use.
- B. The scope of work shall include the painting and pipe marking of fire sprinkler system piping as described in Section 21 00 00.
- C. Dry pipe system(s) shall be installed only in areas subject to freezing and all such areas shall be completely protected in this manner. The dry pipe valve(s) and supply piping shall be located in an area protected against freezing and mechanical injury.
- D. The scope of work shall include providing a complete and properly sized system:
 - 1. For continuously generating sufficiently dry nitrogen gas of no less than 98% purity.
 - 2. To fill and maintain the requisite volume and pressure of this supervisory gas supply in the sprinkler system at all times.
 - 3. With nitrogen generation based on membrane gas separation technology.
 - 4. Complete with oxygen removal vent(s) located in the sprinkler riser room to facilitate removal of oxygen from the sprinkler system piping. Gas sampling shall also be located in this same location.

1.3 RELATED WORK

- A. Section 21 00 00 - Fire Protection
- B. Section 21 02 01 - Coordination Drawings
- C. Section 21 05 29 - Hangers and Supports for Fire Suppression Piping and Equipment

1.4 REFERENCES

- A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- B. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe.
- C. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- D. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.
- E. NFPA 13 - Standard for the Installation of Sprinkler Systems.
- F. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.
- G. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
- H. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

1.5 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.
- B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.
- C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer's name and **country of origin**.
- D. Domestic Manufacture: All valves, pipe, fittings, sprinkler heads, and equipment shall be by a domestic manufacturer.
- E. Welding Procedures and Performance:
 - 1. Meet or exceed the requirements of AWS B2.1/B2.1M "Welding and Brazing Qualifications"; as well as any local AHJ requirements.
 - 2. Maintain and be able to produce complete certified records, including, but not necessarily limited to, the following: Welding Procedure Specifications (WPS's), Procedure Qualification Records (PQR's), and welder qualification records.

1.6 SUBMITTALS

- A. Submit shop drawings in accordance with Section 22 02 00 and as described below.
- B. Submit product data with manufacturer's catalog information, product certifications, and **country of origin** identified. Indicate valve data and ratings. Product data to be submitted shall include, but not necessarily be limited to, the following:
 - 1. Pipe material
 - 2. Pipe fittings and couplings
 - 3. Sprinkler heads and guards
 - 4. Valves, oxygen removal vents, and backflow preventers
 - 5. Nitrogen generator and appurtenances
 - 6. Waterflow, supervisory and alarm devices
 - 7. Fire-stopping sealant and pipe marker products
 - 8. Spare sprinkler head box, signage, and other accessories
 - 9. Include a schedule of wall sleeves to be provided
- C. Product data for hangers and supports *may* be submitted under this section, although these items are specified under 21 05 29 - Hangers and Supports for Fire Suppression Piping and Equipment
- D. Submit shop drawings of entire sprinkler system with all head locations and including accompanying hydraulic calculations to the Architect/Engineer for review. **A current and fully documented fire hydrant flow test must be included.**
- E. Provide Architect with six complete sets of final approved shop drawings before starting the installation. Include details of the sprinkler system showing sections, light fixtures, ducts, and a plan indicating fire department connections, location of all exposed structures within twenty feet of this structure, and other equipment to be used. Drawings shall bear the stamp of review of the local fire insurance rating organization having jurisdiction.
- F. Service Utility Diagram: Furnish Architect with an accurately marked print showing location of underground pipes and valves as installed upon completion of underground work.
- G. Where a project is required to comply with FM Global requirements, ensure to submit a set of drawings, hydraulic calculations, and other required documentation to a designated representative of FM Global for review and acceptance prior to the start of any system installation.

1.7 REGULATORY REQUIREMENTS

- A. Work in accordance with :
 - 1. NFPA 13
 - 2. NFPA 14
 - 3. NFPA 24
 - 4. NFPA 25
 - 5. Requirements of the local Authority Having Jurisdiction (AHJ)
 - 6. FM Global Datasheet 2-0.
 - 7. FM Global Datasheet 2-1.
- B. Product in accordance with:
 - 1. UL listed.
 - 2. FM (Factory Mutual) approved.
 - 3. Requirements of the local Authority Having Jurisdiction (AHJ).

1.8 CERTIFICATE OF TESTING

- A. Furnish Owner with test certificate certifying the system approved by:
 - 1. Fire Marshal
 - 2. Insurance Services Officials

PART 2 - PRODUCTS

2.1 GENERAL

- A. Work included:
 - 1. Design, coordination, furnishing, and installation of inside and outside piping, valves, sprinkler heads, hangers, supports, sleeves, and nitrogen generator.
 - 2. The sprinkler system is a dry pipe automatic system and shall be designed to provide coverage for the area(s) indicated on the Drawings.
 - a. The Contract Drawings indicate the general system extent and location for the dry pipe valve and riser.
 - b. The Contract Drawings identify rooms and spaces, which may aid in the determination of the various occupancy hazard classifications.
 - c. Sprinkler heads are not shown.
 - 3. The Drawings provide a preliminary layout with locations of water service entry/water supply, control valves, riser assembly/zone valves, and fire department connection(s). These are a guide for the subsequent preparation of the Licensed Fire Sprinkler Contractor's detailed working drawings.
 - 4. Prior to bid the fire sprinkler contractor shall determine if more than one dry system is required to protect the area(s) indicated. Failure to do so shall not add cost to the contract or to the Owner.
 - 5. Coordinate work and installation with electrical and fire alarm contractors accordingly. Ensure that power is provided at required locations. Ensure that system is interfaced with the building fire and smoke alarm systems. This shall include, but not necessarily be limited to:
 - a. Flow and tamper switches - including any remote locations such as backflow preventer vaults, water supply post indicating valves, etc.
 - b. Waterflow signals ensure the immediate shut down of associated HVLS fans per NFPA 13, 11.1.7.
 - c. Monitoring of the nitrogen generator.
- B. Requirements:
 - 1. Materials and installation to meet or exceed the requirements of NFPA 13, prevailing edition and the local Authority Having Jurisdiction (AHJ).

2. All components of the system shall be UL listed for the intended service.
3. Provide components with minimum pressure ratings as suited for system working pressure(s).

2.2 VALVES AND SUPERVISORY GAS

A. General valve requirements:

1. Valves shall be rated for no less than 175 psi.
2. All valves controlling connections to water supplies and to supply pipes to sprinklers shall be listed indicating valves.
3. Drain and test valves shall be approved.
4. All control, drain, venting, and test connection valves shall be provided with permanently marked weatherproof metal identification signs.
5. Provide as indicated on the Drawings and configured in accordance with the requirements of the local Authority Having Jurisdiction.

B. Dry Pipe Valves

1. Dry pipe valve assembly shall be UL listed, FM approved and provided complete with listed alarm attachments.
 - a. Approved pressure gauges shall be provided on both the water side and gas side of the dry pipe valve.
 - b. Approved pressure gauge shall be provided on the gas supply to the dry pipe valve.
 - c. Valve body shall include a removable cover for valve clapper access.
 - d. A listed accelerator type quick-opening device complete with approved pressure gauge shall be provided as necessary.
 - e. Acceptable dry pipe valve manufacturers:
 - 1) Victaulic
 - 2) Reliable
 - 3) Tyco-Grinnell
 - f. Provide a listed and dedicated automatic air maintenance device to control supervisory gas flow to each dry pipe system. Unit shall be pre-piped, valved, and complete with fittings and actuator as appropriate for the system. Acceptable device manufacturers:
 - 1) Victaulic Series 757
 - 2) Reliable Model A
 - 3) Tyco Model AMD-1
2. Local waterflow alarm devices shall be a listed water-motor operated device or an electrified bell type for outdoor installation. Additionally, provide an electrified bell for indoor installation. System Sensor, Potter, or Reliable.
3. Provide connectivity to the building fire alarm system.

C. Nitrogen Supervisory Gas Generator

1. FM Approved, UL 508A Listed industrial control cabinet/panel.
2. Air bypass and leak monitoring alarm signals included. Provide connectivity to the building fire alarm system.
3. Capable of keeping up with system leak rate in accordance with both NFPA 13 and NFPA 25 requirements.
4. Fully tested and assembled, turn key package for wall mounted or skid-mounted arrangement per system size. Provide stand alone with separate adjacent air compressor as required for sprinkler system size.
5. Complete with integrated oil-less air compressor and bypass valve, or with separate oil lubricated air compressor as required per system size.

6. Configured for 120 VAC and/or higher voltage if required for a three-phase compressor due to sprinkler system size. Coordinate final power requirements in field with electrical contractor.
 7. Membrane separation technology based, 98% high purity nitrogen generation.
 8. Sized with a capacity capable of restoring normal supervisory pressure in the system within 30 minutes (or within 30 minutes for the single largest system where the nitrogen generator serves more than one dry system).
 9. Acceptable manufacturers: ECS (Engineered Corrosion Solutions) or pre-approved equal.
 10. Paired with float valve based oxygen removal vent assembly with pressure regulating device by the same manufacturer. One for each dry pipe system. ECS model PAV-D.
 11. For multi-zone sprinkler systems with differing supervisory gas pressure needs, provide a nitrogen interface controller if and as necessary.
- D. Control Valves (Gate)
1. Control valves shall be UL listed, FM approved bronze trimmed resilient wedge gate type.
 2. Provide bronze bodied, rising stem, inside screw type for sizes 2" and smaller. Provide ductile iron bodied, rising stem, outside screw and yoke type for sizes 2-1/2" and larger.
 3. Acceptable manufacturers:
 - a. Mueller Company
 - b. Kennedy Valve
 - c. Victaulic
 - d. Nibco
- E. Control Valves (Butterfly)
1. Control valves shall be UL listed, FM approved ductile iron bodied, gear operated with flag, butterfly type.
 2. Acceptable manufacturers:
 - a. Reliable
 - b. Kennedy Valve
 - c. Tyco-Grinnell
 - d. Victaulic
 - e. Nibco
- F. Check Valves
1. Check valves shall be UL listed, FM approved ductile or cast iron bodied, bronze fitted, non-slam type, suited for horizontal or vertical installation.
 2. Acceptable manufacturers:
 - a. Mueller Company
 - b. Kennedy Valve
 - c. Victaulic
 - d. Nibco
 - e. Tyco-Grinnell
- G. Test and Drain Valve Assemblies shall be UL listed, FM approved bronze bodied ball valve type complete with tamper resistant test orifice and sight glasses. AGF Manufacturing, Inc.
- H. Auxiliary drains shall be provided to ensure that all sections of the system can be drained of water. Provide at all low points and similar locations, complete with water detector alarm component to notify personnel of excess water. Wire to fire alarm panel or BMS to remote notification. Pre-manufactured black steel pipe nipple with quarter turn ball valves. AGF Manufacturing, Inc. Model 5300ALBV.

- I. Backflow Preventers: Provide as indicated on the Drawings and in accordance with the requirements of the water supplier and public health Authority Having Jurisdiction. All such devices shall be listed for fire protection service.

2.3 PIPE AND FITTINGS

- A. Underground service entry shall be: UL listed, FM approved, NFPA 24 compliant, type 304 stainless steel, pre-fabricated in-building riser. Acceptable manufacturers:
 1. Ames Fire & Waterworks
 2. Zurn Wilkins
- B. All sprinkler system piping above grade shall be (refer to 21 00 00 for **standpipe** system piping):
 1. ASTM A135/A135M / ASTM A53/A53M schedule 40 black steel pipe with roll-grooved ends, joined with mechanical couplings and with manufactured carbon steel grooved fittings with matching mechanical couplings for pipe 2-1/2" and larger. Fittings shall be fully metallically formed type with an independent gasket and coupling at each pipe connection. All coupling assembly points shall have bolts and nuts.
 2. ASTM A135/A135M / ASTM A795/A795M schedule 40 black steel threaded pipe and cast iron or malleable iron fittings for pipe 2" and smaller.
 3. Welding shall be acceptable only for providing ASTM A53/A53M shop welded, branch outlet fittings, UL Listed and FM Approved for use in fire sprinkler systems, in accordance with NFPA 13 and local AHJ requirements.
 - a. Merit Manufacturing Corporation or pre-approved equal.
 - b. In no case shall butt-welding of pipe ends be allowed.
- C. Acceptable Manufacturers:
 1. Wheatland Tube Company
 2. Bull Moose Tube Company
 3. Tex-Tube
 4. Allied Tube
- D. Acceptable mechanical coupling manufacturers (all grooved couplings and gaskets shall be listed for dry service):
 1. Victaulic
 2. Tyco-Grinnell
 3. Anvil Gruvlok
- E. **Regardless of manufacturer, the use of pipe hole-cut, gasketed bolt-on branch outlets shall not be permitted. This prohibition includes, but is not necessarily limited to, the following: clamp-T, mechanical-T, outlet-T, strap-T, and U-bolt-T outlet connectors.**
- F. In all locations subject to corrosive conditions, ensure to provide a suitable epoxy (spray) coating to all exposed surfaces of pipe and fittings. Such locations shall include, but not necessarily be limited to, the following: natatoriums, pool equipment rooms, chemical and metal process areas, and animal pens. All job-applied protective coatings shall be provided as approved and only after verification that the proper piping has been installed, per the markings along the length of the pipe.

2.4 SPRINKLER HEADS

- A. All sprinkler heads shall be either upright or listed dry sprinkler heads.
- B. Finished Ceiling Type: Listed dry pendent concealed type with white cover plate or in color to match ceiling finish.
- C. Exposed Area Type: Standard upright type with brass finish.
- D. Sidewall Type: Chrome plated finish with matching escutcheon.

- E. Temperature rating on fusible links to suit specific hazard area with minimum margin or safety of 50 degrees F.
- F. Sprinkler heads which utilize an "O"-ring type water seal within the sprinkler frame are not acceptable, in accordance with the latest UL requirements for sprinkler head design.
- G. In all locations subject to corrosive conditions provide heads entirely constructed of stainless steel or heads with polyester coated finish and dipped in wax. Such locations shall include, but not necessarily be limited to, the following: natatoriums, pool equipment rooms, chemical and metal process areas, and animal pens.
- H. In all locations subject to occupant abuse or vandalism provide institutional type sprinkler heads with tamper-resistant construction and suitable "break-away" weight test documentation from the manufacturer. Such locations shall include, but not necessarily be limited to, the following: patient areas of institutional mental health occupancies, prisoner areas (cells, etc.) of correctional facilities – jails, prisons, juvenile detention facilities.
- I. Acceptable manufacturers:
 - 1. Tyco-Grinnell
 - 2. Viking
 - 3. Victaulic
 - 4. Reliable
 - 5. Globe Fire Sprinkler Corporation

2.5 FIRE DEPARTMENT CONNECTIONS

- A. Refer to Section 21 00 00 for all such requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions
- B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items as required by NFPA 13 and installed as per manufacturer's recommendations.

3.2 DESIGN

- A. Design spacing of sprinkler heads and selection sizes shall conform to the requirement of NFPA 13 for the occupancy hazard.
- B. Uniform discharge density design shall be based on hydraulic calculations utilizing the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.
- C. Friction losses in pipe will be based on a value of "C" =100 in the Hazen-Williams formula for steel pipe.
- D. Design and install the system so that no part will interfere with doors, windows, heating, plumbing, or electrical equipment. Do not locate sprinkler heads within 6 inches of lighting fixtures, HVAC diffusers and other obstructions. Sprinkler piping cannot penetrate ductwork, structural members, or lighting fixtures.
- E. The Contractor shall conform to NFPA 13, prevailing edition. Special attention shall be given to the Chapters on Plans and Calculations and on Systems Acceptance. It shall be the Licensed Fire Sprinkler Contractor's responsibility to determine if any deficiencies exist, such as an inadequate water supply, or any other item which would materially affect the acceptability of the system.

- F. Reference the latest architectural reflected ceiling plans. Extend branch lines accordingly to provide sprinklers both above and below "cloud" ceilings, where present and as required.
- G. Ensure to provide sprinklers under fixed obstructions (such as ductwork) over 48 inches wide.

3.3 INSTALLATION - GENERAL

- A. Install all items in accordance with applicable codes.
- B. Install piping so that mains and branches are not located directly underneath HVAC equipment or other items needing access.
- C. Do not install risers or mains in MDF/IDF/Data closets or electrical rooms. Where sprinkler protection is provided, only the associated branch lines and sprinkler heads shall be allowed in such spaces.
- D. Furnish additional heads which may be required for coordinated ceiling patterns without added cost, even though number of heads may exceed minimum code requirements.
- E. All sprinkler heads shall be located as near the center of ceiling tiles as is practical ($\pm 1/2"$). Location shall present a uniform pattern with all heads aligned when completely installed.
- F. Run piping concealed above furred ceilings and in joist space to minimize obstructions. Expose only heads. Exact routing of piping shall be approved by Architect or relocated as required at no additional cost to Owner.
- G. Provide wire guards on all non-concealed pendent and upright sprinklers heads subject to damage, including, but not necessarily limited to, the following locations: mechanical rooms, gymnasiums, athletic areas, wood and metal shops.
- H. Locate outside alarms on wall of building adjacent to sprinkler riser room.
- I. Provide on wall near the sprinkler valve(s): a clearly labeled and suitably sized cabinet containing (a minimum of 5% but no less than four) spare sprinkler heads of each type and a wrench suitable for each head type.
- J. Provide one case of spare escutcheons for each type of sprinkler head.
- K. Provide 1 inch diameter nipple and 1 inch x 1/2 inch reducing fitting for each upright head.
- L. Nitrogen filling (more than one cycle may be required for complete oxygen removal) and nitrogen generator system installation and start-up shall be in strict accordance with the manufacturer's published recommendations.

3.4 INSTALLATION - DRAINAGE

- A. All sprinkler pipe and fittings shall be installed so that the system can be drained.
- B. Unless not practicable, all piping shall be arranged to drain to the main drain valve for each sprinkler system. Make provisions accordingly for any trapped piping and provide auxiliary drains as necessary, complete with signage, and in accordance with NFPA 13 requirements.
- C. Ensure to provide the required pitch to drain per NFPA 13 requirements.
- D. Unless noted otherwise on the Drawings or in conflict with Owner requirements, all drains shall discharge to the outdoors at locations free from the possibility of causing water damage. Each such drain shall be provided with a chrome wall escutcheon and 45 degree galvanized ell turned down.

3.5 SYSTEM IDENTIFICATION

- A. Provide a printed sheet giving brief instructions relative to all necessary aspects of sprinkler controls and emergency procedures next to sprinkler riser mains. Instruction sheet shall be laminated or protected by a transparent plastic cover.

- B. Provide laminated zone map(s) at the riser location(s) clearly indicating the geographical area protected by each zone valve/floor control assembly. Floor plan shall include the locations of all valves (marked and labeled).
- C. Provide an additional laminated map as described above at the fire alarm control panel.
- D. All hydraulic calculation plates must be engraved.
- E. Each system valve (indoor and outdoor) must be permanently labeled with the system information.
- F. Signage:
 - 1. Each riser room door must have a 2'-0" x 3'-0" sign provided on the outside with the wording "SPRINKLER RISER ROOM."
 - 2. Each fire department connection shall have a sign with the street address on it.
 - 3. Signage provided shall comply with NFPA and local AHJ requirements.

3.6 PAINTING AND PIPE IDENTIFICATION

- A. Refer to Section 21 00 00 for all such requirements.

3.7 REPLACEMENT

- A. Upon receipt of written notice of failure of any part of the guaranteed equipment during the guaranteed period, the Contractor will replace the affected part or parts promptly at no additional cost.

3.8 TESTING

- A. Prior to testing, the entire sprinkler system shall be thoroughly flushed clean.
- B. Upon completion of the installation and flushing, test the system and obtain approval of the local fire insurance rating organization having jurisdiction. Particular attention is called to the acceptance requirements of NFPA 13 .
- C. Testing and acceptance must be provided for underground and aboveground piping per NFPA 13 and local AHJ requirements. Documentation of such shall be provided to the Owner.
- D. In addition to the standard hydrostatic test, a supervisory gas leakage test at 40 psi shall be conducted for 24 hours in accordance with NFPA 13 requirements. Any leakage that results in a loss of pressure in excess of 1.5 psi for the 24 hours shall be corrected.
- E. After successful acceptance testing and approval all water shall be drained and all residual water shall be purged from the system prior to filling the dry piping with supervisory gas.

3.9 TRAINING

- A. The Owner's maintenance staff shall be fully briefed in the normal start-up of the system, operation, normal and emergency shutdown.
- B. Routine maintenance, yearly maintenance including nitrogen generator filter replacement, and any seasonal requirements or considerations shall be fully discussed and documented.
- C. Names of those instructed and dates, as well as a list of information provided to the Owner shall be included in the final report.

END OF SECTION

SECTION 22 02 00
BASIC MATERIALS AND METHODS FOR PLUMBING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.
- B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departure and the reasons therefore shall be submitted to the Architect/Engineer for approval as soon as reasonably practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.
- C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is equal to that specified.

1.2 SCOPE OF WORK

- A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent Drawings, including those of other contracts, prior to commencement of Work.
- B. This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings, or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to: materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.
- C. The approximate locations of Plumbing and Fire Protection items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details with regards to locations of piping, appurtenances, etc. Exact locations are to be determined by actual measurements at the building/job-site, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.
- D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.
- E. Any discrepancies within the Contract Documents or between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least seven (7) working days prior to bid, the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

- F. It is the intention of this Section of the specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.
- G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified elsewhere, or necessary for complete and functioning plumbing systems shall be considered a part of the overall "Scope".
- H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.
- I. The Contractor shall participate in the Commissioning process as required; including, but not necessarily limited to: meeting attendance, completion of checklists, and participation in functional testing.

1.3 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

- A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed Shop Drawings.
- B. The piping, fixture, and equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit Shop Drawings for review.
- C. All transitions, offsets and relocations as required by actual field conditions shall be provided by the Contractor at no additional cost to the owner.
- D. Additional coordination with Electrical Subcontractor may be required to allow adequate clearances of electrical equipment, fixtures, and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts, or equipment locations.

1.4 SITE VISIT AND FAMILIARIZATION

- A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the piping, fixtures and equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.
- B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.
- C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.5 WORK SPECIFIED IN OTHER SECTIONS

- A. Finish painting is specified elsewhere. Prime and protective painting is included in the work of this Division.
- B. Owner and General Contractor furnished equipment shall be properly connected to plumbing systems.

- C. Furnishing and installing all required plumbing equipment, control relays and electrical interlock devices, conduit, wire and junction boxes are included in the Work of this Division.

1.6 PERMITS, TESTS, INSPECTIONS

- A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.7 DATE OF FINAL ACCEPTANCE

- A. The date of final acceptance shall be the date of Owner occupancy, or the date all punch list items have been completed, or the date final payment has been received. Refer to Division 01 for additional requirements.
- B. The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- B. Deliver products to the project at such times as the project is ready to receive the fixtures, equipment, pipe, valves, etc. - properly protected from incidental damage and weather damage.
- C. Damaged fixtures, equipment, valves, pipe, or appurtenances shall be promptly removed from the site and new, undamaged items shall be provided in its place promptly with no additional charge to the Owner.

1.9 NOISE AND VIBRATION

- A. The plumbing systems and the component parts thereof shall be guaranteed to operate without objectionable noise, water hammering, and vibration.
- B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.
- C. Carefully fabricate pipe and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.
- D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect/Engineer, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.
- E. Above ceiling piping and valves shall not be installed in direct contact with the work of other trades, including, but not limited to, suspended ceiling hanger wire.

1.10 APPLICABLE CODES

- A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.
- B. Arrange with the serving utility companies for the connection, relocation, and upgrade of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.
- C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements of the nationally accepted codes and standards.
- D. Such codes and standards shall include, but not necessarily be limited to:
 - 1. American Standards Association, ASA.

2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
 3. American Society of Mechanical Engineers, ASME.
 4. American Society of Plumbing Engineers, ASPE.
 5. American Society of Testing Materials, ASTM.
 6. American Water Works Association, AWWA.
 7. National Bureau of Standards, NBS.
 8. National Fire Protection Association, NFPA.
 9. UL, LLC (formerly Underwriters Laboratories).
 10. FM Global.
 11. International Energy Conservation Code, IECC.
 12. International Fire Code.
 13. International Fuel Gas Code.
 14. International Plumbing Code.
- E. Where differences exist between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Architect/Engineer in writing of all differences.
- F. When directed in writing by the Architect/Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards. Correct the deficiencies and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

- A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.
- B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.
- C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.
- D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

- E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.
- F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver new to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.
- G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.
- H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.
- I. Installer: Entity (person or firm) engaged by the Contractor or its Subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.
- J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.
- K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

- L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by the latest ASHRAE Fundamentals Handbook, Chapter 39 "Abbreviations and Symbols", ASME and ASPE published standards.

1.12 DRAWINGS AND SPECIFICATIONS

- A. These Specifications are intended to supplement the Drawings. It will not be the province of the Specifications to address any part of the work which the Drawings can fully convey in every particular and such omission shall not to relieve the Contractor from carrying out portions of work indicated on the Drawings only.
- B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In the event of discrepancy between Drawings and Specifications, or within either Drawings or Specifications, the greater or more costly of the discrepancy shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least seven (7) working days prior to bid opening date for issuance of an addendum.
- C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers' standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.
- D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.
- E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equal capacity, construction, and performance. However, under no circumstances shall any substitution be made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing at least ten (10) days prior to the bid date without fail.
- F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

- G. Wherever a definite material or manufacturer's product is specified and the Specification indicates that products of similar design and equal construction from the list of acceptable manufacturers may be used, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.
- H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUAL" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUAL" product, material or method may be used if it complies with the specifications and is submitted for review to the Engineer as outlined herein.
- I. Where equipment other than that used in the design as specified or shown on the Drawings is provided (either from an acceptable manufacturer list or by submittal review), it shall be the responsibility of the Contractor to coordinate space requirements, building provisions and connection requirements with all trades bear any additional costs.
- J. Where permission to use a substitution product, material, or method is granted by the Owner or Engineer in writing, the Contractor shall bear full responsibility for the implementation of that substitution. Specific responsibilities shall include, but shall not be limited to, the following:
 - 1. Verifying that the substituted item will fit in the space available. This shall include allowances for all code required clearances and manufacturer's maintenance and service clearances.
 - 2. The coordination and provision of all necessary supports, hangers, and appurtenances. Hanger spacing shall be adjusted accordingly and any additional hangers or supports required shall be provided.
 - 3. The coordination and provision of all necessary insulation, firestopping provisions, etc.
 - 4. Adherence to manufacturer's published installation recommendations.
 - 5. Adherence to requirements of the Authority Having Jurisdiction (AHJ) and provision of a code compliant installation.
 - 6. Changes to architectural, structural, electrical, mechanical, and plumbing requirements as a result of the substitution.
 - 7. Bearing any additional costs and time impact and providing any necessary redesign. The Owner will bear no such cost and make no time allowances.
 - 8. Coordination of plumbing and electrical requirements and utility provisions with the Mechanical and Plumbing Design Documents and all other trades, including Division 26.
- K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.
- L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with above and if accepted, will issue a written acceptance allowing the substitutions.

1.13 SUBMITTALS

- A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of Shop Drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty (30) day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive Shop Drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all Shop Drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:
1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
 2. An index page with a listing of all data included in the Submittal.
 3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
 4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
 5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled. Provide at a scale as required (but no less than 1/8" = 1'-0") to demonstrate that the alternate or substituted product will fit in the space available.
 6. Identification of each item of material or equipment matching that indicated on the Drawings.
 7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
 8. Additional information as required in other Sections of this Division.
 9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".
- B. Refer to Division 00 and Division 01 for additional information on Shop Drawings and submittals.

- C. Equipment and materials submittals and Shop Drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of Shop Drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.
- D. Where Shop Drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.
- E. Shop Drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:
 - 1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
 - 2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The Contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
 - 3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
 - 4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous Shop Drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
 - 5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all Shop Drawings.
 - 6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.
- F. Materials and equipment which are purchased or installed without Shop Drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.
- G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.
- H. Submittals are required for, but not necessarily limited to, the following items:

1. Basic Materials.
 2. Plumbing Fixtures and Valves.
 3. Supports and Carriers.
 4. Floor Drains, Roof Drains, and Cleanouts.
 5. Interceptors/Traps (All Types).
 6. Water Heaters and Boilers.
 7. Expansion Tanks.
 8. Water Treatment Equipment.
 9. Water Filters.
 10. Domestic Water Booster Pumps.
 11. Backflow Preventers.
 12. Plumbing Piping.
 13. Piping, Vessel, and Equipment Insulation.
 14. Air Compressors and Air Dryers.
 15. Expansion Fittings and Devices.
 16. Variable Frequency Drives.
 17. Noise and Vibration Controls.
 18. Pipe and Equipment Hangers and Supports.
 19. Plumbing Specialties.
 20. Test, Adjust and Balance Reports.
 21. Testing, Adjusting and Balancing Contractor Qualifications.
 22. Coordination Drawings.
- I. Refer to other Division 22 sections for additional Shop Drawing and submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.14 COORDINATION DRAWINGS

- A. Prepare coordination drawings to an appropriate scale (typically 1/4" = 1'-0" or larger); detailing major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
1. Indicate the proposed locations of pipe, equipment, and other materials. Include the following:
 - a. Wall locations and types.
 - b. Clearances for installing and maintaining insulation.
 - c. Locations of light fixtures and sprinkler heads.
 - d. Clearances for servicing and maintaining equipment, including tube removal and space for equipment disassembly required for periodic maintenance.
 - e. Equipment connections and support details.
 - f. Exterior wall and foundation penetrations.
 - g. Routing of storm, sanitary sewer piping and plumbing piping.
 - h. Fire-rated wall and floor penetrations.
 - i. Sizes and location of required concrete pads and bases.
 - j. Valve stem movement.
 - k. Structural floor, wall and roof opening sizes and details.
 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
 3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

- B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.
- C. By submitting Shop Drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

- A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 22.
- B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.
- C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work; precise locations of all concealed pipe; locations of all valves, controls and operable devices; and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.
- D. Record Drawings shall indicate, at a minimum, the following installed conditions:
 - 1. Mains and branches of piping systems, with valves and control devices located and numbered, unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion fittings, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
 - 2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
 - 4. Contract Modifications, actual equipment and materials installed.
- E. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.
- F. If the Contractor does not keep an accurate set of Record Documents, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.
- G. Upon completion of the Work, the Contractor shall submit three (3) full size sets of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:
 - CERTIFIED RECORD DRAWINGS
 - DATE:
 - (NAME OF GENERAL CONTRACTOR)
 - BY: _____

(SIGNATURE)
(NAME OF GENERAL CONTRACTOR)
BY: _____
(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

- A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled dates for each test. This detailed completion and test schedule shall be submittal at least ninety (90) days before the projected Project completion date.
- B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.
- C. Submit four (4) copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.
- D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in other Sections of Division 22.

1.17 OPERATIONS AND MAINTENANCE MANUALS

- A. Prepare Operations and Maintenance manuals in accordance with the requirements of Division 01 and Division 22. In addition to the requirements of other Sections, this shall include operational, trouble-shooting, and routine maintenance information for fixtures, specialties, and equipment.
 - 1. Identifying names, name tags designations and locations for all equipment.
 - 2. Valve tag lists with valve number, type, color coding, location and function.
 - 3. Reviewed Shop Drawing submittals with exceptions noted compliance letter.
 - 4. Fabrication drawings.
 - 5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
 - 6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 - 7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 8. Servicing instructions and lubrication charts and schedules.
 - 9. Equipment and motor name plate data.
 - 10. Wiring diagrams.
 - 11. Exploded parts views and parts lists for all equipment and devices.
 - 12. Color coding charts for all painted equipment and conduit.
 - 13. Location and listing of all spare parts and special keys and tools furnished to the Owner.
 - 14. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

- B. Coordinate with Division 01 for Operations and Maintenance manual requirements. Unless noted otherwise, bind together in "D ring" style three-ring binders (National model no. 79-883 or equivalent). Binders shall be large enough to allow 1/4" of spare capacity. Include three (3) sets with all approved Shop Drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections with tabbed insertable dividers, labeled for easy reference. Utilize the individual specification section numbers shown in the Plumbing Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 22 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.
- C. In addition to the bound "hard-copy" Operation and Maintenance manuals referenced above, provide an identical electronic copy in searchable PDF format, with all sections bookmarked within the file for easy reference. Provide a USB flash drive with the final manual to the Owner.
- D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of fourteen (14) working days prior to the beginning of the operator training period.
- E. Operating and Maintenance Manuals which the Engineer deems incomplete, poorly organized, or otherwise unacceptable will be rejected in writing. The Contractor will subsequently be required to again turn over Operating and Maintenance Manuals, with all deficiencies corrected, until deemed acceptable by the Engineer.

1.18 OPERATOR TRAINING

- A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel.
- B. The Owner's operator training shall include a minimum of 12 hours of on- site training in three (3) shifts of four (4) hours each.
- C. Before proceeding with the instruction of Owner's Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he or she has a proper understanding of the operation and maintenance of the systems and then resubmit the signed outlines.
- D. Refer to other Sections of Division 22 for additional Operator Training requirements.

1.19 FINAL COMPLETION

- A. At the completion of the work, all equipment, operable appurtenances, and systems shall be tested. All faulty equipment and material shall be repaired or replaced. Refer to other Sections of Division 22 for additional requirements.
- B. Clean and adjust all fixtures, flushometers, valves and operable devices. Replace faulty or otherwise damaged parts immediately prior to final acceptance.
- C. Touch up and/or refinish any scratched equipment and devices immediately prior to final acceptance. This shall be acceptable only for minor superficial scratches, the determination of which rests solely on the judgment of the Architect or Engineer.

1.20 CONTRACTOR'S GUARANTEE

- A. Use of the Plumbing systems to provide temporary service during the construction period shall not be allowed without written permission from the Owner, and, if granted, shall not be cause for the warranty period to start, except as defined below.
- B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one (1) year after its completion and final acceptance, and shall furnish free of additional cost to the Owner all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of issue of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.
- C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.
- D. All air compressors shall have parts and labor guarantees for a period of not less than five (5) years beyond the date of final acceptance.
- E. Refer to other Sections of Division 22 for additional guarantee or warranty requirements.

1.21 TRANSFER OF ELECTRONIC FILES

- A. Project documents are not intended or represented to be suitable for re-use by Architect/Owner or others on extensions of this project or on any other project. Any such re-use or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.
- B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.
- C. When transferring documents in electronic media format, Engineer makes no representations as to the long-term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.
- D. Any re-use or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.
- E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.
 - 1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The Contract Documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.

2. If the client, Architect or Owner of the project requires electronic media for “record purposes”, then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD’s. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.
3. At the Architect/Owner’s request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a “.rvt” or “.dwg” format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government projects. These materials and equipment shall comply with “Buy American Act.”
- B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks unless indicated otherwise.
- C. All access panels located in wet areas such as toilet rooms, locker rooms, shower rooms, natatoriums, kitchens, and any other wet areas shall be constructed of stainless steel.
- D. Access doors shall be as follows:
 1. Plastic Surfaces: Milcor Style K.
 2. Ceramic Tile Surfaces: Milcor Style M.
 3. Drywall Surfaces: Milcor Style DW.
 4. Install panels only in locations approved by the Architect.

2.2 EQUIPMENT PADS

- A. Provide four (4) inch high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.
- B. Provide six (6) inch high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Provide a four (4) foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

PART 3 - EXECUTION

3.1 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.
- B. Refer to equipment specifications in other Divisions (10, 11, 12, 13, 21, 22, etc.) for additional rough-in requirements as necessary and provide accordingly.

3.2 PLUMBING INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of plumbing and fire systems, materials, and equipment. Comply with the following requirements:
1. Coordinate plumbing and fire protection systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, leave-outs, and other openings in building components during progress of construction to allow for plumbing installations.
 4. Coordinate the installation of required supporting devices, sleeves, and pathways to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 7. Coordinate connection of plumbing and fire protection systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and submit proposed solution to the Architect for review.
 9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 10. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
 11. Install access panels or doors where valves, operable devices, and equipment are concealed behind finished surfaces. Refer to Article 2.1 of this Section and to Architectural documents for specifications and locations.
 12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
 13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curb to match roof slope. Refer to architectural drawings and details.
 14. The equipment to be furnished under this Specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.
 15. The architectural and structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
 16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.

17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, valves, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Plumbing Equipment:
 - a. Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Shop Drawings shall include dimensions and lettering format for approval. Attachments shall be with escutcheon pins, self-tapping screws, or machine screws.
 - b. Tags shall be attached to all valves, including control valves, with nonferrous chains. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the Record Drawings.

3.3 CUTTING AND PATCHING

- A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, removal, patching, replacement/repair as required to:
 1. Uncover Work to provide for installation of ill-timed Work.
 2. Remove and replace defective Work.
 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 4. Remove samples of installed Work as specified for testing.
 5. Install fixtures, equipment, piping, and appurtenances in existing structures.
 6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
 7. Patch and replace/repair existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Article 1.11 DEFINITIONS AND SYMBOLS for definition of "Installer."
- C. Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including but not limited to removal of plumbing piping, equipment, plumbing fixtures and trim, and other plumbing items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.4 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

- A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:

1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Subcontractors and the Architect/Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
 2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.
- B. Start-up for major plumbing and fire protection equipment shall be performed by a factory authorized technician. Such equipment shall include, but not necessarily be limited to, the following: domestic water boilers and packaged water heating systems, water softeners, ultra-pure water equipment systems, domestic water booster pumps, fire pumps, and break tank level alarm systems. Refer to other Sections of Divisions 21 and 22 for additional requirements.

3.5 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

- A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing piping, utilities, equipment and other apparatus related to this phase of the work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by this Contractor, who shall produce drawings that shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.
- B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.
- C. All equipment and/or systems noted on the Drawings "To Be Removed" shall be removed including, associated pipe, supports, and hangers. Where pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.
- D. Ensure existing piping and equipment to remain that is adjacent to and impacted by the scope of Work is properly supported, fastened, and secure.
- E. During the construction and remodeling, portions of the Project shall remain in service. Construction equipment, material tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

- F. Certain work during the demolition phase of construction may require overtime, night time, or weekend shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.
- G. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately and disposed of lawfully.
- H. Equipment, piping or other potential hazards to the working occupants of the building or the general public shall not be left overnight outside of the designated working or construction area.
- I. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage that occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.
- J. Include in the contract price all rerouting of existing pipe, utilities, etc., and the reconnecting of the existing equipment and plumbing fixtures as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Provide all temporary pipe, utilities, controls, etc., as required to maintain heating, cooling, ventilation and plumbing services for the existing areas with a minimum of interruption.
- K. All existing plumbing fixtures, pipe, utilities, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.
- L. Pipe, utilities, equipment and controls serving mechanical, plumbing and owner's equipment, etc., which is to remain but which is served by pipe, utilities, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.
- M. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner's representative in order to protect systems that shall remain in service.
- N. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.
- O. Refer to Architectural Demolition and/or Alteration plans for actual locations of walls, ceiling, etc., being removed and/or remodeled.

END OF SECTION

**SECTION 22 02 01
COORDINATION DRAWINGS**

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions 01 31 00 and Supplementary Conditions apply to all Work herein.

1.2 COORDINATION DRAWINGS

- A. The Contractor shall take the lead in coordinating the Mechanical, Electrical, Plumbing, Communications, Electronic Safety/Security and Fire Protection systems within the building.
- B. The Contractor shall coordinate a three-dimensional (3D) model of the building which includes the Mechanical, Electrical, Plumbing, and Fire Protection systems. The Contractor will be provided with the REVIT model that was used to generate the contract documents and this file may be used as the background file. The Contractor shall replace the systems drawn with the actual shop drawing models. The Contractor is not limited to using REVIT and may use any 3-D software in generating and combining the coordination model.
- C. Submitting the contract drawings as coordination drawings will not be acceptable.
- D. The model shall include detailed and accurate representations of all equipment to be installed based upon the reviewed equipment submittals.
- E. The Contractor shall hold a 3-D coordination meeting with all sub-contractors present to review the model and discuss coordination of the installation of the building systems.
- F. Upon completion of the coordination meeting, the Contractor shall submit the 3-D model and 1/4" scale drawings for review.
- G. The model shall detail major elements, components, and systems in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
 - 1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
 - a. Wall and type locations.
 - b. Clearances for installing and maintaining insulation.
 - c. Locations of light fixtures and sprinkler heads.
 - d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - e. Equipment connections and support details.
 - f. Exterior wall and foundation penetrations.
 - g. Routing of storm and sanitary sewer piping.
 - h. Fire-rated wall and floor penetrations.
 - i. Sizes and location of required concrete pads and bases.
 - j. Valve stem movement.
 - k. Structural floor, wall and roof opening sizes and details.
 - 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
 - 3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling mounted items.
- H. Sequence of Coordination
- Below is hierarchy of model elements and the sequencing by which the models will be coordinated.
1. Structural and Architectural model
 2. Miscellaneous steel
 3. Perform preliminary space allocation
 4. Identify hard constraints (locations of access panels, lights, A/V space requirements, etc.)
 5. Main and medium pressure ducts from the shaft out
 6. Main graded plumbing lines and vents
 7. Sprinkler mains and branches
 8. Cold and hot water mains and branches
 9. Lighting fixtures and plumbing fixtures
 10. Smaller sized ducts and flex ducts
 11. Smaller size cold water and hot water piping, flex ducts, etc.
- I. The Contractor shall not install any item until the coordination has been completed and reviewed by the Construction Manager, Owner, and A/E team.
- J. The Contractor shall be responsible for coordination of all items that will affect the installation of the Work. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.
- K. By submitting shop drawings on the project, the Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all trades.

END OF SECTION

SECTION 22 03 00
PLUMBING DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Demolition of plumbing systems and components.
- B. The drawings do not show all demolition work required. The contractor shall make himself familiar with the required scope of work to accomplish the work required by these documents. All demolition work implied or required shall be included in the scope of this contract.
- C. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The contractor shall allow the Owner 2 weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

1.2 RELATED SECTIONS

- A. Alteration Project Procedures (may be present under Division 01).
- B. Selective Demolition (may be present under Division 02).

1.3 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER

- A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:
 - 1. During the construction of this project, normal facility activities will continue in existing buildings until new buildings or renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.
 - 2. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.

1.4 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

- A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing piping, systems, equipment and other apparatus related to this phase of the work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by his contractor, who shall produce drawings which shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.
- B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

- C. All equipment and/or systems noted on the Drawings "To Be Removed" should be removed including, associated pipe, fittings, and hangers and/or line supports. Where pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.
- D. During the construction and remodeling, portions of the Project shall remain in service. Construction equipment, material tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.
- E. Certain work during the demolition and construction phases of construction may require overtime or night time shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Project Administrator at least seventy-two (72) hours in advance in writing.
- F. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately.
- G. Equipment, piping or other potential hazards to the occupants of the building shall not be left overnight outside of the designated working or construction area.
- H. Make every effort to minimize damage to the existing building and the owner's property. Repair, patch or replace as required any damage which might occur as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.
- I. Include in the contract price all rerouting of existing pipe, etc., and the reconnecting of the existing equipment and plumbing fixtures as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the drawings. Furnish all temporary pipe, duct, controls, etc., as required to maintain heating, cooling, ventilation and plumbing services for the existing areas with a minimum of interruption.
- J. All existing plumbing fixtures, pipe, materials, equipment, and appurtenances not included in the remodel or alteration areas are to remain in place.
- K. Pipe, duct, equipment and controls serving mechanical, plumbing and owner's equipment, etc., which is to remain but which is served by pipe, duct, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.
- L. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner's representative in order to protect systems that shall remain in service.
- M. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.
- N. Refer to Architectural "Demolition and/or Alteration" plans for actual location of walls, ceiling, etc., being removed and/or remodeled.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field verify measurements and piping arrangements are as shown on Drawings.
- B. Verify that abandoned piping and equipment serve only abandoned facilities.
- C. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

- A. Disconnect plumbing systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate utility service outages with Utility Company.
- C. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on energized equipment, use personnel experienced in such operations.
- D. Existing Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

- A. Demolish and extend existing plumbing work under related provisions of Division 1, Division 2, and this Section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned piping to source of supply.
- D. Remove exposed abandoned piping systems, including abandoned systems above accessible ceiling finishes. Cut systems flush with walls and floors, and patch surfaces.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to existing installations which remain active. Modify installation or provide access panels as appropriate.
- G. Extend existing installations using materials and methods compatible with existing installations, or as specified.

3.4 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.

3.5 INSTALLATION

- A. Install relocated materials and equipment under the provisions of Alteration Project Procedures Section.

3.6 REMOVAL OF MATERIALS

- A. The contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The contractor may, at his discretion and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.
- B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation are found to be in damaged condition before work has been started on dismantling, the contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the Owner, at no additional cost to the Owner.
- D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.
- E. Certain work during the demolition phase of construction may require overtime or nighttime shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner's Representative at least 72 hours in advance.
- F. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch, or replace as required any damage which might occur as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction. Cooperate with the Owner and other trades in scheduling and performance of the work.
- G. Include in the contract price all rerouting of existing conduits, wiring, outlet boxes, fixtures, etc., and the reconnecting of existing fixtures as necessitated by field conditions to allow the installation of the new systems. Furnish all temporary conduit, wiring, boxes, etc., as required to maintain lighting and power service for the existing areas with a minimum of interruption. Remove wire and conduit back to nearest accessible active junction box and extend to existing homeruns as required.

- H. The contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing such loss or damage. The contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all electrical services for the new and existing facilities. The contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.
- I. Where existing construction is removed to provide working and extension access to existing utilities, contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.
- J. Where partitions, walls, floors, or ceilings of existing construction are being removed, all contractors shall remove and reinstall in locations approved by the Architect all devices required for the operation of the various systems installed in the existing construction.

END OF SECTION

SECTION 22 05 13
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

- A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use. Provide electric motors, control panels, control and safety devices, and control wiring when specified or as required for proper operation of electrical systems associated with plumbing equipment and appurtenances.
- B. WORK SPECIFIED ELSEWHERE:
 - 1. Painting.
 - 2. Power control wiring to motors and equipment.

1.3 WARRANTY

- A. Warrant the Work specified herein for one year and motors for five years beginning on the date of substantial completion against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

1.4 SUBMITTALS

- A. SHOP DRAWINGS: Indicate size material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.
- B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures variations, and accessories.
- C. MOTOR NAMEPLATE INFORMATION: Manufacturer's name, address, utility and operating data.
- D. Refer to Division One for additional information.

1.5 DELIVERY AND STORAGE

- A. DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.
- B. TIME AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.
- C. STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

PART 2 - PRODUCTS

2.1 ELECTRIC MOTORS

- A. APPROVED MANUFACTURERS: Provide motors by a single manufacturer as much as possible.
 - 1. Baldor
 - 2. Marathon
 - 3. Leeson-Lincoln Electric

4. General Electric
5. Westinghouse
- B. TEMPERATURE RATING: Provide insulation as follows:
 1. CLASS B: 40 degrees C maximum.
 2. CLASS F:
 - a. Between 40 degrees C and 65 degrees C maximum.
 - b. Totally enclosed motors.
- C. STARTING CAPABILITY: As required for service indicated five starts minimum per hour.
- D. PHASES AND CURRENT: Verify electrical service compatibility with motors to be used.
 1. UP TO 3/4 HP: Provide electronically commutated brushless DC single phase motors with built-in inverter and microprocessor-based control.
 2. 1 HP AND LARGER: Provide squirrel-cage AC induction polyphase motors.
 3. Name plate voltage shall be the same as the circuit's normal voltage, serving the motor.
- E. SERVICE FACTOR: 1.15 for polyphase; 1.35 for single phase.
- F. FRAMES: U-frames 1.5 hp. and larger.
- G. BEARINGS: Provide sealed re-greasable ball bearings; with top mounted zero lubrication fittings and bottom side drains minimum average life 100,000 hours typically, and others as follows:
 1. Design for thrust where applicable.
 2. PERMANENTLY SEALED: Where not accessible for greasing.
 3. SLEEVE-TYPE WITH OIL CUPS: Light duty fractional horsepower motors or polyphase requiring minimum noise level.
- H. ENCLOSURE TYPE: Provide enclosures per applications as follows:
 1. CONCEALED INDOOR: Open drip-proof (ODP).
 2. EXPOSED INDOOR: Splash-proof.
 3. OUTDOOR TYPICAL: Type III, totally enclosed fan-cooled (TEFC).
 4. OUTDOOR WEATHER PROTECTED: Weather protected II (WPII).
 5. HAZARDOUS LOCATIONS: Explosion-proof.
- I. OVERLOAD PROTECTION: Built-in sensing device for stopping motor in all phase legs and signaling where indicated for fractional horse power motors.
- J. NOISE RATING: "Quiet" except where otherwise indicated.
- K. EFFICIENCY: Minimum full load efficiency listed in the following table, when tested in accordance with IEEE Test Procedure 112A, Method B, including stray load loss measure.

NEMA Efficiency - 1800 RPM Synchronous Speed		
Motor Horsepower	Index Letter	Minimum Efficiency %
3 - 5	G	89.5
7.5	G	91.0
10	F	91.7
15 - 20	E	93.0
25 - 30	E	93.6
40	D	94.1
50	C	94.5
60	C	95.0
75	C	95.0
100 - 125	B	95.4

150 - 200	B	95.8
NEMA Efficiency - 1200 RPM Synchronous Speed		
Motor Horsepower	Index Letter	Minimum Efficiency %
3 - 5	G	89.5
7.5	G	90.2
10	F	91.7
15	F	91.7
20	E	92.4
25 - 30	E	93.6
40 - 50	D	94.1
60	D	94.5
75	C	94.5
100 - 125	C	95.0
150 - 200	B	95.4

2.2 MOTOR CONTROLLERS (STARTERS)

- A. All motor controllers (for equipment furnished under Division 22) shall be furnished under Division 22 and installed under Division 26 unless otherwise noted on the plans.
 1. Starters shall be provided for 3 phase motors 1 horsepower and greater.
- B. Motor starters shall be furnished as follows.
 1. GENERAL: Motor starters shall be Square D Company Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FAVOR) starter. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. ICE sizes are not acceptable. Starters shall be mounted in a general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served. Provide two speed, two winding or two speed, single winding motor starter as required for two speed motors.
 2. CONTACTS: Magnetic starter contacts shall be double break solid silver alloy. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.
 3. OPERATING COILS: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.
 4. OVERLOAD RELAYS: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phase and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset. Provide 6 overload relays for two speed motor starters.
 5. PILOT LIGHTS: Provide a red running pilot light for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.
 6. CONTROLS: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 22. Motor starter controls shall be mounted in the starter enclosure cover.

7. **CONTROL POWER TRANSFORMER:** Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.
8. **AUXILIARY CONTACTS:** Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.
9. **UNIT WIRING:** Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.
10. **ENCLOSURES:** All motor starter enclosures shall be NEMA 1, general purpose enclosures or NEMA-3R if mounted exposed to high moisture conditions. Provide NEMA 4X when located by cooling towers, fountains, or similar locations.
11. **POWER MONITOR:** Provide a square "D" 8430 MPS phase failure and under-voltage relay, base and wiring required for starters serving all 3 phase motors. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.
- C. **APPROVED MANUFACTURERS:** Controller numbers are based on first named manufacturer. Provide one of the following manufacturers.
 1. Siemens.
 2. Square D.
 3. General Electric.
 4. Eaton.

2.3 COMBINATION MOTOR STARTERS

- A. **GENERAL:** Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 1 enclosure unless otherwise noted and shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.1/B, except as modified herein.
- B. **DISCONNECT SWITCH:** Disconnect switches shall be as specified in Division 26.
- C. **APPROVED MANUFACTURERS:** Controller numbers are based on first named manufacturer. Provide one of the following manufacturers.
 1. Siemens.
 2. Square D.
 3. General Electric.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.
- B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors' price shall include all items required as per manufacturer's requirements.
- C. Install in a professional manner. Any part or parts not meeting this requirement shall be replaced or rebuilt without extra expense to Owner.
- D. Install rotating equipment in static and dynamic balance.

- E. Provide foundations, supports, and isolators properly adjusted to allow minimum vibration transmission within the building.
- F. Correct objectionable noise or vibration transmission in order to operate equipment satisfactorily as determined by the Engineer.

END OF SECTION

SECTION 22 05 16
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

- A. The scope of the work shall include the furnishing and complete installation of the fittings and items covered by this Section, with all appurtenances, ready for the Owner's use.
- B. Include the following work in addition to items normally part of this Section:
 - 1. Expansion joints and compensators.
 - 2. Pipe loops, offsets, and swing joints.

1.3 RELATED WORK

- A. Section 22 02 00 - Basic Materials and Methods for Plumbing
- B. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment
- C. Section 22 10 00 - Plumbing Piping

1.4 REFERENCES

- A. IAPMO (UPC) - Uniform Plumbing Code.
- B. NSF 61 - Drinking Water System Components - Health Effects.

1.5 PERFORMANCE REQUIREMENTS

- A. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.
- B. Expansion Calculations:
 - 1. Installation Temperature: 50 degrees F (10 degrees C).
 - 2. Domestic Hot Water: 140 degrees F (60 degrees C).
 - 3. Safety Factor: 30 percent.
- C. Pipe sizes indicated are to establish a minimum quality of compensator. Refer to manufacturer's literature for model series for different pipe sizes.

1.6 SUBMITTALS

- A. Submit shop drawings under provisions of Division One.
- B. Product Data:
 - 1. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
 - 2. Pipe loops, offsets, and swing joints: Indicate temperature rise, developed lengths, pipe size, material expansion coefficient-allowable stress-modulus of elasticity, and final calculated amount of expansion. Indicate bend, loop, offset & return dimensions coinciding with the calculated expansion.
- C. Design Data: Indicate selection calculations.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division One.
- B. Record actual locations of expansion joints, fittings, anchors, and guides.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division One.
- B. Maintenance Data: Include adjustment instructions.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- B. Design expansion compensation system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the state where the project is located.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, project and handle products to site under provisions of Division One.
- B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.
- C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.11 WARRANTY

- A. Provide five year warranty under provisions of Division One.
- B. Warranty: Include coverage for leak free performance of packed expansion joints.

1.12 EXTRA MATERIALS

- A. Furnish under provisions of Division One.

PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

- A. Bellows Type (Based on 4" Pipe):
 - 1. Manufacturers:
 - a. VMC Group, Style EB
 - b. Triplex, Model Resistoflex R6905
 - c. Mercer Rubber Company, Style 803 or 805 (Mason Industries)
 - d. Metraflex
 - 2. Body: Monel wire reinforced molded TFE teflon bellows, multiple arch.
 - 3. Pressure Rating: 70 psig WSP and 250 degrees F (66 degrees C).
 - 4. Maximum Compression: 1 inch.
 - 5. Maximum Extension: 1 inch.
 - 6. Maximum Offset: 1/2 inch.
 - 7. Joint: ASA standard ductile iron flanges, integral molded gasket.
 - 8. Size: Use pipe sized units.
 - 9. Accessories: Control rod limit bolts.
 - 10. Application: Steel piping 8 inch and under.
- B. Pre-manufactured Loop Type:
 - 1. Manufacturers:
 - a. Flexicraft Industries
 - b. Metraflex MLS-UPC-80 series

2. Materials of construction: Copper custom 180 degrees bend (or 90 degree elbows with spool), copper 90 degree elbows for connections to piping, bronze hose and braid.
3. Certifications: NSF 61 lead-free compliant, IAPMO (UPC) approved.
4. Working Pressure: No less than 200 psi at 250 degrees F.
5. Allowable Movement: +/- 4 inches.
6. Labeled from the manufacturer and provided complete with attached support bracket and drain plug.
7. Size: Same as piping being served.
8. Installation: In strict accordance with manufacturer's recommendations, including support.
9. Application: Copper piping 4 inch and under.

2.2 ACCESSORIES

- A. Pipe Alignment Guides to Direct Axial Movement:
 1. Manufacturers:
 - a. Triplex, Model Flexonics
 - b. Metraflex
 2. Welded steel construction bolt together two piece design, frame with four mounting holes, shop painted, spider type guide, exact style/model as necessary for bare or insulated pipe to match size and thickness as appropriate, 4 inch movement standard.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide miscellaneous metals to rigidly anchor pipe to building structure. Provide pipe guides so that movement takes place along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- C. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. This shall include where piping crosses expansion joints in the building.

3.2 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Division One.
- B. Provide inspection services by manufacturer's representative for final installing and to certify the installation is in accordance with manufacturer's recommendations and expansion joints and accessories are performing satisfactorily.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

- A. Pipe, and equipment hangers, supports, and associated anchors.
- B. Sleeves and seals.
- C. Flashing and sealing equipment and pipe stacks.

1.3 RELATED WORK

- A. Section 22 02 00 - Basic Materials and Methods for Plumbing
- B. Section 22 07 19 - Plumbing Piping Insulation
- C. Section 22 10 00 - Plumbing Piping
- D. Section 22 11 21 - Natural Gas Piping Systems

1.4 REFERENCES

- A. ASME B31.1 - Power Piping.
- B. ASME B31.9 - Building Services Piping.
- C. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.5 QUALITY ASSURANCE

- A. Hangers and Supports for Plumbing Piping: In conformance with ASME B31.1 and ASME B31.9.
- B. Hangers and Supports for Plumbing Piping: In conformance with MSS SP-58.

1.6 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division One.
- B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 to 4 Inches Carbon steel, adjustable, clevis.
- C. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.
- E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- F. Wall Support for Pipe Sizes 4 Inches and Over: adjustable steel yoke and cast iron roller.
- G. Vertical Support: Steel riser clamp.

- H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
- I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- J. Roof Pipe Supports and Hangers: Free-standing manufactured pipe support system with hot dip galvanized steel components and hardware with UV-inhibited injection molded high density/high impact black polypropylene base material. Portable Pipe Hangers, Inc. or approved equal.

For pipes 2-1/2" and smaller	Type PP10-R, with pipe roller support
For pipes 3" through 8"	Type PS-1-2, with pipe roller support
For multiple pipes	Type PSE - Custom
- K. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut "Cush-A-Clamp" or equal. Hangers: Plastic coated; Unistrut or equal.
- L. For installation of protective shields also reference Section 22 07 19.
- M. Shields for Vertical Copper Pipe Risers: Sheet lead.
- N. Pipe Rough-In Supports in Walls/Chases: Provide pre-formed plastic pipe supports, Sioux Chief "Pipe Titan", Hold Rite or equal.

2.2 HANGER RODS

- A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.3 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

- A. Metal Flashing: 20 gage galvanized steel.
- B. Lead Flashing: 4 lb./sq. ft. sheet lead for waterproofing.
- C. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.
- D. Coordinate with roofing contractor/architect for type of flashing on metal roofs.

2.5 EQUIPMENT CURBS

- A. Fabricate curbs of hot dipped galvanized steel.

2.6 ROOFTOP PIPE SUPPORTS

- A. All roof-mounted piping shall be supported with engineered pre-fabricated piping support systems specifically designed to be installed on the roof without roof penetrations, flashing, or damage to the roofing material.
 1. Bases shall be made of UV protected HDPE.
 2. Frames shall be made of hot dipped galvanized structural steel.
 3. Nuts, threads, and washers shall be hot dipped galvanized steel.
 4. System shall be specifically designed to fit the piping and the actual conditions of service.
 5. Wood supports are not acceptable.
 6. Portable Pipe Hanger (PHP) system or pre-approved equal, installed per manufacturer's instructions.

2.7 SLEEVES

- A. All pipe penetrations through walls, floors, floor-ceiling assemblies, etc. shall be sleeved to ensure no direct contact between the pipe and that which it passes through. All installations shall be provided consistent with the fire and smoke safeguards required by the building code per the fire-resistance rating as indicated on the architectural drawings and shall be provided consistent with the assemblies/methods indicated on the architectural drawings.
- B. Unless required otherwise (the most stringent requirement shall govern), sleeves for pipes:
 - 1. Through nonfire-resistance-rated floors shall be formed with 18 gage galvanized steel, tack welded to form a uniform sleeve.
 - 2. Through nonfire-resistance-rated walls, through grade beams and foundation walls, and through potentially wet floors shall be formed with schedule 40 steel pipe, galvanized.
 - 3. Through assemblies including but not limited to fire-resistance-rated walls-barriers-partitions, smoke barriers-partitions, etc. shall be schedule 40 steel pipe securely fastened to the rated assembly. All annular spaces shall be firestopped with an approved penetration firestop system (UL listed) compatible with the pipe material and installed per the manufacturer's recommendations.
- C. Fire Stopping Insulation: Glass fiber type, non-combustible, UL listed.
- D. Caulk: Paintable 25-year acrylic sealant.
- E. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.8 FABRICATION

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Design hangers without disengagement of supported pipe.
- C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.9 FINISH

- A. Exposed steel hangers, supports, and appurtenances shall be hot-dipped galvanized. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 INSERTS

- A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.
- B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.
- D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.2 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SIZE	MAX/ HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7'-0"	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron Pipe)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 inch and over	4'-0"	5/8"

- B. Sagging of horizontal pipe is unacceptable.
- C. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- D. Place a hanger within 12 inches of each horizontal elbow and at the vertical horizontal transition.
- E. Use hangers with 1-1/2 inch minimum vertical adjustment.
- F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers. Also reference specific requirements for cast iron piping installation in Section 22 10 00, Part 3 Execution.
- G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- H. For vertical shaft or chase applications where floor slab supported riser clamps cannot be provided to keep the pipe in alignment and to support the weight of the pipe and its contents, ensure to provide suitable fasteners and hardware, braces, unistrut, structural steel members, etc. to accommodate the pipe installation. Coordinate all such work with the project structural engineer to ensure that necessary members and attachment points are provided accordingly to bear the weight of the functioning piping.
- I. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- J. Support riser piping independently of connected horizontal piping.

- K. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

3.3 INSULATED PIPING

- A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
- B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation. Secure the full contact area of the saddle to the pipe insulation with 1/8" thick coat of mastic.
- C. Shields: Install protective shields MSS Type 40 on insulated piping that has vapor barrier. Secure the full contact area of the shield to the pipe insulation with 1/8" thick coat of mastic.
- D. Galvanized sheet metal shields shall span an arc of 180 degrees and shall have dimensions not less than the following:

Nominal Pipe Size	Shield Length	Gauge Thickness
1/4 through 3-1/2 inch	12 inch	18
4 inch	12 inch	16
5 through 6 inch	18 inch	16
8 through 14 inch	24 inch	14
16 through 24 inch	24 inch	12

- E. Ensure to provide an insert of high density insulation (calcium silicate) at each hanger/support to prevent the weight of the pipe from otherwise crushing the insulation. This insert material shall be at least as long as the associated protective shield.
- F. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.4 EQUIPMENT BASES AND SUPPORTS

- A. Provide equipment bases of concrete.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

- A. Provide flexible flashing and metal counter flashing where piping penetrates weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor shower mop sink and all other drains watertight to adjacent materials.
- E. Provide curbs for mechanical roof installations 8 inches minimum high above roofing surface. Contact architect for all flashing details and roof construction. Seal penetrations watertight.

3.6 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermafiber and 3M caulking and provide floor plate.
- C. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with UL listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

END OF SECTION

SECTION 22 05 48
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

- A. The scope of the work shall include the furnishing and complete installation of vibration & sound control products and seismic controls covered by this Section, with all appurtenances, ready for the Owner's use.
- B. Include the following work in addition to items normally part of this Section:
 - 1. Vibration and shock mounting.
 - 2. Flexible pipe connectors.
 - 3. Seismic restraints.

1.3 RELATED WORK

- A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment
- B. Section 22 10 00 - Plumbing Piping
- C. Section 22 30 00 - Plumbing Equipment

1.4 REFERENCES

- A. ICC (IBC) - International Building Code.
- B. NFPA 99 - Health Care Facilities Code.
- C. NSF 61 - Drinking Water System Components - Health Effects.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control and seismic products, of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Vibration and sound control products shall conform to ASHRAE criteria for average noise criteria (NC) curves for all equipment at full load conditions.
- C. Unless indicated otherwise, sound and vibration control products and seismic products shall be provided by a single manufacturer.

1.6 SUBMITTALS

- A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.
- B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. VMC Group
- B. Mason Industries, Inc.
- C. Kinetics Noise Control, Inc.

- D. Vibration Eliminator Co., Inc.
- E. Vibro-Acoustics
- F. Unisource Manufacturing (as specifically noted below)

2.2 GENERAL

- A. Provide vibration isolation supports for equipment, piping and appurtenances to prevent transmission of vibration and noise to the building structure that may cause discomfort to the occupants.
- B. Provide seismic restraints, supports, and attachments suitable for the applicable seismic loads in seismic design category areas as required by the ICC (IBC) and local code requirements.
- C. Where Basis of Design manufacturer and model numbers are indicated, the products of the other listed manufacturers above will be acceptable provided they comply with all of the requirements of this specification.

2.3 BASE MOUNTED PUMPS

- A. Provide VMC Group model SP-NR, style E, elastomeric isolation pads consisting of two layers of 3/8" thick alternate ribbed elastomeric pad bonded to a 16 gauge galvanized steel separator plate.
- B. Pads shall be sized for approximately 40 psi loading and 1/8" deflection.
- C. Provide inertia bases for all base mounted pump applications in which the pumps are to be installed on any floor level other than the ground floor or grade level. Inertia bases shall also be provided for base mounted pump applications in which the associated room where they are housed is in a noise sensitive location, regardless of floor level.

2.4 FLOOR MOUNTED AIR COMPRESSORS, VACUUM PUMPS, AND SIMILAR EQUIPMENT

- A. Provide VMC Group model CAL-2 aluminum housed isolators sized for 2" static deflection. Cast iron or steel housings may be used provided they are hot-dip galvanized after fabrication.
- B. If floor mounted equipment is furnished with an internal vibration isolation option, provide VMC Group model SP-NRC, style E, consisting of two layers of 1" thick ribbed elastomeric pad bonded to a 16 gauge galvanized steel separator plate to address high frequency breakout and afford additional unit elevation for required drains. Ribbed elastomeric pads shall be located in accordance with the equipment manufacturer's recommendations.

2.5 PIPING

- A. Provide line size stainless steel flexible connectors at connections to air compressors, domestic boosters, and other pumps (excluding submersible pumps and small circulators).
 - 1. Type 321 SS annular corrugated interior hose.
 - 2. Type 304 SS single braid exterior hose.
 - 3. End connection type(s) as suited for the application and the equipment and piping being served, but in no case welded or soldered ends.
 - 4. Ensure NSF 61 compliance for all potable water applications.
 - 5. When applied with dissimilar pipe materials, dielectric connections must be provided at both ends.
- B. For medical gas applications (or similar), flexible connectors at intake and outlet of medical air compressors and vacuum pumps shall be specifically produced for such use:

1. They shall be documented, purged, and brazed to NFPA 99 standards.
2. They shall be cleaned, capped, and bagged in accordance with CGA (Compressed Gas Association) G-4.1.
3. Bronze hose and braid, copper return elbow, and copper sweat end connections. Sizes 2-1/2" through 4" shall utilize stainless steel hose and braid, stainless steel return elbow, and copper sweat end fittings silver brazed to the assembly.
4. Unisource Manufacturing Series 455 "MedFlex"

2.6 CORROSION PROTECTION

- A. All vibration isolators shall be designed and treated for resistance to corrosion.
- B. Steel components: PVC coated or phosphated and painted with industrial grade enamel. Nuts, bolts, and washers: zinc-electroplated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.
- B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.
- C. The vibration isolation supplier shall certify in writing that he has inspected the installation and that all external isolation materials and devices are installed correctly and functioning properly.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

- A. The scope of the work shall include the furnishing and complete installation of the items covered by this Section, with all appurtenances, ready for owner's use.
- B. All plumbing piping shall be appropriately labeled.
- C. Refer to Architectural Sections for any additional requirements.

1.3 RELATED WORK

- A. Section 22 10 00 - Plumbing Piping
- B. Section 22 07 19 - Plumbing Piping Insulation

1.4 REFERENCES

- A. ASME A13.1 - Scheme for the Identification of Piping Systems.

PART 2 - PRODUCTS

2.1 VALVE AND PIPE IDENTIFICATION

- A. Valves:
 - 1. All valves shall be identified with a 1-1/2" diameter brass valve tag with stamped, black or red filled characters. Service designations shall be 1/4" letters and valve numbers shall be 1/2" numbers. Secure tags to valve handles by use of copper or Monel wire seals. For any services not identified below, contact Engineer in advance for approval. Service designations:
 - a. Domestic cold water: DCW
 - b. Domestic hot water: DHW
 - c. Domestic hot water return: DHWR
 - d. Natural gas: GAS
 - e. Compressed air: AIR
 - 2. All valves on the project shall be numbered sequentially, with valves for any one system and/or trade grouped together.
 - 3. Valve tags are not required if the valve is located within 3'-0" of the equipment being served and the service is obvious.
 - 4. Catalog a complete written record of all valves on the project, whether tagged or not. Include manufacturer, model number, size, service, system pressure (if like services with differing pressures are present on the project), location, valve tag data, and a description of the equipment/room/area served. Any valves which must be operated in sequence shall be indicated as such. Prepare a valve chart/schedule with all such information and include this chart/schedule in the project Operating and Maintenance Manual.

5. Mark all valve locations on the record drawings with appropriate identifying symbols or information to align with the above referenced valve chart/schedule. In addition to the O&M submission, provide the Owner with a digital copy (PDF format) of all such information in high-resolution, suitable for printing as full size drawings.
 6. Tags and fastenings shall be manufactured by the Seton Nameplate Corporation or approved equal.
 7. In addition to tags, all isolation valves serving emergency safety fixtures shall be provided with immediately adjacent clear and permanent signage indicating their purpose so as to avoid accidental shut-off.
- B. Pipe Marking:
1. All interior visible piping located in accessible spaces shall be provided with pipe markers. Accessible spaces shall include, but not necessarily be limited to, the following: above accessible ceilings, inside equipment rooms and utility spaces, in attic spaces, in crawl spaces, and in chase spaces, etc. viewable via access panels.
 2. All exterior visible piping shall be provided with pipe markers.
 3. Peel-off, self-adhesive, sticker type labels shall not be acceptable.
 4. Pipe markers shall be manufactured with rigid vinyl PVC, printed with UV resistant ink, abrasion and chemical resistant, suited for indoor or outdoor use and for a service temperature of -40 degrees F to 160 degrees F.
 - a. For pipes up to 6" provide cylindrically pre-coiled markers that snap into place without the need for tape or adhesives.
 - b. For pipes 6" and larger provide flat snap-around markers installed using manufacturer's heavy-duty nylon ties or stainless steel strapping.
 - c. Markers shall indicate the pipe service, include flow directional arrows, and meet ASME A13.1.
 5. Acceptable manufacturers:
 - a. Seton Setmark Pipe Markers
 - b. Brimar Industries Pipemarker System 1 Pipe Markers
 - c. Brady Corporation
 6. Markers shall be provided after final insulating, painting, jacketing, etc. of piping and per manufacturer's installation instructions. Strapping (applies to large diameter markers only) shall be snug but shall not compromise any insulation. All such strapping shall also be cleanly trimmed of excess material.
 7. Markers shall be provided in accordance with ASME A13.1 requirements. Specific items indicated below are not intended as a substitute for this complete standard. Markers shall be provided:
 - a. On both sides of each floor or wall penetration.
 - b. On each side of each tee.
 - c. On each side of each valve and/or valve group.
 - d. On each side of each piece of equipment.
 - e. On straight pipe runs at equally spaced intervals not to exceed 50 feet.
 - f. In congested areas, on each pipe at the point it enters and exits the area.
 - g. At the point of connection to each piece of equipment and automatic control valve.
 - h. Where they are readily visible to personnel from the point of normal approach.
 - i. With letter height and length of color field according to the size of the pipe served.
 - j. For non-potable water not less than once per room and at equally spaced intervals not to exceed 20 feet.

8. Color scheme of markers shall be as indicated below and otherwise in accordance with ANSI/ASME color recommendations. Legend color indicates color of legend text and flow directional arrow:

<u>SYSTEM</u>	<u>LABEL COLOR</u>	<u>LEGEND</u>	<u>LEGEND COLOR</u>
Sanitary Sewer	Green	Sanitary Sewer	White
	Green	Plumbing Vent	White
Storm Drain	Green	Storm Drain	White
	Green	Overflow	White
Domestic Water	Green	Domestic Cold Water	White
Domestic Hot Water	Green	Domestic Hot Water	White
Domestic Hot Water Return	Green	Domestic Hot Water Return	White
Fire Protection	Red	Fire Protection	White
	Red	Fire Sprinkler	White
Fuel Gas	Yellow	Natural Gas	Black
	Yellow	Propane Gas	Black
Diesel	Yellow	Diesel Oil	Black
Compressed Air	Blue	Compressed Air	White
Nitrogen	Orange	Nitrogen	Black
Carbon Dioxide	Orange	Carbon Dioxide	Black
Non-Potable Water	Yellow	Caution: Non-Potable Water, Do Not Drink	Black
Deionized Water	Green	Deionized Water	White
Reverse Osmosis Water	Green	R.O. Water	White
Acid Waste	Orange	Acid Waste	Black
		Acid Vent	Black

C. Pipe Painting:

- Pipe painting shall be per the color schedule below or as directed by the Architect. Confirm all color selections with Architect prior to installation, in particular for exposed piping in publicly occupiable areas.
- All exterior piping shall be painted.
- All piping subject to corrosive conditions shall be painted. This shall include, but not necessarily be limited to: natatoriums, pool equipment rooms, chemical and metal processing areas, and animal pens.
- All exposed piping shall be painted (including, but not limited to: piping in mechanical rooms, kitchens, and storage rooms).
- Paint color schedule:

<u>System</u>	<u>Color</u>
Storm Sewer	White
Sanitary Sewer Waste and Vent	Light Gray
Domestic Cold Water	Dark Blue
Domestic Hot Water Supply and Return	Orange

Fuel Gas (except for utility provider installed piping)	Yellow, unless specifically indicated/required otherwise by Architect or AHJ
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2.2 EQUIPMENT IDENTIFICATION

- A. Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

- A. All labeling equipment shall be installed per manufacturer's printed installation instructions.
- B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor's price shall include all items as required per manufacturers' requirements.
- C. All piping to be painted shall be cleaned of rust, dirt, grease, oil and all other contaminants prior to painting. Provide primer if and as recommended by the paint manufacturer. Provide a quality polyamine epoxy paint over all surfaces of pipe.

END OF SECTION

SECTION 22 07 16
PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

- A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.
- B. Work specified elsewhere.
 - 1. Basic materials and methods.
 - 2. Piping systems.

1.3 REFERENCES

- A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. ICC (IECC) - International Energy Conservation Code.
- D. SCAQMD 1168 - Adhesive and Sealant Applications.
- E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 WARRANTY

- A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.
- B. Defects shall include, but not be limited to, the following:
 - 1. Mildewing.
 - 2. Peeling, cracking, and blistering.
 - 3. Condensation on exterior surfaces.

1.5 SUBMITTALS

- A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.
- B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.6 DELIVERY AND STORAGE

- A. DELIVERY: Deliver undamaged materials in the manufacturer's unopened containers clearly labeled with flame and smoke ratings.

PART 2 - PRODUCTS

2.1 EQUIPMENT INSULATION

- A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.
- B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.
- C. A sample quantity of each type insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.
- D. Glass mineral wool materials as manufactured by Knauf Insulation, Owens/Corning, Certain-Teed or Johns Manville will be acceptable, if they comply with the specifications.
- E. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 and UL 723.
- F. All insulation shall comply with minimum requirements of International Energy Conservation Code ICC (IECC) and ASHRAE Std 90.1 I-P.
- G. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.
- H. All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All insulation shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.
- B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

- A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.
- B. Furnish and install piping insulation to:
 - 1. Interior domestic hot water and hot water return piping.
 - 2. Interior domestic cold water piping.
 - 3. Exterior domestic cold water piping.
 - 4. Drain bodies and associated piping.
 - 5. Condensate drainage piping.
 - 6. All pipes subject to freezing conditions shall be insulated.
- C. Work specified elsewhere.
 - 1. Painting.
 - 2. Pipe hangers and supports.
- D. For insulation purposes, piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer wells, unions, pressure reducing stations, and orifice assemblies.

1.3 RELATED SECTIONS

- A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment
- B. Section 22 05 53 - Identification for Plumbing Piping and Equipment
- C. Section 22 10 00 - Plumbing Piping

1.4 REFERENCES

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ASTM C165 - Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
- D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
- E. ASTM C411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- G. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
- H. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.
- I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

- J. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
- K. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- L. ASTM C1393 - Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks.
- M. ASTM C1710 - Standard Guide for Installation of Flexible Closed Cell Preformed Insulation in Tube and Sheet Form.
- N. ASTM C1729 - Standard Specification for Aluminum Jacketing for Insulation.
- O. ASTM C1767 - Standard Specification for Stainless Steel Jacketing for Insulation.
- P. ASTM D1644 - Standard Test Methods for Nonvolatile Content of Varnishes.
- Q. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- R. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- S. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C.
- T. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
- U. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
- V. ICC (IECC) - International Energy Conservation Code.
- W. MIL-A-24179 - Adhesive, Flexible Unicellular-Plastic Thermal Insulation.
- X. MIL-DTL-3316 - Adhesives, Fire-Resistant, Thermal Insulation.
- Y. NACIIS - North American Commercial and Industrial Insulation Standards Manual.
- Z. SCAQMD 1168 - Adhesive and Sealant Applications.
- AA.UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.
- BB.UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

1.5 QUALITY ASSURANCE

- A. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
- B. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.
 - 1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.
- C. All piping insulation thicknesses shall comply with ICC (IECC) and ASHRAE Std 90.1 I-P.
- D. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.
- E. Adhesives, mastics, and sealants used on the interior of the building shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D
- F. All insulations shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or polybrominated diphenyl ether fire retardants.
- G. All insulations shall be UL GREENGUARD Gold certified.
- H. Fiberglass insulations shall have a minimum of 50 percent recycled glass content.

- I. Foam insulation materials shall be manufactured without the use of chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) blowing agents.

1.6 WARRANTY

- A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.
- B. Defects shall include, but not be limited to, the following:
 1. Mildewing.
 2. Peeling, cracking, and blistering.
 3. Condensation on exterior surfaces.

1.7 SUBMITTALS

- A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.
- B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.8 DELIVERY AND STORAGE

- A. Deliver insulation materials to site in unopened containers with manufacturer's product name, ASTM standard designation, type and grade, maximum use temperature, nominal dimensions, manufacturer lot or date code.
- B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.
- C. Store insulation indoors and keep free from exposure to UV and precipitation.

PART 2 - PRODUCTS

2.1 PIPING INSULATION

- A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.
- B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved prior to installation.
- C. A sample quantity of each type of insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.
- D. Any existing piping located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 testing requirements shall be provided with a single layer of high-temperature insulation to establish a noncombustible rating per ASTM E136. Insulation products which are approved for such non-compliant combustible piping materials located air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer's instructions.

2.2 APPROVED MANUFACTURERS

- A. Fiberglass/glass mineral fiber materials shall be as manufactured by Knauf Insulation, Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.
- B. Adhesives, mastics, and sealants shall be as manufactured by 3M company, Armacell, Foster/Childers, Mon-Eco Industries, or Vimasco Corporation and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.
- C. Flexible elastomeric cellular thermal insulation shall be as manufactured by Armacell.
- D. Phenolic foam insulation shall be as manufactured by Resolco, Inc. (Insul-Phen) or Polyguard (Poly-phen).
- E. Metal jacketing and fitting covers shall be as manufactured by Johns Manville or RPR Products, Inc.

2.3 MATERIALS

- A. INTERIOR DOMESTIC WATER PIPE: Provide fiberglass/glass mineral fiber preformed pipe insulation in accordance with ASTM C547, Type I and IV; ASTM C585, ASTM C411, and ASTM C795 with ASJ+ SSL+ vapor retarder jacket complying with ASTM C1136. Thermal conductivity (k-value) at 75 degrees F mean temperature shall be 0.23 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 1,000 degrees F. Provide Knauf Insulation Earthwool 1000 Insulation with ECOSE Technology or approved equal.
- B. EXTERIOR DOMESTIC WATER PIPE: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M, model "AP Armaflex" with secured metal jacketing; thermal conductivity (k-value) at 75 degrees F mean temperature shall be 0.28 Btu x in. /h x sq. ft. x degrees F, or less; maximum service temperature of 300 degrees F; or provide phenolic foam in accordance with ASTM C1126 type III with ASJ vapor retarder jacket and all joints sealed with secured metal jacketing. Thermal conductivity (k-value) at 75 degrees F mean temperature shall be 0.18 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 250 degrees F.
- C. ROOF DRAIN BODIES AND DOWNSPOUTS: Insulate underside of roof and overflow drain bodies with segmented fiberglass board in roll form with glass fibers adhered perpendicular to the vapor retarder facing. Provide fiberglass / glass mineral fiber segmented board pipe and tank insulation: Glass fibers bonded with a thermosetting resin, complying with ASTM C1393, Category 1. Semi-rigid, segmented board in roll form with glass fibers adhered perpendicular to the vapor retarder facing. Provide insulation with factory applied White ASJ+ vapor retarder facing complying with ASTM C1136, Type II, IV, X. Compressive strength per ASTM C165, not less than 120 psf at 10% deformation. Thermal conductivity (k-value) at 100 degrees F mean temperature shall be 0.26 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 850 degrees F. Provide Knauf Insulation Earthwool Pipe & Tank Insulation with ECOSE Technology or approved equal. For associated horizontal roof and overflow drain piping, including first turn down to vertical conductor, provide fiberglass/glass mineral fiber preformed pipe insulation in accordance with ASTM C547, Type I and IV; ASTM C585, ASTM C411, and ASTM C795 with ASJ+ SSL+ vapor retarder jacket complying with ASTM C1136. Thermal conductivity (k-value) at 75 degrees F mean temperature shall be 0.23 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 1,000 degrees F. Provide Knauf Insulation Earthwool 1000 Insulation with ECOSE Technology or approved equal.
- D. CONDENSATE AND SIMILAR DRAINAGE:

1. Condensate piping: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M. Thermal conductivity (k-value) at 75 degrees F mean temperature shall be 0.276 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 230 degrees F. Provide model "Armaflex Ultima", fire rated for use in environmental air plenums; insulation not required when piping is exposed on roof.
2. Waste lines from water coolers and refrigerated drinking fountains to junction with main waste stacks: Insulate as described above.
3. Underside of floor drains and similar receptors receiving cooling coil condensate and the tailpieces, p-traps, and the associated piping to junction with main waste stacks: Insulate as described above.
- E. FACTORY-APPLIED VAPOR RETARDERS - ALL SERVICE JACKETING (ASJ+): Vapor retarder jacket for interior applications shall be composed of an aluminum foil layer, reinforced with glass scrim, bonded to a layer of white kraft paper, interleaving with an outer polymer film leaving no paper exposed; complying with ASTM C1136.
- F. FIELD-APPLIED PROTECTIVE FINISHES
 1. METAL JACKETING: Provide aluminum jacketing complying with ASTM C1729 or stainless steel jacketing complying with ASTM C1767. Metal jacketing shall have a minimum thickness of 0.016 inches for piping sizes through 6" diameter, 0.020" for piping sizes 8" diameter through 10" diameter, and 0.024" for piping sizes 12" diameter through 24" diameter. Provide pre-formed fitting covers for all elbows and tees.
- G. HIGH DENSITY INSERTS
 1. Provide high density inserts at all pipe support locations as indicated herein to prevent excessive compression of the insulation. High density inserts shall have a minimum compressive strength of 100 psig. Pipe supports shall either be noncombustible, or be UL listed and labeled in accordance with UL 2043. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required. Refer to 22 05 29 - Hangers and Support for Plumbing Piping and Equipment.
 2. Provide 360° high density inserts at all pipe support locations for fiberglass insulation applications. High density inserts shall be calcium silicate for fiberglass insulation applications.
 3. Provide 180° high density inserts at all pipe support locations for phenolic foam insulation applications for piping 4.0" diameter or larger. High density inserts shall be phenolic foam insulation meeting the compressive strength requirements indicated herein.
 4. Provide 360° high density inserts at all pipe support locations for flexible elastomeric cellular thermal insulation applications. Provide ArmaFix EcoLight or equal.

2.4 INSULATING CEMENTS

- A. Mineral Fiber Insulating Cement: Comply with ASTM C195.

2.5 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic: Water based; suitable for indoor and outdoor use on below ambient services. Water-Vapor Permeance shall be 0.09 perms at 55-mils dry film thickness when tested in accordance with ASTM E96/E96M, Procedure A. Service Temperature Range shall be -20 to +180 degrees F. Solids content shall be 59 percent by volume and 71 percent by weight per ASTM D1644. Provide Childers CP-35 or approved equal.

2.6 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F. Provide Childers CP-97 or approved equal.
- C. Fiberglass / Glass Mineral Fiber Adhesive: Comply with MIL-DTL-3316C, Class 2, Grade A. Provide Childers CP-82 or approved equal.
- D. Flexible elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I. Provide Armacell Armaflex 520 BLV or approved equal.

2.7 LAGGING ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation. Service Temperature Range shall be 0 to +180 degrees F. Provide Childers CP-52 or approved equal.

2.8 SEALANTS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. Metal Jacket Flashing Sealants shall be fire and water-resistant, flexible, elastomeric sealants with a service temperature range of -40 to +250 degrees F. Provide Childers CP-76 or approved equal.
- C. Fire Barrier Sealant shall be a latex-based, intumescent sealant that dries to form a monolithic firestop seal. Fire barrier sealant shall be firestop tested up to 4 hours in accordance with ASTM E814 and fire resistance tested in accordance with ASTM E1966. Provide 3M CP 25WB+ or approved equal.

2.9 GLASS FIBER FABRIC REINFORCING MESH

- A. Woven Glass Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch. Provide Childers Chil-Glas No. 10 or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. To ensure that external fiberglass/glass mineral fiber flexible blanket and rigid board insulation will achieve its highest possible performance and serve its intended purpose, install all mechanical insulation materials and associated accessories in accordance with manufacturer's published instructions and industry practices detailed by the NACIIS Manual as published by the Midwest Insulation Contractors Association (MICA).
- B. All insulation shall be installed in accordance with the manufacturers' recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.
- C. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.
- D. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- E. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces, free of voids throughout the length of pipe and fittings.

- F. Pipes located outdoors or in tunnels or crawlspaces shall be insulated same as concealed piping and be provided with metal jacketing with longitudinal 1/2" safety hem and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. Jacket securement shall be by metal banding with clips. Banding material shall match jacketing material. Galvanized steel banding is not acceptable.
- G. All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.
- H. Installation of flexible elastomeric foam insulation shall be in accordance with ASTM C1710.
- I. Provide all piping insulation to comply with the ASHRAE Std 90.1 I-P Minimum Thickness Schedule and as indicated below.
 - 1. Low temperature surfaces - Minimum Insulation Thickness
 - a. Exposed exterior domestic water pipe: 1-1/2 inch
 - b. Interior domestic cold water pipe: 1 inch
 - c. Condensate drain lines: 3/4 inch
 - d. Drains receiving condensate: 1 inch
 - e. Concealed piping from roof drains: 1-1/2 inch
 - f. Exposed piping from roof drains: 1 inch
 - 2. Domestic Hot Water and Return Piping - Minimum Insulation Thickness
 - a. Pipe sizes 1-1/4 inch and smaller with operating temperatures of 140°F or less: 1 inch
 - b. Pipe sizes 1-1/2 inch and larger with operating temperatures of 140°F or less: 1-1/2 inch
 - c. Pipe sizes 1-1/4 inch and smaller with operating temperatures greater than 140°F: 1-1/2 inch
 - d. Pipe sizes 1-1/2 inch and larger with operating temperatures greater than 140°F: 2 inch

3.2 WATER PIPE INSULATION INSTALLATION

- A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 12 feet on straight runs, a vapor dam shall be formed between the vapor retarder jacket and the bare pipe. The seal shall be by the applications of vapor retarder mastic to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.
- B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated fiberglass / glass mineral fiber covers finished with two brush coats of vapor retarder mastic reinforced with glass fabric.
- C. All under lap surfaces shall be clean and free of dust, etc. before the SSL is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder mastic shall be applied to all edges of the vapor retarder jacket.
- D. At hangers and supports, provide a high density insulation insert that extends 2" beyond the shield on each side and a protective shield/saddle to prevent compression/damage. Secure shield/saddle to insulation using mastic. Refer to 22 05 29 - Hangers and Support for Plumbing Piping and Equipment.

3.3 FIRE RATED ASSEMBLY PENETRATIONS

- A. All pipe penetrations through walls and concrete floors shall be fire rated by applying rock mineral fiber insulation in the annular space between the pipe and its associated sleeve.

- B. Seal penetrations through fire rated assemblies with an approved fire barrier sealant. Refer to Division 7 for further requirements regarding "Through-Penetration Firestop Systems".
- C. All fire stopping material shall be installed in accordance with manufacturer's printed instructions.

END OF SECTION

SECTION 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.2 RELATED SECTIONS

- A. Section 01 91 00 - General Commissioning Requirements
- B. Section 23 09 63 - Energy Management and Control System (EMCS)

1.3 SUMMARY

- A. The commissioning of the plumbing system and associated controls shall be performed by an impartial technical firm hired by the owner. The commissioning provider shall be certified under one or more of the following certifications:
 - 1. CxA - Certified Commissioning Authority - ACG
 - a. CBCP - Certified Building Commissioning Professional - AEE
 - b. CCP - Certified Commissioning Professional - BCA
 - c. CPMP - Certified Process Management Professional - ASHRAE
 - d. BSC - Building System Commissioning Certification - NEBB
- B. The commissioning provider (Commissioning authority) shall be responsible for leading the entire construction team through the commissioning process including, but not limited to, conducting the commissioning kick-off meeting, preparing the commissioning plan, preparing pre-functional checklists, preparing functional test scripts, participation in functional testing and preparation of required documentation and reports.

1.4 RESPONSIBILITIES

- A. Contractor: Responsibilities of the Contractor as related to the Commissioning Process include, but are not limited to the following:
 - 1. Facilitate coordination of Commissioning work by Commissioning authority.
 - 2. Attend Commissioning meetings or other meetings called by Commissioning authority to facilitate the Commissioning Process.
 - 3. Review Functional Performance Test procedures for feasibility, safety, and impact on warranty, and provide Commissioning authority with written comment on same.
 - 4. Provide all documentation relating to manufacturer's recommended performance testing of equipment and systems.
 - 5. Provide Operations & Maintenance data to Commissioning authority for preparation of checklists and training manuals.
 - 6. Provide As-built drawings and documentation to facilitate Testing.
 - 7. Assure and facilitate participation and cooperation of Sub Contractors and equipment suppliers as required for the Commissioning Process.
 - 8. Certify to Commissioning authority that installation work listed in Pre-Functional Checklists has been completed.
 - 9. Install systems and equipment in strict conformance with project specifications, manufacturer's recommended installation procedures, and Pre-Functional Checklists.
 - 10. Provide data concerning performance, installation, and start-up of systems.
 - 11. Provide copy of manufacturers filled-out start-up forms for equipment and systems.

12. Ensure systems have been started and fully checked for proper operation prior to arranging for Testing with Commissioning authority. Prepare and submit to Commissioning authority **written** certification that each piece of equipment and/or system has been started according to manufacturer's recommended procedure, and that system has been tested for compliance with operational requirements.
 - a. Contractor shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether or not they are specifically listed in Pre-Functional Checklists.
 - b. Contractor is not relieved of obligation for systems/equipment demonstration where performance testing is required by specifications, but a Functional Performance Test is not specifically designated by Commissioning authority.
 13. Coordinate with Commissioning authority to determine mutually acceptable date of Functional Performance Tests.
 14. Provide qualified personnel to assist and participate in Commissioning.
 15. Provide test instruments and communications devices, as prescribed by Commissioning authority, required for carrying out Testing of systems.
 16. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.
 17. Ensure deficiencies found in the Commissioning Issues Log are corrected within the time schedule shown in the Commissioning Plan.
 18. Provide Commissioning authority with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process. This information shall be routed through Architect.
 19. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.
 20. Prepare and submit to Commissioning authority proposed Training Program outline for each system.
 21. Coordinate and provide training of Owner's personnel.
 22. Prepare Operation & Maintenance Manuals and As-Built drawings in accordance with specifications; submit copy to Commissioning authority in addition to other contractually required submissions. Revise and resubmit manuals in accordance with Design Professionals and Commissioning authority comments.
 23. Commissioning requires participation of this Division Subcontractors to ensure that systems are operating in manner consistent with Contract Documents. All costs associated with the participation of Contractor, Sub-Contractors, Design Professionals, and Equipment Vendors in the Commissioning Process shall be included as part of the Construction Contract.
- B. Subcontractors and vendors shall prepare and submit to Commissioning authority proposed Startup procedures to demonstrate proper installation of systems, according to these specifications and checklists prepared by Commissioning authority

1.5 COMMISSIONING PLAN

- A. Commissioning Process tasks and activities:
1. Commissioning kick-off meeting: Conducted by commissioning authority and attended by construction team and design team.
 2. Pre-functional checklists: Prepared by the commissioning authority and filled out by subcontractors performing the work that is applicable.

3. Site visits to review installation of applicable systems and progress of checklist documentation performed and reported by commissioning authority.
 4. Functional testing: Commissioning authority shall conduct functional testing with assistance of applicable subcontractors and document successful results as well as deficiencies (issues). Functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing in accordance with plans and specifications. Testing shall include all modes and sequence of operation, including under full-load, part-load and emergency conditions (including all alarms). Controls system shall be tested to document that control devices, components, equipment and systems are calibrated and adjusted and operate in accordance with the plans and specifications. Sequences shall be functionally tested to document they operate in accordance with plans and specifications.
 5. Preliminary commissioning report: Commissioning authority shall issue a preliminary commissioning report to the owner that has results of the first round of functional testing including deficiencies discovered.
 6. Systems manual: Commissioning authority shall compile the systems manual using submittal data provided by the general contractor and applicable subcontractors.
 7. Final commissioning report: Commissioning authority shall issue final commissioning report documenting the entire process and final results of functional testing. Report shall include final testing and balancing report.
- B. Equipment to be tested
1. Energy Management and Control System interface with applicable plumbing system equipment.
 2. Service water heating systems (100%).
 3. Service water circulation equipment (100%).
 4. Domestic water booster pumps (100%).
- C. Testing functions and conditions
1. Verify shutdown of systems when scheduled.
 2. Calibration of sensors
 3. Confirm functionality of all specified sequences of operations.
 4. Verify the functionality of all alarms.
- D. Performance criteria
1. Water temperatures shall be within tolerances specified in the contract documents.
 2. Water heating system "recovery" rates shall be within specified time frame.
 3. Booster pump shall maintain system pressure within specified tolerance.

PART 2 - PRODUCTS

2.1 NO PRODUCTS SUPPLIED

PART 3 - EXECUTION

3.1 GENERAL

- A. This Division has startup responsibilities and are required to complete sub-systems so COMPLETE SYSTEMS are fully functional. Insuring they meet design requirements of Contract Documents. Commissioning procedures and testing do not relieve or lessen this responsibility or shift this responsibility, in whole or in part, to Commissioning Agent or Owner.

- B. Coordinate with other Sub-Contractors and equipment vendors to set aside adequate time to address Pre-Functional Checklists, Functional Performance Tests, Operations & Maintenance Manual creation, Owner Training, and associated coordination meetings.
- C. Commissioning authority will also conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be issued by Architect as deemed appropriate.

3.2 WORK PRIOR TO COMMISSIONING

- A. Complete all phases of the work so the systems can be started, adjusted, balanced, tested, and otherwise tested.
- B. See pertinent specification sections in this Division, which outline responsibilities for start-up of equipment with obligations to complete systems, including all sub-systems so that they are fully functional.
- C. Assist commissioning authority with all information pertaining to actual equipment and installation as required complete the full commissioning scope.
- D. Contractor shall prepare startup procedures to demonstrate compliance with pre-functional checklists, and coordinate scheduling for completion of these checklists.
- E. A minimum of 7 days prior to date of system startup, submit to Commissioning authority for review, detailed description of equipment start-up procedures which contractor proposes to perform to demonstrate conformance of systems to specifications and Checklists.

3.3 PARTICIPATION IN COMMISSIONING

- A. Attend meetings related to the Commissioning Process; arrange for attendance by personnel and vendors directly involved in the project, prior to testing of their systems.
- B. Provide skilled technicians to startup and test all systems, and place systems in complete and fully functioning service in accordance with Contract Documents.
- C. Provide skilled technicians, experienced and familiar with systems being commissioned, to assist Commissioning authority in commissioning process.

3.4 WORK TO RESOLVE DEFICIENCIES

- A. Complete corrective work in a timely manner to allow expeditious completion of Commissioning Process. If deadlines pass without resolution of identified problems, Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs thus incurred will be Contractor's responsibility.

3.5 PRE-FUNCTIONAL CHECKLISTS (PFC)

- A. Contractor shall complete Pre-Functional Checklists to validate compliance with Contract Documents installation and start-up requirements, for this Division's systems.
- B. Refer to commissioning plan for detailed list of equipment to be commissioned.

3.6 FUNCTIONAL PERFORMANCE TESTING (FPT)

- A. Contractor, in cooperation with Commissioning Agent, shall conduct Functional Performance Testing to validate compliance with Contract Documents.
- B. Refer to commissioning plan for detailed list of equipment to be commissioned.
- C. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.

- D. Assist Commissioning authority in Functional Testing by removing equipment covers, opening access panels, etc. Furnish ladders, flashlights, meters, gauges, or other inspection equipment as necessary.
- E. Sampling
 - 1. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy.
 - 2. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.
 - 3. A common sampling strategy is the “xx% Sampling - yy% Failure Rule”, defined by the following example.
 - a. xx = the percent of the group of identical equipment to be included in each sample.
 - b. yy = the percent of the sample that if failing, will require another sample to be tested.
 - c. The example below describes a 20% Sampling - 10% Failure Rule.
 - d. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.”
 - e. If 10% (yy) of the units in the first sample fail the functional tests, test another 20% of the group (the second sample).
 - f. If 10% of the units in the second sample fail, test all remaining units in the whole group.
 - g. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.
- F. Re-Testing And Failure To Remedy Deficiencies
 - 1. Despite Contractor’s best efforts to ensure systems are problem-free, it is expected that some deficiencies will be found during initial inspection of Pre-functional Checklist, and during initial Functional Testing; such deficiencies are expected to be minimal.
 - 2. It is Contractor’s responsibility to remedy identified deficiencies, both in Pre-functional Checklist and in Functional Testing phases of work, in a timely and thorough manner.
 - 3. It is Contractor’s responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.
 - a. At his discretion, CxA may agree to re-testing systems or equipment where deficiencies remain which are beyond Contractor’s control to resolve expeditiously.
 - b. Typically such re-testing of incomplete systems and equipment will take place only if remaining deficiencies are minor in scope and nature, and are of such nature that they cannot be resolved in a timely manner (such as those due to difficulties in obtaining parts, or where Owner has requested a change that has delayed work, etc.)
 - 4. CxA will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving Contractor’s request.

- a. If CxA finds deficiencies identified in initial inspection or test have not been remedied (with exception of un-resolvable deficiencies in 3.b. above), and such remaining deficiencies are significant enough to require additional inspection or re-testing, Contractor will be back-charged for CxA's expenses, and time at a rate of \$150.00 per hour and \$100.00 expenses, for a third and any subsequent re-inspections and re-tests.
- G. Deferred Testing
 1. "Seasonal Commissioning" pertains to testing during peak heating or cooling seasons when HVAC equipment is operating at full-load or heavy-load conditions. Initial commissioning will be done as soon as contract work is completed, regardless of season. Seasonal Commissioning under full- or heavy-load conditions other than the current season will be handled at later time by GC and CxA.
 2. If adequate load may be artificially placed upon heating or cooling equipment, CxA, at his discretion, may perform functional testing during non-peak load periods.
 3. GC is to provide services of personnel and participate in seasonal testing process in the same manner as he would in non-seasonal testing.
 4. Until off-season commissioning can be accomplished, Owner may retain an amount from GC's payment sufficient to cover the cost of off-season testing.
 5. Unforeseen Deferred Tests: If any check or test cannot be completed due to building structure, required occupancy condition, or other reason, execution of checklists and functional testing may be delayed upon approval of Owner. Tests shall be conducted in same manner as seasonal tests, as soon as possible. Services of required parties will be negotiated. Make final adjustments to Operation and Maintenance Manuals and record drawings due to unforeseen deferred tests.
 6. GC is to provide services of personnel and participate in deferred testing in the same manner as he would for normal commissioning.

3.7 TRAINING

- A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.
- B. Contractor shall be responsible for training coordination and scheduling, and ultimately to ensure that training is completed.
- C. The training agenda (plan) shall include, at a minimum, the following elements:
 1. Purpose of equipment.
 2. Principle of how the equipment works.
 3. Important parts and assemblies.
 4. How the equipment achieves its purpose and necessary operating conditions.
 5. Most likely failure modes, causes and corrections.
 6. On site demonstration.
- D. Commissioning authority shall be responsible for overseeing and approving content and adequacy of training of Owner personnel for all installed systems. Provide Commissioning authority with training plan two weeks before planned training.

3.8 OPERATIONS & MAINTENANCE MANUALS

- A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.
- B. Sub-Contractor shall compile and prepare documentation for equipment and systems specified in this Division, and shall deliver documentation to Contractor for inclusion in Operation & Maintenance Manuals, in accordance with requirements of Division 01, prior to training Owner personnel.

- C. Provide Commissioning authority with a single, electronic copy of Operation & Maintenance Manuals for review. Commissioning authority copy of O&M manuals shall be submitted through Architect.
- D. Operation and maintenance manuals shall include, service agency contact information, maintenance requirements, controls system settings and a narrative of how each system is intended to operate, including set points.

3.9 DOCUMENTATION

- A. Commissioning authority shall provide documentation of process as follows:
 - 1. Preliminary commissioning report including test procedures, results of testing, itemization of deficiencies, deferred tests and climatic conditions required for performance of deferred tests. Preliminary commissioning report shall be issued to owner to demonstrate the first pass of testing has occurred and to demonstrate compliance with applicable codes.
 - 2. Final commissioning report shall include the final test and balance report, final results of functional testing, disposition of deficiencies discovered during testing, including the details of corrective measures used and functional testing procedures used for repeatability of testing in the future.

END OF SECTION

**SECTION 22 10 00
PLUMBING PIPING**

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

- A. The scope of the work shall include the furnishing and complete installation of the piping covered by this Section, with all appurtenances, ready for the Owner's use.
- B. Include the following work in addition to items normally part of this Section:
 - 1. Pipe and pipe fittings:
 - a. Sanitary drainage piping system.
 - b. Storm drainage piping system.
 - c. Domestic water piping system.
 - 2. Adapters, Transitions, Unions, Couplings, Flanges, Connectors
 - 3. Valves
 - 4. Excavation, Bedding, and Backfill

1.3 RELATED WORK

- A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment
- B. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping
- C. Section 22 05 53 - Identification for Plumbing Piping and Equipment
- D. Section 22 07 19 - Plumbing Piping Insulation
- E. Section 22 11 19 - Plumbing Specialties
- F. Section 22 30 00 - Plumbing Equipment
- G. Section 22 40 00 - Plumbing Fixtures

1.4 REFERENCES

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch.
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
- C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
- D. ASME B16.14 - Ferrous Pipe Plugs, Bushings, and Locknuts With Pipe Threads.
- E. ASME B16.15 - Cast Copper Alloy Threaded Fittings: Classes 125 and 250.
- F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- H. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV.
- I. ASME B16.24 - Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500.
- J. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV.
- K. ASME B16.39 - Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300.
- L. ASME B16.50 - Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings.
- M. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings.
- N. ASME BPVC - Boiler and Pressure Vessel Code.

- O. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators.
- P. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems.
- Q. ASSE 1079 - Performance Requirements for Dielectric Pipe Unions.
- R. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- S. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
- T. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
- U. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- V. ASTM A197/A197M - Standard Specification for Cupola Malleable Iron.
- W. ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- X. ASTM A403/A403M - Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.
- Y. ASTM A536 - Standard Specification for Ductile Iron Castings.
- Z. ASTM A582/A582M - Standard Specification for Free-Machining Stainless Steel Bars.
- AA. ASTM A733 - Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples.
- BB. ASTM A865/A865M - Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints.
- CC. ASTM A888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
- DD. ASTM B1 - Standard Specification for Hard-Drawn Copper Wire.
- EE. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire.
- FF. ASTM B16/B16M - Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.
- GG. ASTM B32 - Standard Specification for Solder Metal.
- HH. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
- II. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
- JJ. ASTM B75/B75M - Standard Specification for Seamless Copper Tube.
- KK. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
- LL. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
- MM. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
- NN. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.
- OO. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- PP. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
- QQ. ASTM C1173 - Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
- RR. ASTM C1460 - Standard Specification for Shielded Transition Couplings for Use With Dissimilar DWV Pipe and Fittings Above Ground.
- SS. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

- TT. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
- UU. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- VV. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- WW. ASTM D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
- XX. ASTM D1599 - Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings.
- YY. ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
- ZZ. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- AAA. ASTM D2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
- BBB. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- CCC. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- DDD. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- EEE. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
- FFF. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- GGG. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
- HHH. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
- III. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- JJJ. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- KKK. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- LLL. ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
- MMM. ASTM D3311 - Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.
- NNN. ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials.
- OOO. ASTM D4976 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
- PPP. ASTM D5926 - Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems.
- QQQ. ASTM D6707/D6707M - Standard Specification for Circular-Knit Geotextile for Use in Subsurface Drainage Applications.

- RRR. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- SSS. ASTM E438 - Standard Specification for Glasses in Laboratory Apparatus.
- TTT. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
- UUU. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
- VVV. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- WWW. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
- XXX. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
- YYY. ASTM F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.
- ZZZ. ASTM F1412 - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems.
- AAAA. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
- BBBB. ASTM F1548 - Standard Specification for Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications.
- CCCC. ASTM F1673 - Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems.
- DDDD. ASTM F2618 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems.
- EEEE. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding..
- FFFF. AWS A5.9/A5.9M - Welding Consumables-Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels- Classification.
- GGGG. AWS A5.31M/A5.31 - Specification for Fluxes for Brazing and Braze Welding.
- HHHH. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
- IIII. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.
- JJJJ. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- KKKK. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.
- LLLL. AWWA C209 - Tape Coatings for Steel Water Pipe and Fittings.
- MMMM. AWWA C219 - Bolted Sleeve-Type Couplings for Plain-End Pipe.
- NNNN. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
- OOOO. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
- PPPP. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
- QQQQ. AWWA C651 - Disinfecting Water Mains.
- RRRR. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 mm through 1500 mm).
- SSSS. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
- TTTT. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

UUUU.FM 1680 - Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/ Commercial and Residential.

VVVV. NFPA 13 - Standard for the Installation of Sprinkler Systems.

WWWW. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection.

XXXX. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

YYYY. NSF 14 - Plastics Piping System Components and Related Materials.

ZZZZ. NSF 61 - Drinking Water System Components - Health Effects.

AAAAA. NSF 372 - Drinking Water System Components - Lead Content.

BBBBB. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

CCCCC. UL 1285 - Safety Pipe and Couplings, Polyvinyl Chloride (PVC), and Oriented Polyvinyl Chloride (PVCO) for Underground Fire Service.

1.5 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.
- B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.
- C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer's name and country of origin.
- D. Foreign pipe, fittings or valves are unacceptable.
- E. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed by NSF International.
- F. Welding Materials and Procedures: Conform to ASME BPVC and applicable state labor regulations.
- G. Welders Certification: In accordance with ASME BPVC-IX.

1.6 SUBMITTALS

- A. Submit under provisions of Division One.
- B. Submit product data and video inspection report under provisions of Division One.
- C. Include pipe materials, pipe fittings, valves, and accessories. Provide manufacturer's catalog information, product certifications, and country of origin. Indicate valve data and ratings.
- D. Submit dimensioned detailed drawings and material specifications for pipe isolation and protection systems being provided for void form/carton form/void box installations.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division One.
- B. Record actual locations of valves.
- C. Include written report and digital video record of waste piping inspection.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division One.
- B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum of 5 years documented experience and must be a domestic manufacturer.
- B. Installer: Company specializing in performing the work of this section with a minimum of 5 years documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. DELIVERY: Deliver clearly labeled piping and valves to; and store, protect and handle products on site in accordance with the provisions of Division One.
- B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.
- C. ACCEPTANCE: Accept product on site in original factory packaging. Receive valves on site in shipping containers with labeling in place. Inspect for damage. Damaged valves shall not be acceptable.
- D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.
- E. Provide temporary protective coating on cast iron and steel valves.
- F. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- G. Protect installed piping systems from entry of foreign materials by providing temporary covers, as completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

1.11 EXTRA MATERIALS

- A. Furnish under provisions of Division One.

1.12 REGULATORY REQUIREMENTS

- A. Perform work in accordance with plumbing and building codes having jurisdiction.
- B. PVC pipe, fittings, or similar un-rated material shall not be installed in a return air plenum unless the entire length of all such piping is encased within a minimum two (2) hour fire rated enclosure.
- C. Provide water pressure regulating valves:
 - 1. At the service entry where incoming water supply pressure is greater than 70 psi.
 - 2. Anywhere else in the distribution system where delivered water pressure is excessive relative to the fixture or equipment it serves, based on the fixture or equipment manufacturer's recommendations. Examples may include dish machines, booster heaters, food waste disposers, etc.

PART 2 - PRODUCTS

2.1 SANITARY SOIL, WASTE AND VENT PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

- A. PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.
 - 1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
 - 2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

2.2 SANITARY SOIL, WASTE AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.
 - 1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
 - 2. Joints: solvent weld with ASTM D2564 solvent cement, clear, medium bodied, for sizes 3" and smaller and gray, heavy bodied, for sizes 4" and larger. Mating surfaces shall be prepared with ASTM F656 purple primer immediately prior to cement application.

2.3 GREASE WASTE AND VENT PIPING, WITHIN BUILDING AND BURIED

- A. This Article applies to piping in the kitchen area(s) within the building and also to the piping outside the building limits which connects to the grease trap inlet.
- B. CPVC Pipe and Fittings: All system pipe and fittings shall be from a single manufacturer, Schedule 40 CPVC manufactured of material in conformance with ASTM D1784 and produced in accordance with ASTM F2618 from CPVC Type IV, ASTM Cell Classification 23447.
 - 1. All pipe shall meet the dimensional requirements of ASTM F441/F441M and all pipe markings shall be accompanied by a yellow stripe for ease of identification.
 - 2. All fittings shall be drainage pattern meeting the requirements of ASTM D3311 and specialty patterns according to the manufacturer's specifications.
 - 3. All pipe and fittings shall conform to NSF 14.
 - 4. Joining shall be by solvent cement welding, using "one step" primer-less type CPVC cement specially formulated and manufactured in accordance with ASTM F493. Only cement from the system manufacturer shall be acceptable.
 - 5. Mechanical connections for transition to other system materials shall be as specified by the pipe system manufacturer.
 - 6. All installation shall be in accordance with the manufacturer's instructions and applicable codes.
 - 7. Acceptable Manufacturer: Spears Manufacturing Company Lab Waste CPVC Drainage System only.

2.4 SANITARY SOIL, WASTE AND VENT PIPING, WITHIN BUILDING, NOT BURIED

- A. Cast Iron Pipe: CISPI 301 or ASTM A888, hubless.
 - 1. Fittings: Cast iron, CISPI 301 or ASTM A888 drainage pattern.
 - 2. Acceptable manufacturers (all pipe and fittings shall be from a single manufacturer):
 - a. Tyler Pipe
 - b. Charlotte Pipe
 - c. AB&I Foundry
 - 3. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International.
 - 4. Joints: No hub heavy-duty, shielded, stainless steel couplings meeting ASTM C1540 and FM 1680 Class 1. Complete with minimum 304 stainless steel bands, tightening devices, and shield (minimum 0.015 shield thickness). ASTM C564 neoprene gasket. Made in the USA. Torque all clamps per manufacturer's recommendations.
Acceptable manufacturers:
 - a. Husky SD 4000
 - b. Clamp-All 125
- B. Copper Tubing: ASTM B306, DWV, for sizes 2" and smaller.

1. Fittings: ASME B16.23 cast copper alloy solder joint drainage fittings (DWV), or ASME B16.29, wrought copper and wrought copper alloy solder joint drainage fittings (DWV).
 2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy Grade Sn 50 solder (50-50 tin-lead).
 3. Joints between copper and cast iron pipe shall be made by way of copper soldered to a brass ferrule and the ferrule joined to the cast iron hub by a compression or caulked joint.
- C. Brass Pipe: ASTM B43, chrome plated
1. Fittings: ASME B16.23 cast bronze, chrome plated.
 2. Joints: In accordance with ASTM B828 using ASTM B32 Alloy Grade Sn 50 solder (50-50 tin-lead) or as recommended by the manufacturer.
 3. Applies to exposed piping applications (such as kitchens), wherever required by the prevailing code or by the Authority Having Jurisdiction.
- D. Galvanized Steel Pipe: ASTM A53/A53M, schedule 40.
1. Fittings: ASME B16.3, ASTM A153/A153M hot-dip galvanized, ASTM A197/A197M malleable iron, minimum pressure class 150.
 2. Joints: Threaded joints in accordance with the manufacturer's installation instructions and ASME B1.20.1. Thread sealant tape or compound shall be applied only on male threads and shall be approved, insoluble in water, and non-toxic.
 3. Applies only to limited installations such as services from submersible pumps and ejectors.

2.5 STORM DRAINAGE PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

- A. PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.
1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
 2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

2.6 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.
1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
 2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

2.7 STORM DRAINAGE PIPING, WITHIN BUILDING, NOT BURIED

- A. Cast Iron Pipe: CISPI 310 or ASTM A888, hubless.
1. Fittings: Cast iron, CISPI 310 or ASTM A888 drainage pattern.
 2. Acceptable manufacturers (all pipe and fittings shall be from a single manufacturer):
 - a. Tyler Pipe
 - b. Charlotte Pipe
 - c. AB&I Foundry
 3. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International.

4. Joints: No hub heavy-duty, shielded, stainless steel couplings meeting ASTM C1540 and FM 1680 Class 1. Complete with minimum 304 stainless steel bands, tightening devices, and shield (minimum 0.015 shield thickness). ASTM C564 neoprene gasket. Made in the USA. Torque all clamps per manufacturer's recommendations. Acceptable manufacturers:
 - a. Husky SD 4000
 - b. Clamp-All 125

2.8 DOMESTIC WATER PIPE, BURIED WITHIN 5 FEET OF BUILDING EDGE

- A. Copper Tubing: ASTM B88, Type K. Provide soft annealed for pipe sizes up to and including 2" and hard drawn for sizes 2-1/2" and larger.
 1. Fittings: ASME B16.22 wrought copper pressure fittings.
 2. Joints shall be as follows:
 - a. No joints shall be permitted for pipe sizes 2" and smaller. All such piping must be run continuous where buried and brought up to no less than 12" above the finished floor before any joint is provided.
 - b. For sizes larger than 2", joints between copper pipe and fittings shall be brazed and shall be made in accordance with all the applicable portions of ASTM B828, manufacturer's recommendations, and AWS requirements. Brazing filler metal shall be in accordance with AWS A5.8/A5.8M and any required flux shall meet AWS A5.31M/A5.31, Type FB3-A or FB3-C.
 3. Beginning at no closer than the 5'-0" mark from the building, all piping buried or in contact with concrete shall be provided with one of the following, which shall also extend to a minimum of 6" above the finished floor:
 - a. AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines. Chase Construction Products Tapecoat H35 or approved equivalent.
 - b. Continuous polyethylene lining, minimum 25 mil nominal thickness.
- B. Stainless Steel Pre-Fabricated In-Building Riser (acceptable for sizes 2" through 10")
 1. Corrosion resistant Type 304 stainless steel construction single, extended 90 degree fitting.
 2. UL listed, FM approved and NFPA 24 compliant.
 3. Lead free and NSF 61 / NSF 372 certified.
 4. Acceptable manufacturers:
 - a. Ames Fire & Waterworks Series IBR (4" through 10") and IBR2 (2", 2-1/2", and 3")
 - b. Zurn Wilkins Model WBR (4" through 10")
 5. For sizes 3" and smaller, ensure to provide riser with an (inlet) end connection type as appropriate for the site water service pipe material. Provide an adapter fitting at each end of the riser if/as necessary. All such fittings shall be approved for installation with the piping material being installed, code accepted, and NSF 61 compliant.
 6. Note: For this application, the inlet joint for larger diameter (4" through 10") piping (which shall not be located below a building slab or foundation) can be rubber gasketed push-on type, ANSI/AWWA C111/A21.11. Installation shall be in accordance with AWWA C600.
 7. Provide continuous polyethylene encasement for all piping buried or in contact with concrete in accordance with AWWA C105/A21.5, beginning at no closer than the 5'-0" mark from the building and to a minimum of 6" above the finished floor.