SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

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

1.3 INSTRUCTION PROGRAM

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

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

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

    a. Equipment function.
    b. Operating characteristics.

2. Documentation: Review the following items in detail:

    a. Systems and equipment operation manuals.
    b. Systems and equipment maintenance manuals.
    c. Product maintenance manuals.
    d. Warranties and bonds.
    e. Maintenance service agreements and similar continuing commitments.

3. Operations: Include the following, as applicable:

a. Routine and normal operating instructions.
b. Special operating instructions and procedures.

4. Adjustments: Include the following:

a. Checking adjustments.

5. Troubleshooting: Include the following:

a. Test and inspection procedures.

6. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

7. Repairs: Include the following:

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

1.4 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training.

B. Set up instructional equipment at instruction location.

1.5 INSTRUCTION

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

B. Scheduling: Provide instruction at mutually agreed-on times.

1. Schedule training with Owner, with at least fourteen days' advance notice.

C. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.6 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. Provide video recordings used as a component of training.

PART 2 - PRODUCTS

A. Toilet Partitions

B. Automatic Flush Valves

C. Automatic Faucets

D. Soap Dispensers

E. Sanitary Napkin Dispensers

F. Lighting & Lighted Mirrors

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 MATERIALS OWNERSHIP

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

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

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

1.2 FIELD CONDITIONS

A. Conduct selective demolition so Owner's operations will not be disrupted.

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

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition. Conduct investigative demo as described in plans for Architect review prior to proceeding with full demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.sd

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

1. Maintain fire-protection facilities in service during selective demolition operations.

1.3 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

C. Sustainable Design Requirements for Building Reuse:

1. Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 PROTECTION

A. Remove temporary barricades and protections where hazards no longer exist.

3.3 CLEANING

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

END OF SECTION

SECTION 033053 – MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL (Not Applicable)

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

    a. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft..

2. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

B. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S240.

2.2 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

3.4 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.5 REPAIR

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

3.6 PROTECTION

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

END OF SECTION

SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.3 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Composites, Inc.
b. Glasteel.
c. Marlite.
d. Parkland Plastics, Inc.

2. Surface Finish: Molded pebble texture As selected by Architect from manufacturer's full range.

3. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: As selected by Architect from manufacturer's full range.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer.

E. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

1. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches wide.

1. Mark plumb lines on substrate at panel joint locations for accurate installation.
2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.

1. Drill oversized fastener holes in panels and center fasteners in holes.
2. Apply sealant to fastener holes before installing fasteners.

D. Install factory-laminated panels using concealed mounting splines in panel joints.

E. Install trim accessories with adhesive. Do not fasten through panels.

F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 071210 - FLUID APPLIED

WATERPROOFING PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Furnish all labor, materials, tools, equipment, taxes, and insurance, etc., as well as necessary services and incidentals to the complete preparation of surfaces, delivery and material installation of this Section as shown, noted, detailed, necessary to provide a waterproof and sealed system, as indicated on the Drawings and in the Specifications.

1.3 SECTION INCLUDES

A. Fluid applied membrane waterproofing and flashing.

1.4 RELATED SECTIONS

A. Coordinate work of this Section with work of other Sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other Sections, including:

1. Section 07 90 00 – Caulking and Sealants
2. Section 09 31 00 – Ceramic Tile for Tiled Floor Waterproofing System

1.5 REFERENCES

A. The latest versions of all referenced standards, whether indicated or not, shall be applied to the work of this Section.

B. ASTM C 836 - Tests for High Solids Content, Fluid Applied Membranes.

C. ASTM D 412 - Tests for Rubber Properties in Tension.

D. ASTM D 624 - Tests for Rubber Properties - Tear Resistance.

E. ASTM D 2240 - Tests for Rubber Properties - Durometer Hardness.

F. ASTM E 96 - Tests for Water Vapor Transmission of Materials in Sheet Form.

1.6 SYSTEM DESCRIPTION

A. Provide labor, materials, equipment, insurance and incidentals required to apply fluid applied membrane waterproofing, water repellant sealer, and special application waterproofing. Work shall include but not be limited to, the installation of fluid applied liquid waterproofing, sealers, primers, protective flashings, drainage boards/fabric and protection course as indicated on the drawings and within these specifications.

1. Provide primary materials from Tremco, Inc. Sealant/ Waterproofing Division.
2. Provide secondary materials as required and as recommended by Tremco.

B. All work shall conform to applicable Federal, State and local laws andregulations.

1.7 SUBMITTALS

A. Product Data: Submit the following to the Architect in accordance with Division 01 Submittals:

1. Copy of the fluid applied waterproofing manufacturer's specifications, recommendations, and installation instructions for the fluid applied waterproofing membrane system, including priming protection board, and drainage requirements where applicable including priming and protection for specific waterproofing system.
2. Copy of the special applications waterproofing manufacturer's specifications, recommendations, and installation instructions for the cementitious waterproofing coating.
3. Copy of manufacturer's published data, letter of certification, or certified testing laboratory report that each material complies with requirements and is intended for application shown and that warranty of the product can be achieved based on specified millages.
4. Copy of written itemized listing of all products proposed for use at this project.
5. Copies of a written sample warranty, and associated application and report forms required by the manufacturer for warranty purposes.
6. Copy of tile waterproofing system material manufacturer's test data or certified report confirming compatibility between waterproofing materials, tile waterproofing system and rated-floor penetration sealant materials.

B. Shop Drawings: Submit the following drawings:

1. Contractor shall furnish supplementary waterproofing details depicting special joint or terminal conditions and conditions of interface with other materials.

C. Submit (2) two copies of certifications per Article 1.8 – Quality Assurance.

1.8 QUALITY ASSURANCE

A. Inspection: Upon completion of the installation, an inspection shall be made by a technical representative of the fluid applied waterproofing manufacturer to ascertain that the "system"

has been installed in accordance with published specifications and details.

B. Contractor Qualifications: Contractor shall be approved by the fluid applied waterproofing manufacturer for installation of their products.

C. Pre-Installation Conference:

1. Prior to beginning construction, manufacturer's representative and installing contractor shall meet at project site with the Owner's Representative(s), the Architect and the Contractor. Meeting minutes will be recorded. Decisions made at the meeting will be made part of the Project Record.
2. Discuss and finalize the following at the meeting:

a. Review fluid applied waterproofing system requirements (Drawings, Specifications and other Contract Documents).

b. Resolve conflicts, if any, and clarify manufacturer's specifications, and specifications included herein.

c. Review required submittals, both completed and yet to be completed.

d. Limitations imposed by airport operations or other special requirements.

e. Establish areas on site for use as storage areas and working area.

f. Review and finalize construction schedule related to fluid applied waterproofing applications and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

g. Ventilation requirements for non-low VOC materials that may be used.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site with packages intact and with labels identifying the manufacturer, and product name and lot numbers when appropriate.

B. Store approved materials per manufacturer's recommendations.

1.10 PROJECT CONDITIONS

A. Environmental Requirements: Comply with manufacturer’s requirements for environmental conditions under which the waterproofing and sealing systems can be applied.

B. Substrate Requirements:

1. Provide applicator with surfaces that are broom clean, dry, sound and free of voids, bugholes, rockpockets, honeycombs, protrusions, excessive roughness, foreign matter, frost, ice and other contaminants which may inhibit application or performance of the waterproofing membrane system.
2. Using suitable abrasive methods, remove residue of form release, curing compound, chemical retarders and other surface treatments, laitance, mortar smear, sawcutting residue, mill scale, rust, loose material and other contaminants from concrete, masonry and ferrous metal surfaces to receive the work of this Section.

C. Concrete: Where work of this Section will be applied to concrete, provide applicator with surfaces that are smooth with finish equal to one that is light steel troweled followed by a fine hair broom. No curing compounds or sealers shall be used or must be removed prior to appllication of membrane.

D. Chaseways:

1. Slope concrete surfaces at perimeter of drains that have flanges at membrane level which are not flush with deck surfaces.
2. Rigidly install pipe, vents and other surface protrusions, properly flash them, and cover to prevent entry of membrane materials.

E. Metal and Pipe flashings: Where metal or pipe flashings are substrate to waterproofing membrane, set the flashings in continuous bedding bead of urethane sealant; install sealant S-bead between metal laps and mechanically fasten to substrate along leading edges at every 4" on center, staggered linearly, to lay flat without fishmouths.

F. Joints: Configuration shall be consistent with this Section and with all other requirements of the Contract Documents.

1.11 SEQUENCING AND SCHEDULING

A. The Contractor shall coordinate each portion of this work with work of other Sections to ensure that all construction can be completed once it is begun, and to provide for appropriate inter-discipline interfacing.

1.12 WARRANTY

A. Contractor: Provide a written three (3) year warranty against defective materials and defective workmanship, as well as moisture penetration, at 100 percent replacement value. Contractor shall reapply all materials in order to provide a complete correction of moisture penetration, including any/all defective materials and workmanship. The Contractor shall bare all costs associated with such work, including cost(s) to uncover.

B. Manufacturer: Provide a written five (5) year material warranty from the manufacturer against defective materials and leakage. Warranty shall cover 100 percent replacement of the fluid applied waterproofing system, as well as all future work required to maintain the

installations in watertight condition for a period of five (5) years from the date of completion and final acceptance of the original construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Materials and systems as manufactured by Tremco Construction Products constitute the Basis of Design for fluid applied waterproofing. Refer to Article 2.2 – Materials for other manufacturers listed by product.

B. The following listed manufacturers provide materials and systems acceptable for the Work of this section. Note that warranty provisions submittal requirements, quality assurance requirements, etc., also apply, as specified, to these systems.

1. Recommended systems by Tremco, Inc.

2.2 MATERIALS

A. Fluid applied membrane waterproofing system (basis of design) to be installed within the chaseways (non-tiled) areas of the project as scheduled or shown on theDrawings.

1. TREMproof 250GC by Tremco; horizontal, roller and vertical grades.
2. Vulkem 350 and 351 by Tremco; base coat, aggregate protective course, and top coat.
3. Vulkem 350R by Tremco; base coat system.

B. Substrate / Equipment Cleaner: #200 cleaner by Tremco.

C. Component Materials Manufactured by Tremco:

1. Dymeric 240 FC for Cants.
2. Primer #181 for Metal and PVC.
3. Bonding Primer #171 for Dymeric 2240 FC and Tremproof 250GC, if required by manufacturer.
4. Tremco Dual-Flex Sheeting.
5. Elastomeric sheet flashing: Tremco Dual-Flex Flashing System or Sika "Combiflex" System.
6. Sealant: As recommended by membrane manufacturer and equal to Tremco THC 900/901 or Dymeric 240FC or Vulkem 227 or Vulkem 45SSL.

D. Other component materials not manufactured by Tremco:

1. Aggregate for the Vulkem 350 base coat / aggregate protective course to be a silica composition of at least 6.5 on the MOH's scale of hardness. Aggregate shape to be round to sub-angular in the 16-40 mesh size. A minimum of 80 percent of the aggregate to be 16-30 mesh size. No more than 2 percent fines passing a 70 mesh

screen is acceptable. Aggregate shall contain not more than 1/2 of 1 percent of iron oxide.
2. Joint backer to be closed cell polyethylene backer rod.
3. Cant strip for changes in direction of waterproofing: small cant strip for use in planters, large cant strip for use under pavers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The applying Contractor shall be responsible for inspecting the substrate and verifying that no conditions are present which may prevent or otherwise interfere with installation of the fluid applied waterproofing system or sealer or with obtaining the required manufacturer's warranty.

B. Any adverse condition which might affect the performance of the waterproofing must be reported in writing to the Architect prior to the start of work.

3.2 PREPARATION

A. General:

1. Poured-in-place concrete shall have a smooth, light trowel finish followed by fine hair broom or equivalent finish.
2. Poured-in-place concrete shall have a minimum curing period of 28 days prior to the application of fluid applied waterproofing, unless products are specifically approved by the manufacturer for application over “green” concrete, which has cured for less than 28 days.
3. Prepare surfaces to be free of defects such as holes; cracks; contamination consisting of dirt, dust, grease, efflorescence and other foreign material.

a. All shrinkage shall be pretreated with not less than 60 wet mils of coating extending a minimum of 3" either side of crack.
b. Cracks 1/16" and over, and cold joints shall be routed to 3/8" wide by 1/2" deep, insert approved joint backing and seal with manufacturer's fluid applied membrane material.

B. Protect all adjacent surfaces not designated to receive waterproofing. Mask off adjoining surfaces not to receive membrane system

C. Beginning the installation shall be interpreted as acceptance of the substrate / deck as an acceptable surface for the application of the waterproofing system.

D. Surface preparation and detailing procedures to be in accord with waterproof membrane system manufacturer's instructions and recommendations except where more stringent requirements are indicated.

E. Clean all deck surfaces to receive membrane system in accordance with manufacturer's instructions; vacuum clean or blow clean with oil-free compressed air all surfaces to receive sealants, detailing materials or membranes immediately prior to installation.

F. Clean metal surfaces to bright metal by wire brushing or mechanical etching; scuff-sand lead flashing and plastic surfaces.

G. Prime surfaces in accord with manufacturer's instructions.

H. Install 1/4" diameter backer rod into corner of all horizontal-to-vertical junctures subject to movement and cover with 1/2" minimum detail cant of approved sealant; install 1" detail cants at projections, curbs and other horizontal-to-vertical junctures.

I. Install detail coats, joint and crack treatments, and liquid flashings in accord with manufacturer's instructions. Detail with 12 inch 60 mil coat of 250GC membrane over joint and embed reamy cloth strip 12 inch wide into wet membrane and apply second 30 mil detail coat of 250GC membrane over cloth.

J. Verify that all patching, sealants, etc. work in related sections have been performed, as well as fully cured in accord with manufacturer's instructions prior to application of fluid applied waterproofing.

K. Insure that all surfaces are completely dry prior to fluid applied waterproofing membrane application.

1. Prior to initiating work, moisture content of the substrate shall be tested by placing a section of rubber mat against the surface of the deck and allowed to stand for a minimum period of 12 hours. Upon removal, if moisture can be detected, the concrete substrates must be given ample time to fully cure.
2. Retesting is required, until such time that no moisture can be detected.

3.3 APPLICATION

A. General: Install waterproofing system in accord with manufacturer's recommendations and instructions as applies to the Work except where more stringent requirements are indicated.

1. Waterproofing membrane shall average 120 mil dry-film thickness.
2. Grid deck surfaces to assure proper coverage rates and verify membrane wet-film mil thickness with gauges as work progresses.
3. Retain empty product containers during course of work to aid in determining whether completed membrane complies with required average dry-film thickness.

B. Provide fluid applied waterproofing membrane per manufacturer's installation instructions including deck primer.

C. Provide clear water repellant sealer per manufacturer's installation instructions.

D. Provide special applications waterproofing per manufacturer's installation instructions.

E. Wipe clean all detail coats with white rags wetted with Xylene solvent; do not saturate detail coat.

F. Apply membrane uniformly and allow to cure in accord with manufacturer's instructions.

G. Feather terminating edge when entire area cannot be completed in one day; clean area 6" wide along terminating edge of membrane with Xylene solvent on clean white rags prior to startup on next working day; use interlaminary primer per manufacturer's instructions as needed; overlap existing work by 6" with new work.

H. At changes of plane and at existing walls, apply V-grade waterproofing membrane, reinforced fabric flashings, and cant strips as recommended by manufacturer.

I. Fluid Applied Membrane:

1. Apply fluid applied membrane waterproofing to all properly prepared concrete substrates at a coverage rate per Tremco's installation instructions.

    a. The "wet" film thickness of each coat shall be checked periodically during the application by averaging numerous measurements taken with standard film gauge.

    b. "Holidays" will not be accepted and are to be repaired with additional material until specified minimum mil thicknesses are achieved.

2. Upon completion of waterproofing procedures, allow fluid applied membrane materials to achieve a full cure (36 hours minimum at 70EF / 60 percent RH) prior to flood testing of the system.
3. Tremco 250GC waterproofing may be required to be applied in multiple coats to achieve the 120 mil thickness, per manufacturer’s installation procedure.

L. Flood Test:

1. Prior to framing chase way walls, plug all drains to allow surface flooding (minimum 1/4" depth to cover tops of drains) of chaseway areas to be tested.
2. Flood areas with clean, potable water. After 24 hours, inspect the test areas for leak activity.
3. If leaks are discovered, patch using new waterproofing membrane materials and repeat flood test procedures. Repair or replace damages to construction & existing finishes.

3.4 CLEAN-UP

A. Surfaces adjacent to where fluid applied waterproofing was applied shall be cleaned free of excess material or other soiling due to waterproofing operations. The surfaces shall be cleaned as work progresses.

B. Prevent accidental spilling of waterproofing materials; in event spill:

1. Remove spilled material and waste or other equipment used to clean up spill.
2. Clean surfaces to their original undamaged conditions.

3.5 PROTECTION

A. The Contractor shall protect his work at all times and shall also protect adjacent work and materials by suitable covering or other methods during the progress of his work. Protect against any possibility of over-spray.

B. Freshly coated surfaces located in trafficable areas shall be legibly posted as such immediately following their completion. Provide barricades to protect work, if necessary.

C. The coated surface should not be disturbed for at least 24 to 48 hours.

PART 4 - FLUID APPLIED WATER PROOFING SCHEDULE

4.1 SCHEDULE

A. Install Tremco's "Vulkem 350, including aggregate and 351 where indicated or scheduled on the Drawings, and as noted below:

1. At chaseways over enclosed and un-enclosed spaces below, that are not scheduled to receive a finished tiled surface.
2. Provide aggregate and 351 topping at areas where waterproofing will be left exposed to traffic for a prolonged length of time.
3. Extend water proofing under new metal stud walls and mop sinks at the chase ways. Overlap tiled floor waterproofing systems if products are compatible; however not beyond the restroom face of the metal stud runner.

END OF SECTION 07 12 10

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Insulation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.

1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. For wood-framed construction, install blankets according to ASTM C1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

6. Vapor-Retarder-Faced Blankets: Tape joints in vapor-retarder facings, and seal each continuous area of insulation to ensure insulation is secured in wall cavity where exposed.

    a. Interior Walls: Set units with facing placed on exposed side of wall.

3.7 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass.
2. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
3. Install insulation to fit snugly without bowing.

3.8 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mildew-resistant joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Joint-sealants.
2. Joint sealant backing materials.

1.3 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
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.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

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

2.2 JOINT SEALANTS, GENERAL

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

2.3 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

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

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

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

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 CLEANING

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

3.5 PROTECTION

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

3.6 JOINT-SEALANT SCHEDULE

A. Exterior joints in horizontal traffic surfaces[**JS-#**]:

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.
b. Tile control and expansion joints.
c. Joints between different materials listed above.

B. Interior joints in horizontal traffic surfaces:

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs.
b. Control and expansion joints in tile flooring.
c. Other joints as indicated on Drawings.

C. Interior joints in vertical surfaces and horizontal nontraffic surfaces:

1. Joint Locations:

a. Tile control and expansion joints.
b. Other joints as indicated on Drawings.

D. Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces:

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated on Drawings.

2. Joint Sealant: .
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 081213 - HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

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

B. Coordinate requirements for installation of door hardwares.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal 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 hollow-metal 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 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

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 hollow-metal frames of type indicated.

2.2 FABRICATION

A. Hollow-Metal 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. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. 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.

3. Terminated Stops: Terminate stops 4 inches above finish floor with a 45 -degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

B. Hardware Preparation: Factory prepare hollow-metal frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal frames for hardware.

PART 3 - EXECUTION

3.1 PREPARATION

A. Drill and tap frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. General: Install hollow-metal frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions. Comply with SDI A250.11.

B. 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.

1. 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.
2. Install frames with removable stops located on secure side of opening.

C. Solidly pack mineral-fiber insulation inside frames.

D. Installation Tolerances: Adjust hollow-metal 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.

3.3 CLEANING AND TOUCHUP

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. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

END OF SECTION

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Factory flush wood doors.

1.2 ACTION SUBMITTALS

A. Shop Drawings:

1. Door schedule indicating door location, size, fire protection rating, and swing.
2. Doors to be factory finished and application requirements.

B. Samples for Initial Selection: For finish stain color selection.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.4 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

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

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood 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 UL 10C.

2.3 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR SEMI-TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. VT Industries Inc.

2. Performance Grade: ANSI/WDMA I.S. 1A Standard Duty.
3. Performance Grade by Location:

a. ANSI/WDMA I.S. 1A Standard Duty: .

4. Architectural Woodwork Standards Grade: .
5. Faces: Single-ply wood veneer not less than 1/50 inch thick.

    a. Species: Aspen, Select white ash, Select white birch, Select white maple, Sycamore.
    b. Cut: Rift cut.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

    a. Secure with countersunk, concealed fasteners and blind nailing.
    b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

        1) For factory-finished items, use filler matching finish of items being installed.
3. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

    a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

    a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
    b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
    c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
    d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

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

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

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.

E. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

F. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

B. Related Requirements:

1. Section 081213 "Hollow Metal Frames" for door silencers provided as part of hollow-metal frames.
2. Section 081416 "Flush Wood Doors" for integral intumescent seals provided as part of labeled fire-rated assemblies.

1.2 COORDINATION

A. Floor-Recessed Door Hardware: Coordinate layout and installation with floor construction.

1. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

B. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule [**after**][**or**][**concurrent with**] submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format[**and use same door numbers**] as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

a. Identification number, location, hand, fire rating, size, and material of each door and frame.
b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
e. Fastenings and other installation information.
f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
g. Mounting locations for door hardware.
h. List of related door devices specified in other Sections for each door and frame.

C. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 CLOSEOUT SUBMITTALS

A. Schedules: Final door hardware schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

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

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Manual Closers: 10 years from date of Substantial Completion.
b. Concealed Floor Closers: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested in accordance with UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design".

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
    c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

    a. Wood or Machine Screws: For the following:

        1) Strike plates to frames.
        2) Closers to doors and frames.

    b. Steel Through Bolts: For the following unless door blocking is provided:

        1) Surface hinges to doors.

2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 MAINTENANCE SERVICE

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

B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.8 DOOR HARDWARE SCHEDULE

A.

Abbreviation	Name
BES	Best Locking Systems
IVE	H.B. Ives
LCN	LCN Commercial Division
SCH	Schlage Lock Company

Hardware Group No. 01 Concourse A & B, Plumbing Chase Access

201 208 223* 303 305 308
311

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE*		652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER	FINAL CORES BY OWNER	626	BES
1	EA	WALL STOP	WS406CCV	630	IVE
1	SET	GASKETING			
1	EA	DOOR BOTTOM			
3	EA	SILENCER	SR64	GRY	IVE

* CONCEALED HINGES - 223 only

Hardware Group No. 01 EXT Bagclaim Janitor rooms

104E 106E

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER	FINAL CORES BY OWNER	626	BES
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS436/FS438	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

EXISTING FRAME TO REMAIN - NEW DOOR & HARDWARE. CONTRACTOR/HARDWARE SUPPLIER TO VERIFY EXISTING CONDITIONS FOR NEW HARDWARE REQUIREMENTS.

Hardware Group No. 02 Bagclaim Entrance Hallway Janitor room

101
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER	FINAL CORES BY OWNER	626	BES
1	EA	SURFACE CLOSER	4050A RW/PA TBSRT	689	LCN
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS436/FS438	626	IVE
1	SET	GASKETING			
1	EA	DOOR BOTTOM			
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 02 EXT Concourse B – Janitor Room

306E 307E
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER	FINAL CORES BY OWNER	626	BES
1	EA	SURFACE CLOSER	4050A RW/PA TBSRT	689	LCN
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

EXISTING FRAME TO REMAIN - NEW DOOR & HARDWARE. CONTRACTOR/HARDWARE SUPPLIER TO VERIFY EXISTING CONDITIONS FOR NEW HARDWARE REQUIREMENTS.

Hardware Group No. 03 Concourse A – Family room

209E
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4050A RW/PA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 03 EXT Concourse B - Family room

302E
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4050A RW/PA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

EXISTING FRAME TO REMAIN - NEW DOOR & HARDWARE. CONTRACTOR/HARDWARE SUPPLIER TO VERIFY EXISTING CONDITIONS FOR NEW HARDWARE REQUIREMENTS.

Hardware Group No. 04 Concourse A Janitor Rooms

202E 206E
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER	FINAL CORES BY OWNER	626	BES
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

EXISTING FRAME TO REMAIN - NEW DOOR & HARDWARE. CONTRACTOR/HARDWARE SUPPLIER TO VERIFY EXISTING CONDITIONS FOR NEW HARDWARE REQUIREMENTS.

Hardware Group No. 05 Temporary Barrier Doors

219 220 229
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER	FINAL CORES BY OWNER	626	BES
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

END OF SECTION

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors in accordance with 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.

PART 2 - PRODUCTS

2.1 FABRICATION

A. Shop fabricate mirrors to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Rounded polished.

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. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

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

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

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. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. NGA Publications: "Laminated Glazing Reference Manual," "Glazing Manual" and "Installation Techniques Designed to Prolong the Life of Flat Glass Mirrors."

B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with 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.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 DELIVERY, STORAGE AND HANDLING

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

1.2 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, 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 Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

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

2.2 GYPSUM BOARD, GENERAL

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

3.4 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Face Size: Actual tile size, excluding spacer lugs.

C. Module Size: Actual tile size plus joint width indicated.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

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

D. Store liquid materials in unopened containers and protected from freezing.

1.3 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/8 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.
    b. Tile floors consisting of tiles 8 by 8 inches or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

3.4 ADJUSTING AND CLEANING

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.

B. 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.

3.5 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.

END OF SECTION

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.3 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 resilient products 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. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

1. Installation of resilient products indicates acceptance of surfaces and 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; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Primers.
2. Floor sealers and paints.
3. Dry fall coatings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. Behr Paint Company; Behr Process Corporation.
2. Benjamin Moore & Co.
3. PPG Paints.
4. Pratt & Lambert.
5. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
6. Sherwin-Williams Company (The).
7. Valspar Corporation (The).

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. VOC Emissions: For field applications inside the building, wall paints shall contain no more than half of the chronic REL of VOCs when tested according to the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.3 PRIMERS

A. Interior, Institutional Low-Odor/VOC Primer Sealer: Water-based primer sealer with low-odor characteristics and a VOC of less than 10 grams per liter for use on new interior plaster, concrete, and gypsum wallboard surfaces that are subsequently to be painted with latex finish coats.

B. Water-Based Rust-Inhibitive Primer: Corrosion-resistant, water-based-emulsion primer formulated for resistance to flash rusting when applied to cleaned, interior ferrous metals subject to mildly corrosive environments.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Behr Paint Company; Behr Process Corporation.
b. Benjamin Moore & Co.
c. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
d. Sherwin-Williams Company (The).

2.4 WATER-BASED FINISH COATS

A. Interior, Latex, High-Performance Architectural Coating, Low Sheen: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Behr Paint Company; Behr Process Corporation.
b. Benjamin Moore & Co.
c. PPG Paints.
d. Sherwin-Williams Company (The).

2. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.

2.5 SOLVENT-BASED FINISH COATS

A. Interior, Alkyd, Flat: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Behr Paint Company; Behr Process Corporation.
b. Benjamin Moore & Co.
c. PPG Paints.
d. Sherwin-Williams Company (The).

2. Gloss and Sheen Level: Manufacturer's standard flat finish.

2.6 FLOOR SEALERS AND PAINTS

A. Water-Based Concrete Floor Sealer: Clear, water-based, acrylic-copolymer-emulsion sealer formulated for oil, gasoline, alkali, and water resistance and for use on concrete traffic surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Behr Paint Company; Behr Process Corporation.
b. H&C® Decorative Concrete Products; a brand of Sherwin-Williams Co.
c. PPG Paints.
d. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
e. Sherwin-Williams Company (The).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Wood: 15 percent.
3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. 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 the following:

1. SSPC-SP 2.
2. SSPC-SP 3.
3. SSPC-SP 7/NACE No. 4.
4. SSPC-SP 11.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

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

3.5 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Water-Based Concrete Floor Sealer System: Concrete Floors.

a. First Coat: Matching topcoat.
b. Topcoat: Water-based concrete floor sealer.

B. Steel Substrates:

1. Alkyd over Surface-Tolerant Primer System: Hollow Metal Door Frames.

a. Prime Coat: Surface-tolerant metal primer.
b. Intermediate Coat: Matching topcoat.

c. Topcoat: Interior, alkyd, flat.

C. Gypsum Board Substrates:

1. High-Performance Architectural Latex System: Ceilings, Walls.

a. Intermediate Coat: Matching topcoat.
b. Topcoat: Interior, latex, high-performance architectural coating, low sheen.

END OF SECTION

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers
2. Wood stains.

B. Related Requirements:

1. Section 099123 "Interior Painting" for stains and transparent finishes on concrete floors.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
2. Include preparation requirements and application instructions.
3. Indicate VOC content.

B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.4 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures of less than 5 deg F above the dew point, or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. Behr Paint Company; Behr Process Corporation.
2. Benjamin Moore & Co.
3. Lenmar Lacquers; Benjamin Moore & Co.
4. Sherwin-Williams Company (The).
5. Vista Paint Corporation.

2.2 SOURCE LIMITATIONS

A. Source Limitations: Obtain each coating product from single source from single manufacturer.

2.3 MATERIALS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

B. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Stain Colors: As selected by Architect from manufacturer's full range As indicated in a color schedule.

2.4 PRIMERS

A. Alkyd Sanding Sealer, Interior, Solvent Based, Clear: Solvent-based, quick-drying, clear, sandable alkyd sealer used on new interior wood surfaces that are to be top-coated with an alkyd varnish.

2.5 WOOD STAINS

A. Stain, Interior, Semitransparent, for Interior Wood: Solvent-based, oil or oil/alkyd, semitransparent, pigmented stain for new interior wood surfaces that are to be finished with a clear varnish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Interior Wood Substrates: 13 percent, when measured with an electronic moisture meter.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

B. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

C. Exterior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Prime edges, ends, faces, undersides, and backsides of wood.

a. For solid hide stained wood, stain edges and ends after priming.
b. For varnish-coated stained wood, stain edges and ends and prime with varnish. Prime undersides and backsides with varnish.

3. Countersink steel nails, if used, and fill with putty or plastic wood filler tinted to final color. Sand smooth when dried.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions.

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

END OF SECTION

SECTION 102113.14 - STAINLESS STEEL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 COORDINATION

A. Coordinate requirements for overhead supports, blocking, reinforcing, and other supports concealed within wall and ceiling to ensure that toilet compartments can be supported and installed as indicated.

1.2 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain stainless steel toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:

1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf applied at any direction and at any point, without deformation of panel.

C. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" for toilet compartments designated as accessible.

2.3 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221.

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

E. Zamac: ASTM B86, commercial zinc-alloy die castings.

2.4 FABRICATION

A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories and solid blocking within panel where required for attachment of toilet accessories.

B. Ceiling-Hung Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.

C. Urinal-Screens: Manufacturer's standard corrosion-resistant anchoring assemblies at walls. Wall mount only.

D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide inswinging doors for standard toilet enclosures and 36-inch- wide outswinging doors with a minimum 32-inch- wide clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels or Screens: 1/2 inch.
b. Panels or Screens and Walls: 1 inch.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 COORDINATION

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

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

B. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.2 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

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

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Shower Seats: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 124000 - QUARTZ COUNTERTOPS AND SINKS PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Quartz agglomerate surfacing countertops and sinks.

B. Quartz agglomerate backsplashes.

C. Quartz agglomerate splashes where shown or indicated on the drawings.

D. Adhesives and sealants.

1.3 RELATED SECTIONS

A. Section– Metal Fabrications.

B. Section– Rough Carpentry.

C. Section– Joint Sealants.

1.4 RELATED REQUIREMENTS:

A. ASTM C 97: Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension
B. Stone.

C. ASTM C 170: Standard Test Method for Compressive Strength of Dimension Stone.

D. ASTM C 834: Standard Specification for Latex Sealants.

E. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.

F. ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

G. ASTM E 84: Standard Test Method for Surface Burning Characteristics of BuildingMaterials.

H. SCAQMD Rule 1168: Adhesive and Sealant Applications.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Submit product data for each specified product. Include manufacturer's technical data sheets and published instructions.

2. Low VOC certifications content for adhesives and sealants.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

1. Submit fully dimensioned shop drawings showing countertop and sink layouts, back splashes, ends plashes, vanities, joinery and seam locations, edge conditions, terminations, substrate construction, cutouts and holes. Show support framing and plumbing installation provisions. Include elevations, section details, and large-scale details.

C. Samples

1. Submit selection and verification samples for each color and pattern required, and a single sink mock-up and prototype. The mock-up shall be constructed off site prior to demolition of the existing restrooms and shall include all components of the in-place installation. Refer to the Drawings for the extent and mock-up area to be provided for review and acceptance by the Architect and the Owner.

D. Quality Assurance Submittals:

1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties, if required.

2. Warranty: Specimen copy of specified warranty.

E. Closeout Submittals:

1. Maintenance Data: Submit manufacturer's published Care & Maintenance manual with closeout submittals.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling: Comply with manufacturer's recommendations for shipping and handling quartz surfacing materials to preclude breakage or damage. Brace quartz surfacing units as necessary during shipment, transporting in near-vertical position with finished face towards finished face. Do not allow finished surfaces to rub during shipping andhandling.

B. Storage and Protection: Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer. Store quartz surfacing sheet materials on rack in near-vertical position to preclude damage. Store with finished face towards finished face. Prevent warpage and breakage.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements and opening by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

B. Adhesive: Acclimate adhesives to occupancy room temperatures with maximum temperature not to exceed 75 degrees Fahrenheit.

1.7 WARRANTY

A. Manufacturer's Limited Warranty: Provide manufacturer's standard 10 Year Commercial Limited Warranty against defects in quartz surfacing sheet materials.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: Wilsonart

2.2 QUARTZ SURFACING SHEET MATERIAL

A. Acceptable Product: Basis of Design: "Wilsonart Silicone", or Architect and Owner approved manufacturer.
B. Composition: Up to 93 percent quartz aggregate combined with polyester resin binders and proprietary pigments that are fabricated into slabs using vacuum vibro-compaction technology.
C. Quartz Finish: Polished finish with Gloss-o-meter reading greater than 45.
D. Color, Pattern and shape/size: Haida Quartz; custom trough sink and counter per the

drawings.

E. Material Thickness: Product Type 063 – 1.18 inch (3cm), nominal.
F. Material Weight: 15 lbs./ft^2 for 3 cmthick surfacing.
G. Sink and Countertop Dimensions: Indicated on Drawings, varying lengths andsizes.
H. Conformance Standards:

1. NSF/ANSI Standard 51.

F. Physical Characteristics:

1. Flexural Strength: Greater than 4,000 psi; ASTM D 790.

2. Flexural Strain: Less than 0.375 percent; ASTM D 790.

3. Flexural Modulus: Greater than 3.75 MPsi; ASTM D 790

4. Stain Resistance (24 Hour): No effect to moderate effect; NEMA LD-3

5. Abrasion Resistance: Greater than 100 in.-lbs.; ASTM C 501

6. Density: Greater than 2.1 g/cm^3; ASTM C 97.

7. Compressive Strength: (One Axis – Dry): Greater than 20,000 psi; ASTM C 170

8. Moisture Absorption: Maximum 0.022 percent; ASTM C 97.

J. Edge Detail: Straight and 1/4” Radius as indicated on the Drawings.

2.3 ACCESSORY MATERIALS

A. Joint Adhesive: Methacrylate-based adhesive for chemically bonding quartz surfacing seams. Color complementary to quartz surfacing sheet material. UL 2818 GREENGUARD Gold certified and complies with SCAQMD Rule 1168.

1. Basis of Design: “Wilsonart Hard Surface Adhesive”

2. Other Acceptable Products: Pigmented knife grade adhesives suitable for use with quartz surfacing that are also acceptable, to the manufacturer.

B. Siliconized Acrylic Sealant: Siliconized acrylic latex sealant. For general applications to fill gaps between countertops and at terminating substrates. Complies with ASTM C 834, Type OP, Grade NF, and SCAQMD Rule 1168.

1. Product: “Wilsonart Color Matched Silicone” or Architect and Owner approvedproduct.

2. Color: Complementary to quartz surfacing color.

C. Construction Adhesive: Countertop manufacturer's recommended silicone-based low VOC construction adhesive for backsplashes, end splashes, and other applications according to manufacturer's published fabrication instructions.

2.4 FABRICATION

A. Fabricate components in shop, to greatest extent practicable, in sizes and shapes indicated according to approved shop drawings and manufacturer's approved procedures.

B. Form joint seams between quartz surfacing components with specified seam adhesive. Completed joints inconspicuous in appearance and without voids. Provide joint reinforced if required by manufacturer for particular installation conditions. Joints to be seamless.

C. Provide holes and cutouts for plumbing fixtures, trash openings and accessories indicated on approved shop drawings. Rout cutouts and finish edges smooth.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions that could adversely affect the work of this Section.

B. Substrates must be sound, flat, smooth, and free from dust or other surface contaminants.

C. Commencement of work will constitute acceptance of substrates and conditions to receive the work.

3.2 COUNTERTOP AND SINK INSTALLATION

A. Install quartz surfacing components plumb, level, and true according to approved shop drawings and manufacturer's published installation instructions. Use woodworking and specialized fabrication tools acceptable to manufacturer.

1. Fasten quartz surfacing components to base cabinets or other supporting substrates with suitable adhesives acceptable to manufacturer.

B. Form joint seams with specified seam adhesive. Seams to be inconspicuous in completed work. Seams in locations shown on approved shop drawings. Promptly remove excess adhesive.

1. Clamp or brace quartz surfaces in position until adhesive sets.

C. Fill gaps between countertop and terminating substrates with specified silicone sealant.

D. Install backsplashes and end splashes where indicated on Drawings. Adhere to countertops

with specified construction adhesive.

E. Counters: Secure front panels to solid substrate with specified construction adhesive.

3.3 REPAIRS

A. If permissible to Architect, minor surface marring for quartz surfacing components may be repaired according to manufacturer's published installation instructions.

B. Remove and replace quartz surfacing components that are damaged and cannot be satisfactorily repaired.

3.4 CLEANING AND PROTECTION

A. Clean quartz surfacing components according to manufacturer's published maintenance instructions. Completely remove excess adhesives and sealants from finished surfaces.

B. Protect completed work from damage during remainder of construction period.

END OF SECTION 12 40 00

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SECTION 210150 - PRODUCT SUBSTITUTIONS - FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. Procedural requirements governing the Contractor's selection of products and product options are included in other sections.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions". The following are not considered substitutions:

1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.

2. Revisions to Contract Documents requested by the Owner or Architect.

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

4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if received within sixty days after commencement of the Work. Requests received more than sixty days after commencement of the Work may be considered or rejected at the discretion of the Architect/Engineer.

1. Submit three copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

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

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

   b. Samples, where applicable or requested.

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

   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.

   e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

   f. Cost information, including a proposal of the net change, in the Contract Sum.

   g. Assurance that the substitution is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

B. Action: Within one week of receipt of the request for substitution, the Architect/Engineer will request additional information or documentation necessary for evaluation of the request. Within two weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect will notify the Contractor of acceptance or refection of the proposed substitution. Acceptance will be in the form of a Change Order. If a decision on used of a proposed substitute cannot be made or obtained within the time allocated, use one of the products specified as approved.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Contractor's substitution request will be received and considered by the Architect/Engineer when one or more of the following conditions are satisfied, as determined by

the Architect/Engineer; otherwise requests sill be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.

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

3. The request is timely, fully documented and properly submitted.

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

5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

6. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinates.

9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution can provide the required warranty.

10. Where a proposed substitution involves more than one Sub Contractor, each Contractor shall cooperate with the other Contractors involved to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.

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

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 210200 - SHOP DRAWINGS AND SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF REQUIREMENTS

A. This Section specifies procedural requirements for non-administrative submittals including shop drawings product data, samples, and other miscellaneous submittals.

B. Shop drawings are technical drawings and data that have been specially prepared for this project. Information required on shop drawings includes dimensions, identification of specific products and materials which are included in the work, compliance with specified standard and notations of coordination requirements with other work. Provide special notation of dimensions that have been established by field measurement. Indicate deviations from the contract documents on the shop drawings.

C. Product data includes standard printed information on manufactured products that has not been specially-prepared for this project. General information required specifically as product data includes manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies, and the application of their labels and seals special notation of dimensions which have been verified by way of field measurement, and special coordination requirements for interfacing the material, product or system with other work.

D. Samples are physical examples of work. Documentation required specifically for sample submittals includes a generic description of the sample, the sample source or the product name or manufacturer, compliance with governing regulations and recognized standards. In addition, indicate limitations in terms of availability, sizes, delivery time, and similar limiting characteristics.

E. Miscellaneous submittals are work-related, nonadministrative submittals that do not fit in the three previous categories.

1.3 SUBMITTAL PROCEDURES

A. Submit all Division 21 Shop Drawings, product data samples, and related documents in one package. Submittal should be as complete as possible and include the following:

1. Enclose submittal in 3-ring or similar loose leaf booklet.
2. Include title page and table of contents.
3. Include list of subcontractors' qualifications and suppliers.

4. Provide tabs in front of major submittal sections relating back to table of contents.

B. No individual submittal sections will be considered and will be returned marked "No Action", with the following exceptions:

1. Items with long "Lead Time" may be submitted early if all such items are packaged together.

2. Sheet metal, piping and control drawings may be submitted after initial submittal due to preparation time required.

C. Prepare and transmit the submittal to the Architect/Engineer sufficiently in advance of the scheduled performance of related work and other applicable activities. Advise the Architect/Engineer if processing time is critical to the progress of the work.

1. Allow two weeks minimum for the Architect/Engineer's initial processing of each submittal. The Architect/Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.

2. Allow one week for processing each resubmittal.

3. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.

D. Mark each submittal with a permanent label for identification. Provide the following information on the label for proper processing and recording of action taken.

1. Project name.
2. Date.
3. Name and address of Architect/Engineer, Contractor, subcontractor and supplier.
4. Name of manufacturer.
5. Number and title of appropriate specification section.
6. Drawing number and detail references, as appropriate.
7. Similar definitive information as necessary.
8. Provide a space on the label for the Contractor's review and approval markings, and a space for the Architect/Engineer's "Action" marking.

E. Transmit each submittal from the Contractor to the Architect/Engineer, and to other destinations as indicated, by use of a transmittal form. Submittals received from sources other than the Contractor will be returned to the sender marked "No Action".

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

A. Shop Drawings: Provide six prints plus two additional prints where they are required for maintenance manuals. Two prints will be retained; the remainder will be returned. One of the prints returned will be marked-up and maintained by the Contractor as a "Record Document". Provide coordination drawings where required for the integration of the work. Show sequencing and relationship of separate units of work which are located in areas with restricted space. Submit newly prepared information, drawn to accurate scale on sheets not less than 8 inches by 11 inches; except for actual pattern or template type drawings, the maximum sheet size shall not exceed 36

inches by 48 inches. Indicate the name of the firm that prepared each shop drawing and provide appropriate project identification in the title block.

B. Product Data: Submit six copies. Do not proceed with installation of materials, products and systems until a copy of product data applicable to the installation is in the possession of the installer. Do not permit the use of unmarked copies of product data in connection with the performance of the work.

C. Samples: Submit three sets of samples for the Architect/Engineer's visual review; one set will be returned with comments. Maintain the reviewed submittal set of samples, as returned by the Architect/Engineer, at the project site, available for quality control comparisons throughout the course of performing the work.

D. Miscellaneous Submittals:

1. Inspection and Test Reports: Classify each inspection and test report as being either "shop drawings" or "product data" depending on whether the report is specially prepared for the project, or a standard publication of workmanship control testing at the point of production. Process inspection and test reports accordingly.

2. Warranties: Refer to other sections for specific general requirements on warranties, product bonds, workmanship bonds and maintenance agreements. In addition to copies desired for the Contractor's use, furnish two executed copies of such warranties, bonds or agreements. Provide two additional copies where required for maintenance manuals.

3. Standards: Where submittal of a copy of standards is indicated, and except where copies of standards are specified as an integral part of a "Product Data" submittal, submit a single copy of standards for the Architect/Engineer's use.

4. Closeout Submittals: Refer to other sections of these specifications for specific submittal requirements of project closeout information, materials, tools, and similar items.

a. Record Documents: Furnish set of original documents as maintained on the project site. Along with original marked-up record drawings, provide two copies of marked-up drawings which may be reduced to not less than half size.

b. Operation And Maintenance Data: Include description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts. Also include manufacturer's printed operating procedures, maintenance procedures, and servicing instructions, lubrication charts and schedules.

c. Materials and Tools: Refer to individual sections of these specifications for required quantities of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

1.5 ARCHITECT/ENGINEER'S ACTION

A. Except for submittals for the record and similar purposes, where action and return on submittals is required or requested, the Architect/Engineer will review each submittal, mark with appropriate "Action Taken", and where possible return within two weeks of receipt. The Architect/Engineer will stamp each submittal to be returned with a uniform, self-explanatory action stamp, appropriately marked to indicate one of the following:

1. Final Unrestricted Release: Where the submittals are marked "No Exception Taken", the work covered by the submittal may proceed provided it complies with the requirements of the contract documents; acceptance of the work will depend upon that compliance.

2. Final-But-Restricted Release: When the submittals are marked "Exception Taken as Noted", the work covered by the submittal may proceed provided it complies with both the Architect's/Engineer's notations or corrections on the submittal and with the requirements of the contract documents; acceptance of the work will depend on that compliance.

3. Returned for Resubmittal: When the submittal is marked either "Revise and Resubmit" or "Not Accepted Resubmit", do not proceed with the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise the submittal or prepare a new submittal in accordance with the Architect's/Engineer's notations stating the reasons for returning the submittal; resubmit the submittal without delay. Repeat if necessary to obtain a different action marking. Do not permit submittals with this marking to be used at the project site, or elsewhere where work is in progress.

4. Other Action: Where the submittal is returned, marked with the Architect/Engineer's explanation, for special processing or other Contractor activity, or is primarily for information or record purposes, the submittal will be marked "For Information Only".

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION

SECTION 210500 - BASIC FIRE PROTECTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division 21. It expands and supplements the requirements specified in sections of Division 1.

1.3 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. Extend all grease fittings to an accessible location.

1.4 FIRE PROTECTION INSTALLATIONS

A. Coordinate mechanical equipment and materials installation with other building components. Verify all dimensions by field measurements. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

B. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

C. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible. Coordinate the installation of mechanical materials and equipment above ceilings with suspension system, light fixtures, and other installations.

D. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

1.5 DRAWINGS AND SPECIFICATIONS

A. Separate divisional drawings and specifications shall not relieve the Contractor from full responsibility to complete all work which may be indicated on any of the drawings or in any division of the specification.

B. The specifications and drawings are complementary and are to be taken together for a complete interpretation of the work.

C. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Therefore, no interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for a complete installation are excluded.

D. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

E. Examine the architectural, structural, electrical and mechanical drawings and specifications prior to submitting bid. Architectural and structural drawings take precedence over mechanical drawings with reference to building construction, location of risers, and any other similar fixed items.

F. The Architect shall be notified of any discrepancies, omissions, conflicts or interferences which occur between drawings and specifications. If such notification is received in adequate time additional data or changes will be issued by addendum to all bidders.

1.6 CUTTING AND PATCHING

A. Do not endanger or damage installed Work through procedures and processes of cutting and patching. Do not cut structural members without prior written approval of the structural Engineer or Architect.

B. Arrange for repairs required to restore other work, because of damage caused as a result of fire protection installations. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

C. Perform cutting, fitting, and patching of equipment and materials required to: uncover Work to provide for installation of ill-timed Work; remove and replace defective Work; remove samples of installed Work as specified for testing; install equipment and materials in existing structures; upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

D. Cut, remove and legally dispose of selected fire protection equipment, components, and materials as indicated, including, but not limited to removal of piping, compressors, sprinklers and trim, and other items made obsolete by the new Work.

E. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Locate identify, and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to change over.

1.7 FIRE PROTECTION SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary), Division 1 and Division 21 Section: SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES for submittal definitions, requirements, and procedures. Submittal of shop drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.

1.8 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders, Division 1 and Division 21 Section “PRODUCTS AND SUBSTITUTION” for requirements in selecting products and requesting substitutions.

1.9 PRODUCT LISTING

A. Prepare listing of major fire protection equipment and materials for the project. Submit this listing as a part of the submittal requirement specified.

1.10 PRODUCTS

A. When two or more items of same material or equipment are required (sprinklers, pumps, valves, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated. Provide products which are compatible within systems and other connected items.

1.11 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications: adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

1.13 RECORD DOCUMENTS

A. Refer to the Division 1 Section: PROJECT CLOSEOUT or PROJECT RECORD DOCUMENTS for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark drawings to indicate revisions to piping, size and location both exterior and interior: including locations of valves and other control devices, compressors and similar units requiring periodic maintenance or repair: actual equipment locations, dimensioned from column lines: actual inverts and locations of underground piping: concealed equipment, dimensioned to column lines: mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., fire protection devices, expansion compensators, tanks, etc.): Change Orders: concealed control system devices.

C. Mark specifications to indicate approved substitutions: Change Orders; actual equipment and materials used.

D. Reproducible record drawings shall be on disk.

1.14 OPERATION AND MAINTENANCE DATA

A. In addition to the information required by Division 1 for Maintenance Data, include the following information:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions: regulation, control, stopping, shut-down, and emergency instructions: and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting: disassembly, repair, and reassembly: aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

1.15 WARRANTIES

A. Refer to the Division 1 Section: SPECIFIC WARRANTIES for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division 21, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond: duration of warranty or bond: and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.16 CLEANING

A. Refer to the Division 1 Section: PROJECT CLOSEOUT or FINAL CLEANING for general requirements for final cleaning.

1.17 FIRE PROTECTION WORKING

A. Prepare and submit a set of working plans in accordance with NFPA 13(Chapter 22) showing major elements, components, piping, and materials in relationship with other building components. Prepare drawings to an accurate scale of 1/8"=1'-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing and maintaining equipment, valve stem movement, and similar requirements.

B. Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the Work.

C. If the contractor’s working plans deviate significantly from the engineer’s plans, the contractor shall employ the services of a licensed professional engineer to sign and seal the working plans and hydraulic calculations and become the delegate engineer.

END OF SECTION

SECTION 211313 - FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies automatic sprinkler systems and standpipe and hose systems for buildings and structures. Materials and equipment specified in this Section include pipe, fittings, valves, and specialties; sprinklers and accessories.

B. Products furnished but not installed include sprinkler cabinet with spare sprinklers. Furnish to the Owner's maintenance personnel.

1.3 DEFINITIONS

A. Pipe sizes used in this specification are nominal pipe size (IPS).

B. Other definitions for fire protection systems are listed in NFPA Standards 13, 14, and 24.

C. Working Plans as used in this Section means those documents (including drawings and calculations) prepared pursuant to the requirements contained in NFPA 13 for obtaining approval of the authority having jurisdiction.

1.4 SYSTEM DESCRIPTION

A. Fire protection system is a "Wet-Pipe" system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by fire.

1.5 SUBMITTALS

A. Product Data: Include each type of sprinkler, valve, piping specialty, fire protection specialty, fire department connection specified.

B. Shop Drawings: Submit drawings which have been prepared in accordance with NFPA 13 identified as "Working Plans," and which have been approved by the authority having jurisdiction. Where the engineer has performed the hydraulic calculations and provided drawings with pipe routing and sizing, the contractor must install the system as designed. Any major rerouting or

resizing of piping must be approved by the engineer prior to installation. Any system redesign costs, incurred by the engineer, will be the responsibility of the contractor.

C. Coordination Drawings: Detail fire protection piping systems in accordance with Division 23 Section "Basic Mechanical Requirements".

D. Maintenance Data: For each type sprinkler, valve, piping specialty, fire protection specialty, fire department connection specified, for inclusion in operating and maintenance manual specified in Division 1 and Division 21 Section "Basic Fire Protection Requirements".

E. Quality Control Submittals: Test Reports and Certificates: Include "Contractor's Material & Test Certificate for Above Ground Piping" and "Contractor's Material & Test Certificate for Underground Piping" as described in NFPA 13.

F. Fire protection products shall be shown on drawings and product submittals and shall be specifically identified with the applicable Victaulic series or number.

G. Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installation and alterations of fire protection piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by a qualified installer. The term qualified means experienced in such work (experienced shall mean having a minimum of five previous projects similar in size and scope to this project), familiar with all precautions required, and has complied with all the requirements of the authority having jurisdiction. Upon request, submit evidence of such qualifications to the Architect. Refer to Division 1 Section "Definitions and Standards" for definitions for "Installers".

B. Regulatory Requirements: Comply with the requirements of the following codes.

1. NFPA 13 - Standard for the Installation of Sprinkler Systems.

2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

3. UL and FM Compliance: Fire protection system materials and components shall be Underwriter's Laboratories listed and labeled, and Factory Mutual approved for the application anticipated.

C. All grooved Fire Protection components (including couplings, fittings, valves and accessories) to be supplied by one manufacturer and shall be UL listed and/or FM Global approved. Grooving tools shall be of the manufacturer as the grooved components.

1.7 EXTRA MATERIALS

A. Valve Wrenches: Furnish to Owner, two valve wrenches for each type of sprinkler installed.

B. Sprinklers and Cabinets: Furnish six extra sprinklers of each style included in the project. Furnish each style with its own sprinkler cabinet and special wrenches as specified in this Section.

PART 2 - PRODUCTS

2.1 PIPE AND TUBING MATERIALS

A. General: Refer to Part 3 Article "PIPE APPLICATIONS" for identification of systems where the below specified pipe and fitting materials are used.

B. Steel Pipe: ASTM A 120 or ASTM A 53 or A 795 or A 135, seamless, black steel pipe, plain ends.

1. Schedule 40 for 2" and smaller.
2. Schedule 5 for 2" and smaller, Victaulic Pressfit® system.
3. Schedule 10 for 2½" and larger.
4. Schedule 10 for 2 ½" and larger, roll grooved ends as per ANSI/AWWA C-606.

2.2 FITTINGS

A. Cast-Iron Threaded Fittings: ANSI B16.4, Class 125, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.

B. Malleable-Iron Threaded Fittings: ANSI B16.3, Class 150, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.

C. Grooved Mechanical Fittings: ASTM A 47, malleable-iron fittings with grooves or shoulders designed to accept grooved end couplings. Acceptable manufacturers include Stockham, and Victaulic.

D. Victaulic Pressfit® Fittings: Fitting housings shall be Pressfit® products formed of precision cold drawn steel pipe, as manufactured by Victaulic, with self contained O-ring seals in the fitting ends. Fittings shall be zinc electroplated ASTM B-633 (external only).

E. Grooved Mechanical Couplings: Consist of ductile iron housing ASTM A-536, Grade 65-45-12, a synthetic rubber gasket of a central cavity pressure-responsive design, grade to suit the intended service conforming to ASTM D-2000, with nuts and bolts heat treated carbon steel track head conforming to ASTM A-449 and A-183, locking pin, locking toggle, or lugs to secure roll-grooved pipe and fittings. Grooved mechanical couplings including gaskets used on dry-pipe systems shall be listed for dry-pipe service. Acceptable manufacturers include Stockham, and Victaulic.

1. Rigid Type:

a) 1¼" through 4": Housings shall be cast ductile iron with offsetting, angle-pattern bolt pads. Coupling shall be "Installation Ready" rigid joints designed for direct "stab" installation onto grooved pipe without prior disassembly of the coupling. Victaulic Firelock EZ Style 009.

b) 5" & larger: Housings shall be cast ductile iron with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. Standard rigid joints shall be Victaulic Style Firelock 005 or 07 Zero-Flex.

2. Flexible Type:

a) 1½" and larger: Use in seismic areas where required by NFPA 13. Victaulic Style 75 or 77.
b) 2 through 8": Victaulic Style 791 One piece hinged boltless coupling with locking pin and installation tool for assembly and disassembly and EPDM gasket.

F. Ductile Iron Flanged Adapters: Flat faced for use with grooved end pipe and fittings for joining ANSI Class 125/150 flanged components to a grooved piping system. Victaulic Style 741 or 744.

G. Cast-Iron Threaded Flanges: ANSI B16.1, Class 125, raised ground face, bolt holes spot faced.

H. Cast Bronze Flanges: ANSI B16.24, Class 125, raised ground face, bolt holes spot faced.

I. Gasket Materials: Thickness, material, and type suitable for fluid or gas to be handled, and design temperatures and pressures. Coupling gaskets shall be UL listed for fire protection services as follows:

Fire Protection Service	Temperature Range	Gasket Recommendation
Dry Systems	Ambient	Flushseal® or EZ Style 009 design, Grade EPDM, Type A
Freezer Applications	-30°F to 0°F (-34°C to -18°C)	Flushseal®, Grade L, Silicone
Water/Wet Systems	Ambient	C-Shape or EZ Style 009 design, Grade EPDM, Type A

2.3 BASIC VALVES

A. Gate Valves - Two Inch (2") and Smaller: Body and bonnet of cast bronze, 175 pound cold water working pressure - nonshock, threaded ends, solid wedge, outside screw and yoke, rising stem, screw-in bonnet, and malleable iron handwheel. Valves shall be capable of being repacked under pressure, with valve wide open. Acceptable manufacturers include Fairbanks, Jenkins, Kennedy Valve, (Div. of ITT Grinnell Valve Co., Inc.), and Stockham.

B. Ball Valve (2") and Smaller: Standard port ball valve with carbon steel PressFit® ends, 175 psi forged brass body, chrome plated brass ball and stem with TFE seats and EPDM O-ring seal. Victaulic Series 522.

C. Gate Valves - Two and One-half Inch (2½") and Larger: Iron body; bronze mounted, 175 pound cold water working pressure - nonshock. Valves shall have solid taper wedge; outside screw and

yoke, rising stem; flanged bonnet, with body and bonnet conforming to ASTM A 126 Class B; replaceable bronze wedge facing rings; flanged ends; and a packing assembly consisting of a cast iron gland flange, brass gland, packing, bonnet, and bronze bonnet bushing. Valves shall be capable of being repacked under pressure, with valve wide open.

D. OS&Y Gate Valves 2½" through 12": Ductile iron body, 250 psi grooved ends. ASTM A-536; cast iron yoke and hand wheel, ASTM A-126-B; EPDM coated cast iron disc; ASTM B16 brass rising stem; flanged and epoxy coated cast iron bonnet; EPDM o-ring stem seals and body gasket. Victaulic Series 771.

E. NRS Gate Valves 2½" through 12": Ductile iron body, ASTM A-536, bronze mounted 250 psi grooved ends; EPDM coated cast iron disc; ASTM B16 brass rising stem; flanged and epoxy coated cast iron bonnet; EPDM o-ring stem seals and body gasket. Victaulic Series 772.

F. Butterfly Valve 2½" and larger in lieu of Gate Valve: 300 psi grooved ends. Ductile iron body, ASTM A536; ductile iron disc, ASTM A536 with EPDM coating; stainless steel stem and handwheel operated with weather proof actuator. Victaulic Series 705W.

G. Swing Check Valves: MSS SP-71; Class 175, cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends. Valve shall be capable of being refitted while the valve remains in the line. Acceptable manufacturers include Fairbanks, Jenkins, Kennedy Valve, (Div. of ITT Grinnell Valve Co., Inc.) and Stockham

H. Spring Assisted Check Valve 2½" through 12": PPS coated Ductile iron body, ASTM A-536, Grade 65-45-12, aluminium bronze non-slam tilting disc, stainless steel spring and shaft, rubber seat suitable for intended service, stainless steel spring and shaft, 250 psi. Victaulic Series 717.

I. Spring Assisted Riser Check Valve 4" through 8": Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, aluminium bronze non-slam tilting disc, stainless steel spring and shaft, rubber seat suitable for intended service, stainless steel spring and shaft, welded-in nickel seat, 200 psi, designed to accept a riser check kit. Victaulic Series 717R.

J. Alarm Check Valve 1½" through 8": Black enamel coated ductile iron body conforming to ASTM A-536, grade 65-45-12, aluminum bronze clapper, stainless steel spring and shaft, EPDM seal, and Nitrile seat O-ring. Valve internal parts shall be replaceable without removing the valve from the installed position. Water working pressure is 300 psi up to 6" and 225 psi for 8" sizes. Suitable for constant and variable pressure systems with optional Series 752 retard chamber. Victaulic FireLock® Series 751.

2.4 AUTOMATIC SPRINKLERS

A. Sprinklers: Fusible link type, and style as indicated or required by the application. Unless otherwise indicated, provide sprinklers with nominal one-half inch (½") discharge orifice, for "Ordinary" temperature range. Provide quick response sprinklers in all light hazard occupancies. Die-cast brass frame, Teflon encapsulated Belleville spring seal and frangible glass bulb. Body cast with hex shaped wrench boss. (Sprinklers shall not contain O-rings.) Quick or standard response type. Acceptable manufacturers include Automatic Sprinkler Corp. of America,

Firematic Sprinkler Devices, Inc., Globe Fire Equipment Co., Guardian Automatic Sprinkler Co., Inc., ITT Grinnell, Viking Corp and Victaulic Company.

B. Sprinkler Finishes: Provide sprinklers with the following finishes.

1. Upright, Pendent, and Sidewall Styles: Chrome plated in finish spaces, exposed to view; rough bronze finish for sprinklers in unfinished spaces and not exposed to view. Sprinklers shall be wax-coated where installed exposed to acids, chemicals, or other corrosive fumes. Victaulic Model V27.

2. Concealed Style: Rough brass, with painted white cover plate. Victaulic Model V38.

3. Flush Style: Bright chrome, with painted white escutcheon plate, Victaulic Model V29.

4. Recessed Style: Bright chrome, with bright chrome escutcheon plate, Victaulic Model V27.

5. Intermediate Level Style: Bright chrome.

C. Sprinkler Cabinet and Wrench: Finished steel cabinet, suitable for wall mounting, with hinged cover and space for six (6) or twelve (12) spare sprinkler sprinklers plus two (2) sprinkler wrenches. Provide a separate cabinet for each style sprinkler on the project.

D. Sprinkler Guard and Escutcheons: Guards and Escutcheons shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.

E. Flexible Drops:

1. In lieu of rigid pipe offsets or return bends for sprinkler drops, the Victaulic EasyFlex Flexible Drop System may be used to locate sprinklers as required by final finished ceiling tiles and walls.

2. The drop system shall consist of a braided or corrugated type 304/316 stainless steel hose piece, 1" NPT Male threaded adapter for connection to header piping and a 1/2" or 3/4" NPT Female adapter for connection to the sprinkler head.

3. Unions shall be provided on both ends of the flexible hose for ease of installation. The flexible drop shall attach to the ceiling grid using a one-piece bracket that can be installed without the use of tools and have a 3" minimum bending radius for installation in narrow or confined spaces.

4. The braided drop system is UL Listed and FM Approved and the corrugated system is UL Listed for sprinkler services to 175 psi.

2.5 FIRE DEPARTMENT CONNECTIONS

A. Sidewalk Siamese Connection: Chrome plated cast brass, angle body, two-way, siamese connection. Connection sizes shall be 4" outlet and two (2) and 2½" female inlets, having NH standard threads, for the connection size indicated, as specified in NFPA 1963. Each inlet shall have a clapper valve, and plug and chain. Provide an 18" high chrome plated brass sleeve and

chrome plated brass sidewalk plate, with words "STANDPIPE - FIRE DEPT CONNECTION" or "AUTO SPKR - FIRE DEPT CONNECTION," or "AUTO SPKR & STANDPIPE - FIRE DEPT CONNECTION" in raised letters. Acceptable manufacturer of Fire Department Connection is Valve Guardian Fire Equipment, Inc.

B. Where applicable, install a Victaulic #10-DR 90-degree elbow with drain connection at each Fire Department connection for complete system drainage.

2.6 ALARM DEVICES

A. General: Types and sizes shall mate and match piping and equipment connections.

B. Water Flow Indicators: Vane type water flow detector, rated to 250 psig; designed for horizontal or vertical installation; have 2 SPDT circuit switches to provide isolated alarm and auxiliary contacts, 7-ampere 125-volts AC and 0.25-ampere 24-volts DC; complete with factory-set, field-adjustable retard element to prevent false signals, and tamper-proof cover which sends a signal when cover is removed. Acceptable manufacturer: Viking Corp.

C. Water-Motor Gongs: 10" diameter cast aluminum gong, with factory-finish in red enamel; Pelton Wheel type operator with nylon shaft bearings with internal components of non-corrosive stainless-steel or aluminum, with upstream strainer, and shaft length and sleeve to suit wall thickness and construction; ¾" inlet and 1" drain. Acceptable manufacturer: Victaulic Series 760.

D. Supervisory Switches: SPST, normally closed contacts, designed to signal valve in other than full open position. Acceptable manufacturer: Viking Corp.

PART 3 - EXECUTION

3.1 PIPE APPLICATIONS

A. Install Schedule 40 steel pipe with threaded joints and fittings for 2" or smaller.

B. Install Schedule 10 steel pipe with roll-grooved ends and grooved mechanical couplings for sizes 2½" and larger.

3.2 PIPING INSTALLATIONS

A. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. So far as practical, install piping as indicated.

1. Deviations from approved "Working Plans" for sprinkler piping, require written approval of the authority having jurisdiction. Written approval shall be on file with the Architect prior to deviating for the approved "Working Plans".

B. Install sprinkler piping to provide for system drainage in accordance with NFPA 13.

C. Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions in pipes 2" and smaller, adjacent to each control valve. Unions are not required on flanged devices or in piping installations using grooved mechanical couplings.

E. Install flanges on valves, apparatus, and equipment having 2½" and larger connections.

F. Hangers and Supports: Comply with the requirements of NFPA 13 and NFPA 14. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be in accordance with the grooved mechanical coupling manufacturer's written instructions, for rigid systems.

G. Make connections between underground and above-ground piping using an approved transition piece strapped or fastened to prevent separation.

H. Install mechanical sleeve seal at pipe penetrations in basement and foundation walls.

I. Install test connections sized and located in accordance with NFPA 13 complete with shutoff valve. Test connections may also serve as drain pipes.

J. Install pressure gauge on the riser or feed main at or near each test connection. Provide gauge with a connection not less than ¼" and having a soft metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and where they will not be subject to freezing.

3.3 PIPE JOINTS

A. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint. Align threads at point of assembly. Apply appropriate tape or thread compound to the external pipe threads. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded. Do not use pipe with threads which are stripped, chipped, corroded, or otherwise damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

B. Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.

C. Mechanical Grooved Joints: Cut or roll grooves on pipe ends dimensionally compatible with the couplings. Assemble grooved joints according to manufacturer's (Victaulic) written instructions. Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by Victaulic. A Victaulic factory trained representative shall provide on-site training to contractor's

field personnel in the installation of grooved piping products. Factory trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

D. Steel-Piping, PressFit® Joints: Pipe shall be certified for use with the PressFit system. Pipe shall be square cut, +/- 0.030", properly deburred and cleaned. Pipe ends shall be marked at the required location, using a manufacturer-supplied gauge, to ensure full insertion into the coupling or fitting during assembly. Use a Victaulic "PFT" series tool with the proper sized jaw for pressing.

E. End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

3.4 VALVE INSTALLATIONS

A. Install fire protection specialty valves, fittings, and specialties in accordance with the manufacturer's written instructions, NFPA 13 and 14, and the authority having jurisdiction.

B. Gate Valves: Install supervised-open gate valves so located to control all sources of water supply except fire department connections. Where there is more than one control valve, provide permanently marked identification signs indicating the portion of the system controlled by each valve. Refer to Division 15 Section "Mechanical Identification" for valve tags and signs.

C. Install check valves in each water supply connection.

3.5 SPRINKLER INSTALLATIONS

A. Use proper tools to prevent damage during installations.

B. Where sprinklers are installed in lay-in tile ceilings, install in the center of tile.

C. Do not install sprinklers that have been dropped, damaged or show a visible loss of fluid. Never install sprinklers with cracked bulbs. Sprinkler bulb protector shall be removed by hand after installation. Do not use tools or any other device(s) to remove the protector that could damage the bulb in any way.

3.6 FIRE HOSE AND RACK INSTALLATIONS

A. Install hose and racks in fire hose cabinets specified in Division 10 Section "Fire Extinguishers, Cabinets, and Accessories".

3.7 FIRE DEPARTMENT CONNECTION INSTALLATIONS

A. Install automatic drip valves at the check valve on the fire department connection to the mains.

B. Install mechanical sleeve seal at pipe penetration in outside walls.

3.8 FIELD QUALITY CONTROL

A. Flush, test, and inspect sprinkler piping systems in accordance with NFPA 13.

B. Replace piping system components which do not pass the test procedures specified, and retest repaired portion of the system.

END OF SECTION

SECTION 220150 - PRODUCT SUBSTITUTIONS- PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. Procedural requirements governing the Contractor's selection of products and product options are included in other sections.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions". The following are not considered substitutions:

1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.

2. Revisions to Contract Documents requested by the Owner or Architect.

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

4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if received within sixty days after commencement of the Work. Requests received more than sixty days after commencement of the Work may be considered or rejected at the discretion of the Architect/Engineer.

1. Submit three copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

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

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

   b. Samples, where applicable or requested.

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

   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.

   e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

   f. Cost information, including a proposal of the net change, in the Contract Sum.

   g. Assurance that the substitution is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

B. Action: Within one week of receipt of the request for substitution, the Architect/Engineer will request additional information or documentation necessary for evaluation of the request. Within two weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. Acceptance will be in the form of a Change Order. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use one of the products specified as approved.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Contractor's substitution request will be received and considered by the Architect/Engineer when one or more of the following conditions are satisfied, as determined by

the Architect/Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.

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

3. The request is timely, fully documented and properly submitted.

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

5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

6. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.

9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution can provide the required warranty.

10. Where a proposed substitution involves more than one Sub Contractor, each Contractor shall cooperate with the other Contractors involved to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.

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

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 220200 - SHOP DRAWINGS AND SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF REQUIREMENTS

A. This Section specifies procedural requirements for non-administrative submittals including shop drawings product data, samples, and other miscellaneous submittals.

B. Shop drawings are technical drawings and data that have been specially prepared for this project. Information required on shop drawings includes dimensions, identification of specific products and materials which are included in the work, compliance with specified standard and notations of coordination requirements with other work. Provide special notation of dimensions that have been established by field measurement. Indicate deviations from the contract documents on the shop drawings.

C. Product data includes standard printed information on manufactured products that has not been specially-prepared for this project. General information required specifically as product data includes manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies, and the application of their labels and seals special notation of dimensions which have been verified by way of field measurement, and special coordination requirements for interfacing the material, product or system with other work.

D. Samples are physical examples of work. Documentation required specifically for sample submittals includes a generic description of the sample, the sample source or the product name or manufacturer, compliance with governing regulations and recognized standards. In addition, indicate limitations in terms of availability, sizes, delivery time, and similar limiting characteristics.

E. Miscellaneous submittals are work-related, nonadministrative submittals that do not fit in the three previous categories.

1.3 SUBMITTAL PROCEDURES

A. Submit all Division 22 Shop Drawings, product data samples, and related documents in one package. Submittal should be as complete as possible and include the following:

1. Enclose submittal in 3-ring or similar loose leaf booklet.
2. Include title page and table of contents.
3. Include list of subcontractors' qualifications and suppliers.

4. Provide tabs in front of major submittal sections relating back to table of contents.

B. No individual submittal sections will be considered and will be returned marked "No Action", with the following exceptions:

1. Items with long "Lead Time" may be submitted early if all such items are packaged together.
2. Sheet metal, piping and control drawings may be submitted after initial submittal due to preparation time required.

C. Prepare and transmit the submittal to the Architect/Engineer sufficiently in advance of the scheduled performance of related work and other applicable activities. Advise the Architect/Engineer if processing time is critical to the progress of the work.

1. Allow two weeks minimum for the Architect/Engineer's initial processing of each submittal. The Architect/Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.
2. Allow one week for processing each resubmittal.
3. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.

D. Mark each submittal with a permanent label for identification. Provide the following information on the label for proper processing and recording of action taken.

1. Project name.
2. Date.
3. Name and address of Architect/Engineer, Contractor, subcontractor and supplier.
4. Name of manufacturer.
5. Number and title of appropriate specification section.
6. Drawing number and detail references, as appropriate.
7. Similar definitive information as necessary.
8. Provide a space on the label for the Contractor's review and approval markings, and a space for the Architect/Engineer's "Action" marking.

E. Transmit each submittal from the Contractor to the Architect/Engineer, and to other destinations as indicated, by use of a transmittal form. Submittals received from sources other than the Contractor will be returned to the sender marked "No Action".

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

A. Shop Drawings: Provide six prints plus two additional prints where they are required for maintenance manuals. Two prints will be retained; the remainder will be returned. One of the prints returned will be marked-up and maintained by the Contractor as a "Record Document". Provide coordination drawings where required for the integration of the work. Show sequencing and relationship of separate units of work which are located in areas with restricted space. Submit newly prepared information, drawn to accurate scale on sheets not less than 8 inches by 11 inches; except for actual pattern or template type drawings, the maximum sheet size shall not exceed 36 inches by 48 inches. Indicate the name of the firm that prepared each shop drawing and provide appropriate project identification in the title block.

B. Product Data: Submit six copies. Do not proceed with installation of materials, products and systems until a copy of product data applicable to the installation is in the possession of the installer. Do not permit the use of unmarked copies of product data in connection with the performance of the work.

C. Samples: Submit three sets of samples for the Architect/Engineer's visual review; one set will be returned with comments. Maintain the reviewed submittal set of samples, as returned by the Architect/Engineer, at the project site, available for quality control comparisons throughout the course of performing the work.

D. Miscellaneous Submittals:

1. Inspection and Test Reports: Classify each inspection and test report as being either "shop drawings" or "product data" depending on whether the report is specially prepared for the project, or a standard publication of workmanship control testing at the point of production. Process inspection and test reports accordingly.
2. Warranties: Refer to other sections for specific general requirements on warranties, product bonds, workmanship bonds and maintenance agreements. In addition to copies desired for the Contractor's use, furnish two executed copies of such warranties, bonds or agreements. Provide two additional copies where required for maintenance manuals.
3. Standards: Where submittal of a copy of standards is indicated, and except where copies of standards are specified as an integral part of a "Product Data" submittal, submit a single copy of standards for the Architect/Engineer's use.
4. Closeout Submittals: Refer to other sections of these specifications for specific submittal requirements of project closeout information, materials, tools, and similar items.

    a. Record Documents: Furnish set of original documents as maintained on the project site. Along with original marked-up record drawings, provide two copies of marked-up drawings which may be reduced to not less than half size.
    b. Operation And Maintenance Data: Include description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts. Also include manufacturer's printed operating procedures, maintenance procedures, and servicing instructions, lubrication charts and schedules.
    c. Materials and Tools: Refer to individual sections of these specifications for required quantities of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

1.5 ARCHITECT/ENGINEER'S ACTION

A. Except for submittals for the record and similar purposes, where action and return on submittals is required or requested, the Architect/Engineer will review each submittal, mark with appropriate "Action Taken", and where possible return within two weeks of receipt. The Architect/Engineer will stamp each submittal to be returned with a uniform, self-explanatory action stamp, appropriately marked to indicate one of the following:

1. Final Unrestricted Release: Where the submittals are marked "No Exception Taken", the work covered by the submittal may proceed provided it complies with the requirements of the contract documents; acceptance of the work will depend upon that compliance.

2. Final-But-Restricted Release: When the submittals are marked "Exception Taken as Noted", the work covered by the submittal may proceed provided it complies with both the Architect's/Engineer's notations or corrections on the submittal and with the requirements of the contract documents; acceptance of the work will depend on that compliance.
3. Returned for Resubmittal: When the submittal is marked either "Revise and Resubmit" or "Not Accepted Resubmit", do not proceed with the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise the submittal or prepare a new submittal in accordance with the Architect's/Engineer's notations stating the reasons for returning the submittal; resubmit the submittal without delay. Repeat if necessary to obtain a different action marking. Do not permit submittals with this marking to be used at the project site, or elsewhere where work is in progress.
4. Other Action: Where the submittal is returned, marked with the Architect/Engineer's explanation, for special processing or other Contractor activity, or is primarily for information or record purposes, the submittal will be marked "For Information Only".

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION

SECTION 220500 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division 22. It expands and supplements the requirements specified in sections of Division 1.

1.3 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. Extend all grease fittings to an accessible location.

1.4 PLUMBING INSTALLATIONS

A. Coordinate mechanical equipment and materials installation with other building components. Verify all dimensions by field measurements. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

B. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

C. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible. Coordinate the installation of mechanical materials and equipment above ceilings with suspension system, light fixtures, and other installations.

D. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

1.5 DRAWINGS AND SPECIFICATIONS

A. Separate divisional drawings and specifications shall not relieve the Contractor from full responsibility to complete all work which may be indicated on any of the drawings or in any division of the specification.

B. The specifications and drawings are complementary and are to be taken together for a complete interpretation of the work.

C. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Therefore, no interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for a complete installation are excluded.

D. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

E. Examine the architectural, structural, electrical and mechanical drawings and specifications prior to submitting bid. Architectural and structural drawings take precedence over mechanical drawings with reference to building construction, location of plumbing fixtures, and any other similar fixed items.

F. The Architect shall be notified of any discrepancies, omissions, conflicts or interferences which occur between drawings and specifications. If such notification is received in adequate time additional data or changes will be issued by addendum to all bidders.

1.6 CUTTING AND PATCHING

A. Do not endanger or damage installed Work through procedures and processes of cutting and patching. Do not cut structural members without prior written approval of the structural Engineer or Architect.

B. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

C. Perform cutting, fitting, and patching of mechanical equipment and materials required to: uncover Work to provide for installation of ill-timed Work; remove and replace defective Work; remove samples of installed Work as specified for testing; install equipment and materials in existing structures; upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

D. Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including, but not limited to removal of piping, plumbing fixtures and trim, and other items made obsolete by the new Work.

E. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Locate identify, and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to change over.

1.7 PLUMBING SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary), Division 1 and Division 22 Section: SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES for submittal definitions, requirements, and procedures. Submittal of shop drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.

1.8 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders, Division 1 and Division 22 Section "PRODUCTS AND SUBSTITUTION" for requirements in selecting products and requesting substitutions.

1.9 PRODUCT LISTING

A. Prepare listing of major plumbing equipment and materials for the project. Submit this listing as a part of the submittal requirement specified.

1.10 PRODUCTS

A. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated. Provide products which are compatible within systems and other connected items.

1.11 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications: adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

1.13 RECORD DOCUMENTS

A. Refer to the Division 1 Section: PROJECT CLOSEOUT or PROJECT RECORD DOCUMENTS for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark drawings to indicate revisions to piping, size and location both exterior and interior: including locations of valves and other control devices, boxes, and similar units requiring periodic maintenance or repair: actual equipment locations, dimensioned from column lines: actual inverts and locations of underground piping: concealed equipment, dimensioned to column lines: mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.): Change Orders: concealed control system devices.

C. Mark specifications to indicate approved substitutions: Change Orders; actual equipment and materials used.

D. Reproducible record drawings shall be on disk.

1.14 OPERATION AND MAINTENANCE DATA

A. In addition to the information required by Division 1 for Maintenance Data, include the following information:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions: regulation, control, stopping, shut-down, and emergency instructions: and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting: disassembly, repair, and reassembly: aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.15 WARRANTIES

A. Refer to the Division 1 Section: SPECIFIC WARRANTIES for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division 22, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond: duration of warranty or bond: and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.16 CLEANING

A. Refer to the Division 1 Section: PROJECT CLOSEOUT or FINAL CLEANING for general requirements for final cleaning.

1.17 MECHANICAL COORDINATION DRAWINGS

A. Prepare and submit a set of coordination drawings showing major elements, components, and systems of mechanical equipment and materials in relationship with other building components. Prepare drawings to an accurate scale of 1/4"=1'-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing and maintaining insulation, servicing and maintaining equipment, valve stem movement, and similar requirements. Indicate movement and positioning of large equipment into the building during construction.

B. Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, 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. Mechanical equipment room layouts.
2. Specific equipment installations, including:
   a. Pumps and compressors.
   b. Tanks and heat exchangers.
   c. Water heaters and softeners.
3. Work in pipe spaces, chases, trenches, and tunnels.
4. Ceiling plenums which contain piping, ductwork, or equipment in congested arrangement.
5. Installations in mechanical riser shafts, at typical sections and crucial offsets and junctures.
6. Numbered valve location diagrams.
7. Manifold piping for multiple equipment units.

END OF SECTION

SECTION 220519 - METERS AND GAUGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of meters and gauges required by this Section is indicated on drawings and/or specified in other Division 22 sections. Types of meters and gauges specified in this Section include the following:

1. Glass Thermometers.
2. Direct Mount Dial Thermometers.
3. Dial Type Insertion Thermometers.
4. Thermometer Wells.
5. Pressure Gauges.
6. Pressure Gauge Cocks.
7. Gauge Connector Plugs.
8. Venturi - Type Flow Meters.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of meters and gauges, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Comply with ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, including installation instructions for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer’s figure number, scale range, location, and accessories for each meter and gauge.

PART 2 - PRODUCTS

2.1 THERMOMETERS

A. Glass Thermometers: Provide a die cast Cycolac plastic case finished in baked epoxy enamel, with glass front, spring secured, and nine inches long. The adjustable joint shall also be die cast aluminum, with 180° adjustment in vertical plan, 360° adjustment in horizontal plane, with locking device. Provide a clip mounted mercury filled tube and 1% scale range accuracy. Scale shall be satin faced, nonreflective aluminum, with permanently etched markings. Stem shall be copper-plated steel or brass, for separable socket. Ranges shall be as follows:

1. Hot Water: 30°F-240°F with 2°F scale divisions.

B. Direct Mount Dial Thermometers: Provide vapor tension, universal angle type with drawn steel or brass, glass lens, 4 ½" diameter. The adjustable joint shall be die cast aluminum, with 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device. The thermal bulb shall be copper with phosphor bronze bourdon pressure tube, one scale division accuracy. The scale shall be progressive, satin face, nonreflective aluminum with permanently etched markings. Movement shall be brass precision geared. Stem shall be copper plated steel, or brass, for separable socket, length to suit installation. Ranges shall be as follows:

1. Hot Water: 40°F-240°F.

C. Dial Type Insertion Thermometers: Provide bi-metal, stainless steel case and stem, 1 inch diameter dial, dust and leak proof, 1/8 inch diameter stem with normal length of five inches, accuracy equal to 0.5% or dial range. Ranges shall be as follows:

1. Hot Water: 0°F-220°F.

D. Acceptable manufacturers include Trerice (H.O.) Co., Weiss Instruments, Inc., and Weksler Instruments Corp.

2.2 THERMOMETER WELLS

A. Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2' extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

2.3 TEMPERATURE OR PRESSURE GAUGE CONNECTOR PLUGS

A. General: Provide temperature gauge connector plugs rated for 500 psi and 200°/f (93°C). Construct of brass and finish in nickel-plate, equip with ½" NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

B. An acceptable manufacturer is Peterson Equipment Co.

2.4 PRESSURE GAUGES

A. Provide pressure gauges for general use, 1% accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection. Cases shall be drawn steel or brass, with glass lens, 4 ½" diameter. Provide a brass connector with 1/4" male NPT. Provide a protective siphon when used for steam service. Scales shall be white coated aluminum with permanently etched markings. Accuracy shall be 1%. Ranges shall be as follows:

1. Case: Drawn steel or brass, glass lens, four and 4 ½" diameter.
2. Connector: Brass with 1/4" male NPT. Provide protective siphon when used for steam service.
3. Scale: White coated aluminum, with permanently etched markings.
4. Range: Conform to the following:
   a. Hot or Cold Water: 0 - 100 psi.

B. Acceptable manufacturers include Trerice (H.O.) Co., Weiss Instruments, Inc., Weksler Instruments Corp.

2.5 PRESSURE GAUGE COCKS

A. Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems. Construct gauge cock of brass with 1/4" female NPT on each end, and “T” handle brass plug.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which meters and gauges are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to the installer.

3.2 INSTALLATION

A. Install temperature gauges, pressure gauges, and flow meters in accessible location and positioned so as to be easily read by an observer standing on the floor.

B. Install gauge connector plugs in piping tees where indicated, located on pipe at most readable position. Secure cap.

C. Install pressure gauge cocks in piping tees with snubber.

3.3 ADJUSTING AND CLEANING

A. Adjust faces of meters and gauges to proper angle for best visibility.

B. Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows, repair any scratched or marred surfaces with manufacturer’s touch-up paint.

END OF SECTION

SECTION 220529 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of supports and anchors required by this Section is indicated on drawings and/or specified in other Division 22 sections. Types of supports and anchors specified in this Section include the following:

1. Horizontal-Piping Hangers and Supports.
2. Vertical-Piping Clamps.
3. Hanger-Rod Attachments.
4. Building Attachments.
5. Saddles and Shields.
6. Miscellaneous Materials.
7. Equipment Supports.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.

C. UL and FM Compliance: Provide products which are UL-listed and FM approved for sprinkler piping systems.

1.4 SUBMITTALS

A. The manufacturer shall determine the number, size, and type of anchor bolts, cable restraints, etc. for each piece and groups of pipes.

B. Details for steel frames to be used in connection with the isolations and seismic restraint of the items.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering hangers and supports which may be incorporated in work include B-Line Systems Inc., Carpenter and Patterson, Inc., Corner & Lada Co., Inc., Elcen Metal Products Co., Fee & Mason Mfg., Co. (Div. Figgie International), Anvil International, and Pipe Shields, Inc.

2.2 HANGERS, ATTACHMENTS AND SUPPORTS

A. Provide factory-fabricated anchors, hangers, attachments, and supports complying with MSS SP-58, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers, attachments, and supports for copper-piping systems.

B. Horizontal-Piping Hangers and Supports:

1. Adjustable Steel Clevis Hangers: MSS Type 1 (Anvil Fig. 260).
2. Steel Pipe Clamps: MSS Type 4 (Anvil Fig. 212).
3. Adjustable Swivel Pipe Rings: MSS Type 6 (Anvil Fig. 104).
4. Split Pipe Rings: MSS Type 11 (Anvil Fig. 108).
5. U-Bolts: MSS Type 24 (Anvil Fig. 137).
6. Clips: MSS Type 26 (Anvil Fig. 262).
7. Adjustable Pipe Saddle Supports: MSS Type 38 (Anvil Fig. 264), including steel pipe base support and cast-iron floor flange.
8. Single Pipe Rolls: MSS Type 41 (Anvil Fig. 171).
9. Adjustable Roller Hangers: MSS Type 43 (Anvil Fig. 174).

C. Vertical - Piping Clamps: Two-Bolt Riser Clamps: MSS Type 8 (Anvil Fig. 261).

D. Hanger - Rod Attachments: Steel Turnbuckles: MSS Type 13 (Anvil Fig. 230).

E. Building Attachments:

1. Concrete Inserts: MSS Type 18 (Anvil Fig. 285).
2. Top Beam C-Clamps: MSS Type 19 (Anvil Fig. 61).
3. Side Beam or Channel Clamps: MSS Type 20 (Anvil Fig. 225 or 226).
4. Center Beam Clamps: MSS Type 21 (Anvil Fig. 131).
5. C-Clamps: MSS Type 23 (Anvil Fig. 86).
6. Steel Brackets:
   a. Light Duty: MSS Type 31 (Anvil Fig. 194).
   b. Medium Duty: MSS Type 32 (Anvil Fig. 195).
7. Horizontal Travelers: MSS Type 58 (Anvil Fig. 170).

2.3 SADDLES AND SHIELDS

A. Provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated

piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Shields: MSS Type 40 (Anvil Fig. 167); of length recommended by manufacturer (minimum 12").

2.4 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

E. Equipment Supports: Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed. Correct inadequacies including proper placement of inserts, anchors and other building structural attachments. Installation of hangers, supports, anchors and associated work must be coordinated with all work by other disciplines to avoid conflicts.

3.2 INSTALLATION OF HANGERS, ATTACHMENTS AND SUPPORTS

A. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers. Install supports with maximum spacings complying with MSS SP-69. Do not use wire or perforated metal to support piping, and do not support piping from other piping. Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

B. Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment, and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

C. Insulated Piping:

1. Clamps: Attach clamps, including spacers, to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold water piping, install coated protective shields. For pipe eight inches and over, install wood insulation saddles.

D. Install building attachments within concrete or on structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional supports at concentrated loads and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

E. Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with suggested hanger spacing and rod sizes for straight horizontal runs according to MSS SP-69 as tabulated below:

	Hanger Spacing in Feet			
Pipe Size (Inches)	Std. Wt. Cast Iron Pipe Water	Copper Tube Water	PVC Water	Rod Size (Inches)
½	5	5	4	¼
¾	6	5	4	¼
1	7	6	4½	¼
1½	9	8	4½	⅜
2	10	8	5	⅜
2½	11	9	5	⅜
3	12	10	6	⅜
4	14	12	6½	½
6	17	14	7½	½
8	19	24	16	⅝

10	20	18	8½	¾
12	23	19		⅞
14	25			1
16	27			1
18	28			1¼
20	30			1¼

3.3 ADJUSTING AND CLEANING

A. Adjust hangers so as to distribute loads equally on attachments.

B. Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 220553 - PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of mechanical identification work required by this Section is indicated on drawings and/or specified in other Division 22 sections. Types of identification devices specified in this Section include painted identification materials, plastic pipe markers, valve tags, valve schedule frames, and plastic equipment markers.

B. Refer to Division 26 sections for identification requirements of electrical work; not work of this Section.

C. Painting specifications and color coding for pipes and equipment are also included in this Section.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Comply with ANSI A13.1 for lettering sizes, enamel paint and plastic tape colors, and pressure sensitive vinyl pipe markers.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8" x 11" bond paper. Tabulate valve number, piping system, system abbreviation location of valve and variations for identification. Mark valves which are intended for emergency shut-off and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering mechanical identification materials which may be incorporated in the work include Allen Systems, Inc., Brady (W.H.) Co. (Signmark Div.), Industrial Saftey Supply Co., Inc., and Seton Name Plate Corp.

2.2 IDENTIFICATION MATERIALS

A. Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Provide single selection for each product category.

B. Painted Identification Materials: Provide standard fiberboard stencils, with not less than 1¼" high letters for ductwork and not less than ¾" high letters for access door signs and similar operational instructions. Provide standard exterior type stenciling enamel, either brushing grade or pressurized spray-can form and grade, and standard identification enamel of colors indicated.

C. Plastic Pipe Markers: Provide manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers. Print each pipe marker with arrows to indicate flow direction. For pipes with external diameters less than 6" (including insulation), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by adhesive lap joint in pipe marker overlap. For pipes with external diameters of 6" and larger (including insulation) provide either full-band or strip-type pipe markers, but not narrower than three times letter height, laminated or bonded to pipe (or insulation), or taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than ¾" wide; full circle at both ends of pipe marker, tape lapped 3".

D. Plastic Tape: Provide manufacturer's standard color-coded pressure sensitive (self-adhesive) vinyl tape, not less than three mils thick. Provide 1" wide tape markers on pipes with outside diameters (including insulation) of less than 6", 2½" wide tape for larger pipes.

E. Valve Tags: Provide 19 gauge polished brass valve tags with stamp-engraved piping system abbreviation in ¼" high letters and valve numbers ½" high, and with 5/32" hole for fastener. Provide 1½" diameter tags and manufacturer's standard solid brass chain or solid brass S-hooks for attachment of tags to valves. Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to the concealed valve.

F. Valve Schedule Frames: For each page of valve schedule, provide removable glazed display frame. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.3 LETTERING AND GRAPHICS

A. Designations used in mechanical identification work should correspond with those shown on plans. If not otherwise indicated, provide designations which allow proper identification and operation/maintenance of mechanical systems and equipment.

2.4 COLOR CODING FOR PIPES AND EQUIPMENT

A. Color coding is to be in accordance with standard color code as developed by the Consulting Engineer. Colors to be selected by Consulting Engineer from Standard Colors of manufacturer. Color code painting shall be provided for all exposed conduits, through items and pipelines for the transport of gases, liquid and semiliquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and all operating accessories which are integral to the whole functional pipe and electrical conduit system. See Color Code Schedule attached at the end of this Section.

B. Pipelines which are not listed on the Color Code Schedule shall be assigned a color by the Consulting Engineer and shall be treated as an integral part of the Contract.

C. Color Code Schedule:

Description	**Color**
Cold Water Pipe	Blue or match existing color
Exterior Pipe Supports	Match exterior finish of building and coordinate with Owner for finish color.
Support Steel, Equipment tanks, etc.	Battleship gray
Valves	Green body, red handles
Housekeeping Pads/Inertia Bases	Green
Hot Water Piping	Brown

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install identification after completion of surfacing covering and painting, and prior to installation of acoustical ceilings and similar removable concealment.

B. Provide duct markers or stenciled signs on each access door in housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information. Where access doors are concealed, plasticized tags may be installed for identification in lieu of specified signs.

3.2 PIPING SYSTEM IDENTIFICATION

A. Install stenciled pipe markers including color-coded background band or rectangle, and contrasting lettering, for each system indicated to receive identification, and include arrows to show normal direction of flow.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior nonconcealed locations.

1. Near each valve and control device.

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch where there could be question of flow pattern.

3. Near locations where pipes pass through walls or floors/ ceilings, or enter nonaccessible enclosures.

4. At access doors, manholes and similar access points which permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

3.3 VALVE IDENTIFICATION

A. Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibbs, and shut-off valves at plumbing fixtures and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

B. Mount valve schedule frames and schedules in machine rooms where indicated or where directed by Architect/Engineer.

3.4 EQUIPMENT IDENTIFICATION

A. Paint the equipment identification abbreviation as shown on the plans for all major pieces of mechanical equipment such as water heaters, pumps, compressors, etc., installed under this contract.

3.5 ADJUSTING AND CLEANING

A. Adjusting: Relocate any identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.6 PAINTING

A. No paint containing lead will be allowed.

B. All paint materials and equipment used on the job shall be stored in a single space designated by the Architect and Owner. The storage area shall be kept neat and clean. Floors shall be adequately protected from paint spillage. All cloths and cotton waste which might constitute a fire hazard shall be placed in metal containers and destroyed at the end of each work day. All damage caused to surfaces within the storage area shall be repaired. A fire extinguisher shall be provided and fully charged at all times for this area.

C. Provide primers and other undercoat paint produced by same manufacturer as finish coats. Primers shall be compatible with finish paints.

D. All work shall be guaranteed by this Contractor against defects caused by use of inferior materials or workmanship for a period of 1 year from date of final acceptance of building.

E. All hangers and pipe support floor stands shall be painted. The system shall be painted up to but not including the flanges attached to the mechanical equipment nor the flexible conduit connected to electrical motors. Colors shall be as noted in the Color Code Schedule.

F. All systems which are an integral part of the equipment, that is originated from the equipment and returning to the same piece of equipment, shall be painted between and up to but not including the fixed flanges or connections on the equipment.

G. All metal surfaces to be painted shall be thoroughly cleaned of objectionable matter before priming or field coat are applied. Wire brushes shall not be used on galvanized and shop painted surfaces.

1. Unpainted Ferrous Metal: Surfaces shall be cleaned with wire brushes or by other proper and acceptable means. Grease and oil shall be removed with gasoline, benzine, or other similar volatile cleaners. The surface shall be free from moisture or frost.

2. Zinc-Coated (Galvanized) Surfaces: Grease and oil shall be removed with gasoline, benzine, or other similar volatile cleaner. Surfaces shall then be treated with an approved chemical compound such as phosphoric acid wash. The chemical compound shall be completely removed with clean, fresh water, and the surfaces thoroughly dried prior to priming.

3. Zinc-Chromate Shop Painted Ferrous Metal: Grease and oil shall be removed with gasoline, benzine, or other similar volatile cleaner.

H. Structural and miscellaneous metals are specified to be shipped to the job site with prime coat. Items shall be touched-up as necessary at the job site prior to erection.

1. Ferrous materials delivered to the job site without shop coats shall be thoroughly cleaned and primed in the field. Cleaning shall be in accordance with Steel Structures Painting Council Surface Preparations Specifications #2. After cleaning, all surfaces except galvanized shall be primed with zinc-chromate iron oxide primer, equal to Pittsburgh's formulation 17-6. Galvanized surfaces shall be prepared as previously specified and given a special galvanized primer.

I. After erection, all weld splatter shall be removed and additional cleaning done, as required, to ensure a proper paint bond. The prime shall be applied to all surfaces as soon as possible after cleaning.

J. Pipe and equipment insulation such as canvas jacket insulation to be painted shall be cleaned of all loose foreign and objectionable material prior to priming.

K. Wherever previously primed or painted surfaces have been destroyed or defaced, they shall be restored with materials of like kind. Gouges or scratches in factory-applied finishes shall be filled with suitable fillers and sanded smooth prior to priming and painting or for special finishes, refinished in accordance with manufacturer's recommendations.

L. The premises shall at all times be kept free from accumulation of waste material and rubbish by employees or work. At the completion of the painting remove all tools, scaffolding, surplus materials, and all rubbish from and about the buildings and leave work area "broom clean" unless more exactly specified.

M. Upon completion, remove all paint where it has been spilled, splashed, or splattered on floors, fixtures, equipment, furniture, and all other surfaces, leaving the work ready for inspection.

3.7 EXTRA STOCK

A. Furnish minimum of five percent extra stock of each plumbing identification material required, including additional numbered valve tags for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

B. This Contractor shall furnish the Owner with two full gallon cans of each finished color and complete manufacturer label and formula, and color chip with manufacturer's color name and/or code and location at which paint occurs.

END OF SECTION

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of mechanical insulation required by this Section is indicated on drawings and schedules, and by requirements of this Section. Types of mechanical insulation specified in this Section include the following:

1. Insulation of piping, tanks, fittings and other surfaces.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications: Firm with at least five years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of twenty-five or less, and smoke-developed index of fifty or less, in accordance with latest NFPA 90A.

D. Comply with the latest approved edition of the "Florida Energy Code".

E. Insulation materials: Insulation materials must be manufactured at facilities certified and registered with an approved registrar to conform to ISO 9000 quality standard.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation.

1.5 DELIVERY AND STORAGE OF MATERIALS

SCHEDULE 1 - Deliver all materials to the job site and protect the insulation against dirt, water, chemical, and mechanical damage before, during, and after installation. Do not install damaged or wet insulations; remove it from the job site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering products which may be incorporated in the work include Armstrong World Industries, Inc., Knauf Fiber Glass GmbH., Johns-Manville Products Corp., Owens-Corning Fiberglass Corp., Pittsburgh Corning Corp., and Rubatex Corp.

2.2 PIPING INSULATION MATERIALS

A. Fiberglass Piping Insulation: Preformed sectional fiberglass insulation and factory-applied vapor barrier, all service jacket with pressure sensitive self-sealing longitudinal laps and butt strips. Suitable for operating temperatures from 0℉ to +850℉ and similar to Johns-Manville's Micro-lok AP-T. Must be Type I, rigid, molded, non-combustible, and must meet ASTM C547.

B. Flexible unicellular piping insulation (Armaflex): Preformed split sectional closed-cell pipe insulation. Suitable for operating temperatures of -40℉ to +220℉. Thermal conductivity "K" factor of 0.27.

C. Jackets:

1. Type A: Smooth or embossed aluminum jacket, 0.016" minimum thickness secured with ½-inch aluminum bands, for all exterior installations.

2. Type B: Pre-sized reinforced glass cloth, smoothly adhered to insulation or cement surface with lagging adhesive; lap joints a minimum of three inches and adhere with lagging adhesive.

3. Type C: PVC plastic, Zeston 2000, one-piece molded-type fitting covers and Jekting material, gloss-white.

4. Type D: White or embossed, self-adhesive jacket: VentureClad 5-ply laminate for exterior installations.

D. Fittings: Provide fitting coverings of a similar material and thickness as adjacent pipe coverings. Cover all elbows, tees, valves, flanges and other fittings of piping system.

E. Accessories: All staples, bands, wires, adhesives, cements, sealers and protective finishes to be as recommended by insulation manufacturers.

2.3 EQUIPMENT INSULATION MATERIALS

A. Rigid Fiberglass Insulation: Board with factory applied all service jacket, suitable for operating temperatures of 0℉ to +450℉. Similar to Johns-Manville's 800 spin-glass.

B. Flexible Unicellular Equipment Insulation: Closed-cell insulation suitable for operating temperatures of -40℉ to +220℉. Exterior applications, apply VentureClad 1577CW – white, highly UV resistant.

C. Jacketing Material: Provide presized glass cloth jacketing material, not less than 7.8 ounces per square yard or VentureClad 1577CW-embossed 5-ply self-adhesive vapor barrier/weather proofing membrane.

D. Provide accessories (staples, bands, wire, etc.) and compounds (adhesives, cements, sealers, etc.) as recommended by insulation manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSULATION INSTALLATION, GENERAL

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices.

B. Install insulation materials with smooth and even surfaces. Do not use cut pieces or scraps abutting each other.

C. Clean and dry surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered. Maintain integrity of vapor-barrier, and protect to prevent puncture or other damage.

D. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

E. Protect outdoor insulation from weather or ultraviolet deterioration by installing outdoor protective finish or jacketing; VentureClad 1577CW – white, UV resistant.

3.3 PLUMBING PIPING SYSTEM INSULATION

A. Omit insulation on chrome-plated exposed piping, air chambers, unions, strainers, check valves, balance cocks, flow regulators, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and preinsulated equipment.

B. Insulate potable chilled water piping and roof drains and ten feet of connecting drain line with ½-inch flexible Unicellular; VentureClad 1577CW – white for exterior applications.

C. Insulate potable hot water piping and potable hot water recirculating piping with one of the following types and thicknesses of insulation for circulating mains and runouts. Jacket material shall be VentureClad 1577CW – white for exterior applications.

1. Fiberglass insulation thickness for temperature range:

Pipe Size	100°F - 160°F	161°F - 200°F
up to 1¼"	1"	1"
1½" to 2"	1"	1½"
2½" and up	1½"	2"

2. Flexible Unicellular: Non-circulating runouts, not to exceed ten feet in length for all temperature ranges above, ¾-inch thick insulation for pipe sizes up to one inch.

D. Install insulation on pipe systems subsequent to painting, testing, and acceptance of tests.

E. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

F. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply three inch wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with three inch wide vapor barrier tape or band. VentureClad butt strip tape, finish includes white and embossed (permeance 0.0000) or equal.

3.4 EQUIPMENT INSULATION

A. Insulate the following hot equipment with fiberglass insulation, 2" thick, except 3" thick for low pressure boilers and steam heat exchangers. Jacketing material shall be VentureClad 1577CW – white.

1. Boilers.
2. Hot water storage tanks.
3. Water heaters.
4. Heat exchangers.
5. Hot water pumps.

B. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship. Apply insulation using staggered joint method for both single and double layer construction. Apply each layer of insulation separately. Impale breeching and stack insulation over weld pins or secure with ½” steel bands on twelve inch centers.

C. Finish with ½" coat of finishing cement. Fill in with cement of sufficient thickness to remove surface irregularities. Cover insulated surfaces with all-service jacketing. Jacketing material shall be VentureClad 1577CW – white self adhesive jacket. Lap seams at least two inches. Apply over vapor barrier where applicable.

3.5 REPAIR, REPLACEMENT AND PROTECTION

A. Repair or replace damaged sections of existing mechanical insulation, including units with vapor barrier damage and moisture saturated units both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.

B. Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 221116 - WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies the water distribution piping system, including potable cold, hot, recirculated hot water piping, fittings, and specialties within the building to a point five feet outside the building.

B. Products installed but not furnished under this Section include water meters which will be provided by others, to the site, ready for installation.

1.3 DEFINITIONS

A. Water Distribution Piping: A pipe within the building or on the premises which conveys water from the water service pipe or meter to the points of usage.

B. Water Service Piping: The pipe from the water main or other source of potable water supply to the water distributing system of the building served.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data for water hammer arresters, valves, hydrants, backflow preventors and pressure-temperature relief valves.

1.5 QUALITY ASSURANCE

A. Comply with applicable portions of the local plumbing code and authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PIPE AND PIPING PRODUCTS

A. Pipe within building (except below slab), sizes 4" and smaller shall be copper tubing. Conform to ASTM B88, Type L, hard temper, copper tube, ANSI B16.22 streamlined pattern wrought-copper fittings, soldered joints using 95-5 tin-antimony solder.

B. Pipe inside and outside building, below ground, sizes 4" and smaller shall be copper tubing. Conform to ASTM B88, Type K, soft temper copper tube. All joints below ground are to be silver brazed.

. C. Pipe inside and outside building above and below ground sizes 6: ans smaller be Corzan® CPVC pipe and conform to meet or exceed the requirements of ASTM F441 in Schedule 80. Fittings shall meet or exceed the requirements of ASTM F437 (schedule 80 threaded), and ASTM F439 (schedule 80 socket).

D. Balance Cocks, Soldered Ends 2" and smaller: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern. Acceptable manufacturers include American Air Filter Co., Bell & Gossett ITT (Fluid Handling Div.), Hammond Valve Corp., Milwaukee Valve Co., Inc., Spirax Sarco., and Taco, Inc.

E. Hose Bibbs: Bronze body, renewable composition disc, tee handle, three-fourths inch (¾") NPT inlet, ¾" hose outlet, vacuum breaker. Acceptable manufacturers for hose bibbs and faucets include Hammond Valve Corp., Lee Brothers (Div. Phelps Dodge Brass Co.), Mansfield Plumbing Products, Nibco Inc., Prier Brass Mfg. Co., Tanner Mfg. Co., and Watts Regulator Co.

F. Provide proper size for relief valve, in accordance with ASME Boiler and Pressure Vessel Codes. Combined pressure-temperature relief valves shall be bronze body with test lever and thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210°F, and pressure relief at 150 psi; suit wall thickness. Acceptable manufacturers include Cash (A.W.) Valve Mfg. Corp., Conbraco Industries, Inc., Watts Regulator Co., and Zurn Industries, and Inc. (Wilkins-Regulator Div).

G. Hydrants: Acceptable manufacturers include Josam Mfg. Co., Smith (Jay R.) Mfg. Co., Tyler Pipe (Sub. Of Tyler Corp.), Woodford Mfg. Co., and Zurn Industries Inc. (Hydromechanics Div.).

H. Backflow Preventors: Acceptable manufacturers include Febco Sales, Inc. (Subs. of Charles M. Bailey Co., Inc.), Hersey Products, Inc., ITT Lawler (Fluid Handling Div.), and Watts Regulator Co.

I. Water Hammer Arrestors: Provide Plumbing and Draining Institute types A, B, C, D, E, and F. Josam Mfg. Co., Smith (Jay R.) Mfg. Co., Zurn Mfg. Co., and Precision Plumbing Prod.

2.2 HIGH PURITY WATER PIPING SPECIFICATIONS

A. PVDF Pipe: Pipe shall be manufactured to Schedule 80 iron pipe dimensions, from virgin, un-pigmented PVDF resin meeting ASTM D-3222 requirements. Pipe will be furnished in 10-foot lengths, cylindrical and straight, and will meet dimensional tolerances of ASTM D-2447 for dimensions.

B. PVDF Fittings: Fittings shall be manufactured to Schedule 80 wall thickness from virgin, un-pigmented PVDF ressin meeting ASTM D-3222 requirements. Fittings are to be joined by using the socket fusion method, conforming to ASTM D-2657 requirements. Fittings to be joined mechanically shall be complete with face seal, PVDF snap ring, and all parts necessary to

assemble a high quality joint that tests to 150 psi. All fittings shall be individually bagged and sealed.

C. PVDF Ball Valves: Ball valves shall be manufactured from virgin, un-pigmented PVDF resin to be fully compatible with the Orion PVDF High Purity System. All valves shall test to 150 psi at 79°F. Each valve shall be individually packaged and sealed.

D. PVDF Ball Check Valves: Ball check valves shall be manufactured from virgin, un-pigmented PVDF resin to be fully compatible with the Orion PVDF high Purity System. Each valve shall be individually packaged and sealed.

E. PVDF Needle Valves: Needle valves shall be manufactured from virgin, un-pigmented PVDF resin to be fully compatible with the Orion PVDF High Purity System. Each valve shall be individually packaged and sealed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all water distribution piping is installed in accordance with pertinent codes and regulations, the original design, and the referenced standards. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation. Coordinate pipe sleeve locations with other disciplines. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PIPING AND PIPING PRODUCTS

A. So far as practical, install piping as indicated. Solder copper tubing joints in accordance with the procedures specified in ANSI B9.1.

B. Extend water distribution piping to connect to water service piping as indicated for service entrance to building. Install shutoff valve at service entrance inside building complete with strainer, pressure gauge, and test tee with valve.

C. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation. Where sleeves penetrate rated partition walls, floors, etc., the integrity of the smoke/fire barrier must be maintained.

D. Valves:

1. Install sectional valves on each branch and riser, close to main, where branch or riser serves two or more plumbing fixtures or equipment connections, and elsewhere as indicated.

2. Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

3. For sectional shutoff valves 2" and smaller, use gate or ball valves; for sectional shutoff valves 2½" and larger, use gate or butterfly valves.

E. Install balance cocks in each hot water recirculating loop, discharge side of each pump, and elsewhere as indicated.

F. Install hose bibbs on exposed piping where indicated with vacuum breaker.

G. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

H. Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code.

I. Install water hammer arresters in locations recommended by manufacturers.

3.3 FIELD QUALITY CONTROL

A. Do not enclose, cover, or put into operation any new, extended, or replaced water distribution piping system until it has been inspected, tested, and approved by the authority having jurisdiction. Work which has been concealed prior to inspection, testing and approval must be uncovered. Notify the plumbing official having jurisdiction at least 24 hours prior to the time such inspection must be made. Prepare inspection reports, signed by the plumbing official. If the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection.

1. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

2. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

B. All new water distribution piping systems which have been altered, extended or repaired for leaks and defects must be tested. Perform tests in the presence of the plumbing official. Prepare reports for all tests and required corrective action. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

1. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for a period of four hours. Leaks and loss in test pressure constitute defects which must be repaired using new materials. Retest system until satisfactory results are obtained.

3.4 ADJUSTING AND CLEANING

A. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use. Prepare reports for all purging and disinfecting activities.

B. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure described in either AWWA C601, or AWWA D105, or as described below:

1. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.

2. Fill the system to be tested, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate and allow to stand for 24 hours.

3. Drain the system of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine; isolate and allow to stand for three hours.

4. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming from the system.

5. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

END OF SECTION

SECTION 221316 - DRAINAGE AND VENT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies building sanitary and storm drainage and vent piping systems, including drains and drainage specialties.

1.3 DEFINITIONS

A. Building Drain: That part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer.

B. Building Sewer: That part of the drainage system which extends from the end of the building drain and conveys its discharge to a public sewer, private sewer, individual sewage disposal system, or other point of disposal.

C. Drainage System: Includes all the piping within a public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.

D. Vent System: A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and back pressure.

1.4 SUBMITTALS

A. Product Data: Submit product data for drainage piping specialties, floor drains, and roof drains.

B. Coordination Drawings: Prepare and submit coordination drawings for Drainage and Vent Piping.

C. Quality Control Submittals: Submit reports specified in Part 3 of this Section.

1.5 QUALITY ASSURANCE

A. Comply with applicable portions of local plumbing code and the authorities having jurisdiction.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate the installation of all drains and associated materials, such as flashings, with other work such as roofing, concrete slabs and sanitary storm sewers to ensure proper interface with all project components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering products which may be incorporated in the work include Ancon Inc., Josam Mfg. Co., Smith (Jay R.) Mfg. Co., Tyler Pipe (Subs. of Tyler Corp.), and Zurn Industries Inc. (Hydromechanics Div.).

2.2 DRAINAGE AND VENT PIPE AND FITTINGS

A. Above Ground, All Pipe Sizes: Hubless cast-iron soil pipe. Conform to CISPI Standard 301, service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310 and stainless steel clamp and shield.

B. Underground Pipe Sizes 15" and Smaller: Cast-iron soil pipe. Conform to ASTM A74, for service weight, hub-and-spigot soil pipe and fittings, with neoprene compression gasket joints conforming to ASTM C564. Pipe and fittings shall have a heavy coating of coal tar varnish or asphaltum on both inside and outside surfaces.

C. Above Ground, Not In Plenum Returns, and Underground, All Pipe Sizes: Polyvinyl chloride (PVC) DWV, Schedule 40 pipe and socket fittings, conforming with ASTM D-2665. Pipe cement shall be PVC solvent cement conforming to ASTM D-2564.

2.3 DRAINAGE PIPING SPECIALTIES

A. Trap Primers: Bronze body valve with automatic vacuum breaker, with ½" connections matching piping system. Comply with ASSE 1018.

B. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

C. Floor Cleanouts: Heavy-duty rated cast-iron body and frame, with cleanout plug and adjustable round nickel bronze top, manufacturer's standard cast unit, exposed rim type, with recess to receive ⅛" thick resilient floor finish.

D. Cast-iron Top: Manufacturer’s standard cast unit, exposed flush type, with standard mill finish.

E. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including screws.

F. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide under-deck clamp and sleeve length as required.

G. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.

H. Vandal-proof Vent Caps: Cast-iron body full size of vent pipe, with caulked base connection for cast-iron pipes, threaded base for steel pipes.

I. Roof Drains: See plans for sizes and specifications. Provide static extensions as required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed. Do not proceed until unsatisfactory conditions have been corrected.

3.2 FOUNDATION PREPARATION FOR UNDERGROUND BUILDING DRAINS

A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.

B. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill at each pipe bell hole.

3.3 INSTALLATION, GENERAL

A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.

B. Cast-Iron Soil Pipe: Make lead and oakum caulked joints, compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

C. PVC Pipe: The pipe and socket must be cleaned, burrs removed, primed, and solvent applied to both. They must be assembled quickly and twisted one-quarter turn to spread the solvent.

D. Make changes in direction for drainage and vent piping using appropriate 45-degree wyes, half-wyes, or long sweep bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

E. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

F. Install building drain pitched down at minimum slope of ¼" per foot for piping 3" and smaller and ⅛" for piping 4" and larger unless shown otherwise.

G. Extend building drain to connect to sewer piping.

H. Install sleeve and mechanical sleeve seal through foundation wall for watertight installation.

I. Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:

1. as required by plumbing code;
2. at each change in direction of piping greater than 45 degrees;
3. at minimum intervals of 50' for piping 4" and smaller and 100' for larger piping;
4. at the base of each vertical soil or waste stack.

B. Cleanout Covers: Install floor and wall cleanout covers for concealed piping, types as indicated.

C. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

D. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer’s instructions.

3.5 INSTALLATION OF FLOOR DRAINS

A. Install floor drains in accordance with manufacturer's written instructions at low points of surface areas to be drained, or as indicated. Position drains so that they are accessible and easy to maintain. Trap all drains connected to the sanitary sewer.

B. Set drain elevation depressed below finished slab elevation as listed below to provide proper slope to drain:

DEPRESSION	RADIUS OF AREA DRAINED
½"	5'-0"
¾"	10'-0"
1"	15'-0"
1¼"	20'-0"
1½"	25'-0"

C. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

3.6 FIELD QUALITY CONTROL

A. Do not enclose, cover, or put into operation any new, extended, or replaced drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction. Work which has been concealed prior to inspection, testing, and approval must be uncovered. Notify the plumbing official having jurisdiction at least 24 hours prior to the time such inspection must be made. Prepare inspection reports, signed by the plumbing official.

1. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

2. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

3. If piping system fails to pass the test or inspection, make the required corrections, and arrange for reinspection.

B. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. Perform tests in the presence of the plumbing official. Prepare reports for all tests and required corrective action. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

1. Rough Plumbing: Test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
2. Finished Plumbing: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.

C. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

3.7 ADJUSTING AND CLEANING

A. Clean drain strainers, domes, traps and interior of piping. Remove dirt and debris as work progresses.

B. Protect drains to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies general installation requirements for plumbing fixtures and specific requirements for fittings, trim, and accessories. Refer to plumbing drawings and Plumbing Fixture Schedule for fixture requirements.

1.3 QUALITY ASSURANCE

A. Comply with applicable portions of the latest local plumbing code and the authorities having jurisdiction.

1.4 SUBMITTALS

A. Product Data: Submit product data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified; clearly indicate rated capacities of selected models of water coolers.

B. Shop Drawings: Submit rough-in drawings, detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with other trades as required for installation. Furnish templates as necessary.

C. Wiring Diagrams: Submit manufacturer's electrical requirements and wiring diagrams for power supply to units. Clearly differentiate between portions of wiring that are factory installed and field installed portions.

D. Color Charts: Submit manufacturer's standard color charts for cabinet finishes and fixture colors.

E. Maintenance Data: Include data in maintenance manual as specified in other sections.

F. Quality Control Submittals: Submit certification of compliance with specified ANSI, UL, and ASHRAE Standards and with performance verification requirements specified in this Section.

PART 2 - PRODUCTS

2.1 FITTINGS, TRIM, AND ACCESSORIES

A. Supplies and Stops for Lavatories and Sinks: Polished chrome-plated loose-keyed angle stop having ½" inlet and ⅜" O.D. by 12" long flexible tubing outlet, and wall flange and escutcheon. Insulate the trap and hot water supply for handicapped lavatories with insulation kit.

B. Supplies and Stops for Water Closets: Polished chrome-plated, loose-keyed angle stop having ½" inlet and ⅜" O.D. by 12" long flexible tubing outlet with collar, and wall flange and escutcheon.

C. Traps: Cast brass, 1¼" and 1½" adjustable "P" trap with cleanout and waste to wall. All connections at wall shall be slip joint type.

D. Tub Waste and Overflow Fittings: Concealed lever operated pop-up bath waste and overflow, chrome plated waste spud with universal type outlet connection suitable for one and 1½" I.P.S., or 1½" solder-joint outlet connection on waste tee.

E. Escutcheons: Chrome-plated cast brass with set screw.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards. Fasten plumbing fixtures securely to supports or building structure. Secure behind or within wall construction to provide rigid installation. Comply with the installation requirements of ANSI A117.1 and Public Law 90-480 with respect to plumbing fixtures for the physically handicapped.

B. Set shower receptor and mop basins in a leveling bed of cement grout.

C. Install a stop valve in an accessible location in the water connection to each fixture.

D. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.

E. Seal fixtures to walls and floors using silicone sealant as specified in other sections. Match sealant color to fixture color.

F. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt in a quantity of one device for each ten fixtures. Furnish faucet repair kits complete with all necessary washers, springs, pins, retainers, packings, O-rings, sleeves, and seats in a quantity of one kit for each forty faucets.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed unit for damage. Replace damaged fixtures. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.

B. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow and stream.

C. Replace washers of leaking or dripping faucets and stops.

3.4 PROTECTING AND CLEANING

A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials. Provide protective covering for installed fixtures, water coolers, and trim.

B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

END OF SECTION

SECTION 230150 - PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. Procedural requirements governing the Contractor's selection of products and product options are included in other sections.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions". The following are not considered substitutions:

1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.

2. Revisions to Contract Documents requested by the Owner or Architect.

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

4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if received within sixty days after commencement of the Work. Requests received more than sixty days after commencement of the Work may be considered or rejected at the discretion of the Architect/Engineer.

1. Submit three copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

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

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

   b. Samples, where applicable or requested.

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

   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.

   e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

   f. Cost information, including a proposal of the net change, in the Contract Sum.

   g. Assurance that the substitution is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

B. Action: Within one week of receipt of the request for substitution, the Architect/Engineer will request additional information or documentation necessary for evaluation of the request. Within two weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. Acceptance will be in the form of a Change Order. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use one of the products specified as approved.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Contractor's substitution request will be received and considered by the Architect/Engineer when one or more of the following conditions are satisfied, as determined by

the Architect/Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.

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

3. The request is timely, fully documented and properly submitted.

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

5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

6. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.

9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution can provide the required warranty.

10. Where a proposed substitution involves more than one Sub Contractor, each Contractor shall cooperate with the other Contractors involved to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.

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

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 230200 - SHOP DRAWINGS AND SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF REQUIREMENTS

A. This Section specifies procedural requirements for non-administrative submittals including shop drawings product data, samples, and other miscellaneous submittals.

B. Shop drawings are technical drawings and data that have been specially prepared for this project. Information required on shop drawings includes dimensions, identification of specific products and materials which are included in the work, compliance with specified standard and notations of coordination requirements with other work. Provide special notation of dimensions that have been established by field measurement. Indicate deviations from the contract documents on the shop drawings.

C. Product data includes standard printed information on manufactured products that has not been specially-prepared for this project. General information required specifically as product data includes manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies, and the application of their labels and seals special notation of dimensions which have been verified by way of field measurement, and special coordination requirements for interfacing the material, product or system with other work.

D. Samples are physical examples of work. Documentation required specifically for sample submittals includes a generic description of the sample, the sample source or the product name or manufacturer, compliance with governing regulations and recognized standards. In addition, indicate limitations in terms of availability, sizes, delivery time, and similar limiting characteristics.

E. Miscellaneous submittals are work-related, nonadministrative submittals that do not fit in the three previous categories.

1.3 SUBMITTAL PROCEDURES

A. Submit all Division 23 Shop Drawings, product data samples, and related documents in one package. Submittal should be as complete as possible and include the following:

1. Enclose submittal in 3-ring or similar loose leaf booklet.
2. Include title page and table of contents.
3. Include list of subcontractors' qualifications and suppliers.

4. Provide tabs in front of major submittal sections relating back to table of contents.

B. No individual submittal sections will be considered and will be returned marked "No Action", with the following exceptions:

1. Items with long "Lead Time" may be submitted early if all such items are packaged together.

2. Sheet metal, piping and control drawings may be submitted after initial submittal due to preparation time required.

C. Prepare and transmit the submittal to the Architect/Engineer sufficiently in advance of the scheduled performance of related work and other applicable activities. Advise the Architect/Engineer if processing time is critical to the progress of the work.

1. Allow two weeks minimum for the Architect/Engineer's initial processing of each submittal. The Architect/Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.

2. Allow one week for processing each resubmittal.

3. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.

D. Mark each submittal with a permanent label for identification. Provide the following information on the label for proper processing and recording of action taken.

1. Project name.
2. Date.
3. Name and address of Architect/Engineer, Contractor, subcontractor and supplier.
4. Name of manufacturer.
5. Number and title of appropriate specification section.
6. Drawing number and detail references, as appropriate.
7. Similar definitive information as necessary.
8. Provide a space on the label for the Contractor's review and approval markings, and a space for the Architect/Engineer's "Action" marking.

E. Transmit each submittal from the Contractor to the Architect/Engineer, and to other destinations as indicated, by use of a transmittal form. Submittals received from sources other than the Contractor will be returned to the sender marked "No Action".

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

A. Shop Drawings: Provide six prints plus two additional prints where they are required for maintenance manuals. Two prints will be retained; the remainder will be returned. One of the prints returned will be marked-up and maintained by the Contractor as a "Record Document". Provide coordination drawings where required for the integration of the work. Show sequencing and relationship of separate units of work which are located in areas with restricted space. Submit newly prepared information, drawn to accurate scale on sheets not less than 8 inches by 11 inches; except for actual pattern or template type drawings, the maximum sheet size shall not exceed 36

inches by 48 inches. Indicate the name of the firm that prepared each shop drawing and provide appropriate project identification in the title block.

B. Product Data: Submit six copies. Do not proceed with installation of materials, products and systems until a copy of product data applicable to the installation is in the possession of the installer. Do not permit the use of unmarked copies of product data in connection with the performance of the work.

C. Samples: Submit three sets of samples for the Architect/Engineer's visual review; one set will be returned with comments. Maintain the reviewed submittal set of samples, as returned by the Architect/Engineer, at the project site, available for quality control comparisons throughout the course of performing the work.

D. Miscellaneous Submittals:

1. Inspection and Test Reports: Classify each inspection and test report as being either "shop drawings" or "product data" depending on whether the report is specially prepared for the project, or a standard publication of workmanship control testing at the point of production. Process inspection and test reports accordingly.

2. Warranties: Refer to other sections for specific general requirements on warranties, product bonds, workmanship bonds and maintenance agreements. In addition to copies desired for the Contractor's use, furnish two executed copies of such warranties, bonds or agreements. Provide two additional copies where required for maintenance manuals.

3. Standards: Where submittal of a copy of standards is indicated, and except where copies of standards are specified as an integral part of a "Product Data" submittal, submit a single copy of standards for the Architect/Engineer's use.

4. Closeout Submittals: Refer to other sections of these specifications for specific submittal requirements of project closeout information, materials, tools, and similar items.

a. Record Documents: Furnish set of original documents as maintained on the project site. Along with original marked-up record drawings, provide two copies of marked-up drawings which may be reduced to not less than half size.

b. Operation And Maintenance Data: Include description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts. Also include manufacturer's printed operating procedures, maintenance procedures, and servicing instructions, lubrication charts and schedules.

c. Materials and Tools: Refer to individual sections of these specifications for required quantities of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

1.5 ARCHITECT/ENGINEER'S ACTION

A. Except for submittals for the record and similar purposes, where action and return on submittals is required or requested, the Architect/Engineer will review each submittal, mark with appropriate "Action Taken", and where possible return within two weeks of receipt. The Architect/Engineer will stamp each submittal to be returned with a uniform, self-explanatory action stamp, appropriately marked to indicate one of the following:

1. Final Unrestricted Release: Where the submittals are marked "No Exception Taken", the work covered by the submittal may proceed provided it complies with the requirements of the contract documents; acceptance of the work will depend upon that compliance.

2. Final-But-Restricted Release: When the submittals are marked "Exception Taken as Noted", the work covered by the submittal may proceed provided it complies with both the Architect's/Engineer's notations or corrections on the submittal and with the requirements of the contract documents; acceptance of the work will depend on that compliance.

3. Returned for Resubmittal: When the submittal is marked either "Revise and Resubmit" or "Not Accepted Resubmit", do not proceed with the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise the submittal or prepare a new submittal in accordance with the Architect's/Engineer's notations stating the reasons for returning the submittal; resubmit the submittal without delay. Repeat if necessary to obtain a different action marking. Do not permit submittals with this marking to be used at the project site, or elsewhere where work is in progress.

4. Other Action: Where the submittal is returned, marked with the Architect/Engineer's explanation, for special processing or other Contractor activity, or is primarily for information or record purposes, the submittal will be marked "For Information Only".

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION

SECTION 230500 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division 23. It expands and supplements the requirements specified in sections of Division 1.

1.3 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. Extend all grease fittings to an accessible location.

1.4 MECHANICAL INSTALLATIONS

A. Coordinate mechanical equipment and materials installation with other building components. Verify all dimensions by field measurements. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

B. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

C. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible. Coordinate the installation of mechanical materials and equipment above ceilings with suspension system, light fixtures, and other installations.

D. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

1.5 DRAWINGS AND SPECIFICATIONS

A. Separate divisional drawings and specifications shall not relieve the Contractor from full responsibility to complete all work which may be indicated on any of the drawings or in any division of the specification.

B. The specifications and drawings are complementary and are to be taken together for a complete interpretation of the work.

C. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Therefore, no interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for a complete installation are excluded.

D. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

E. Examine the architectural, structural, electrical and mechanical drawings and specifications prior to submitting bid. Architectural and structural drawings take precedence over mechanical drawings with reference to building construction, location of plumbing fixtures, and any other similar fixed items.

F. The Architect shall be notified of any discrepancies, omissions, conflicts or interferences which occur between drawings and specifications. If such notification is received in adequate time additional data or changes will be issued by addendum to all bidders.

1.6 CUTTING AND PATCHING

A. Do not endanger or damage installed Work through procedures and processes of cutting and patching. Do not cut structural members without prior written approval of the structural Engineer or Architect.

B. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

C. Perform cutting, fitting, and patching of mechanical equipment and materials required to: uncover Work to provide for installation of ill-timed Work; remove and replace defective Work; remove samples of installed Work as specified for testing; install equipment and materials in existing structures; upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

D. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.

E. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Locate identify, and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to change over.

1.7 MECHANICAL SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary), Division 1 and Division 23 Section: SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES for submittal definitions, requirements, and procedures. Submittal of shop drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.

1.8 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders, Division 1 and Division 23 Section “PRODUCTS AND SUBSTITUTION” for requirements in selecting products and requesting substitutions.

1.9 PRODUCT LISTING

A. Prepare listing of major mechanical equipment and materials for the project. Submit this listing as a part of the submittal requirement specified.

1.10 PRODUCTS

A. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated. Provide products which are compatible within systems and other connected items.

1.11 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications: adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

1.13 RECORD DOCUMENTS

A. Refer to the Division 1 Section: PROJECT CLOSEOUT or PROJECT RECORD DOCUMENTS for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark drawings to indicate revisions to piping and ductwork, size and location both exterior and interior: including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair: actual equipment locations, dimensioned for column lines: actual inverts and locations of underground piping: concealed equipment, dimensioned to column lines: mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.): Change Orders: concealed control system devices.

C. Mark specifications to indicate approved substitutions: Change Orders; actual equipment and materials used.

D. Reproducible record drawings shall be on disk.

1.14 OPERATION AND MAINTENANCE DATA

A. In addition to the information required by Division 1 for Maintenance Data, include the following information:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions: regulation, control, stopping, shut-down, and emergency instructions: and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting: disassembly, repair, and reassembly: aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

1.15 WARRANTIES

A. Refer to the Division 1 Section: SPECIFIC WARRANTIES for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division 23, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond: duration of warranty or bond: and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.16 CLEANING

A. Refer to the Division 1 Section: PROJECT CLOSEOUT or FINAL CLEANING for general requirements for final cleaning.

B. Refer to Division 23 Section: TESTING, ADJUSTING, AND BALANCING for requirements for cleaning filters, strainers, and mechanical systems prior to final acceptance.

1.17 MECHANICAL COORDINATION DRAWINGS

A. Prepare and submit a set of coordination drawings showing major elements, components, and systems of mechanical equipment and materials in relationship with other building components. Prepare drawings to an accurate scale of ¼"=1'-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing and maintaining insulation, servicing and maintaining equipment, valve stem movement, and similar requirements. Indicate movement and positioning of large equipment into the building during construction.

B. Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, 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. Mechanical equipment room layouts.

2. Specific equipment installations, including:

   a. Pumps and compressors.
   b. Tanks and heat exchangers.
   c. Air handling units.

3. Work in pipe spaces, chases, trenches, and tunnels.

4. Ceiling plenums which contain piping, ductwork, or equipment in congested arrangement.

5. Installations in mechanical riser shafts, at typical sections and crucial offsets and junctures.

6. Numbered valve location diagrams.

7. Manifold piping for multiple equipment units.

END OF SECTION

SECTION 230529 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of supports and anchors required by this Section is indicated on drawings and/or specified in other Division 23 sections. Types of supports and anchors specified in this Section include the following:

1. Horizontal-Piping Hangers and Supports.
2. Vertical-Piping Clamps.
3. Hanger-Rod Attachments.
4. Building Attachments.
5. Saddles and Shields.
6. Miscellaneous Materials.
7. Equipment Supports.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.

C. UL and FM Compliance: Provide products which are UL-listed and FM approved for sprinkler piping systems.

1.4 SUBMITTALS

A. The manufacturer shall determine the number, size, and type of anchor bolts, cable restraints, etc. for each piece and groups of pipes.

B. Details for steel frames to be used in connection with the isolations and seismic restraint of the items.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering hangers and supports which may be incorporated in work include Cooper B-Line Systems Inc., Fee & Mason Mfg., Co., Anvil International, and Pipe Shields, Inc.

2.2 HANGERS, ATTACHMENTS AND SUPPORTS

A. Provide factory-fabricated anchors, hangers, attachments, and supports complying with MSS SP-58, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers, attachments, and supports for copper-piping systems.

B. Horizontal-Piping Hangers and Supports:

1. Adjustable Steel Clevis Hangers: MSS Type 1 (Anvil Fig. 260).
2. Steel Pipe Clamps: MSS Type 4 (Anvil Fig. 212).
3. Adjustable Swivel Pipe Rings: MSS Type 6 (Anvil Fig. 104).
4. Split Pipe Rings: MSS Type 11 (Anvil Fig. 108).
5. U-Bolts: MSS Type 24 (Anvil Fig. 137).
6. Clips: MSS Type 26 (Anvil Fig. 262).
7. Adjustable Pipe Saddle Supports: MSS Type 38 (Anvil Fig. 264), including steel pipe base support and cast-iron floor flange.
8. Single Pipe Rolls: MSS Type 41 (Anvil Fig. 171).
9. Adjustable Roller Hangers: MSS Type 43 (Anvil Fig. 181).

C. Vertical - Piping Clamps: Two-Bolt Riser Clamps: MSS Type 8 (Anvil Fig. 261).

D. Hanger - Rod Attachments: Steel Turnbuckles: MSS Type 13 (Anvil Fig. 230).

E. Building Attachments:

1. Concrete Inserts: MSS Type 18 (Anvil Fig. 285).
2. Top Beam C-Clamps: MSS Type 19 (Anvil Fig. 93).
3. Side Beam or Channel Clamps: MSS Type 20 (Anvil Fig. 225 or 226).
4. Center Beam Clamps: MSS Type 21 (Anvil Fig. 133).
5. C-Clamps: MSS Type 23 (Anvil Fig. 86).
6. Steel Brackets:
   a. Light Duty: MSS Type 31 (Anvil Fig. 194).
   b. Medium Duty: MSS Type 32 (Anvil Fig. 195).
7. Horizontal Travelers: MSS Type 58 (Anvil Fig. 170).

2.3 SADDLES AND SHIELDS

A. Provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Shields: MSS Type 40 (Anvil Fig. 167); of length recommended by manufacturer (minimum 12").

2.4 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

E. Equipment Supports: Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed. Correct inadequacies including proper placement of inserts, anchors and other building structural attachments. Installation of hangers, supports, anchors and associated work must be coordinated with all work by other disciplines to avoid conflicts.

3.2 INSTALLATION OF HANGERS, ATTACHMENTS AND SUPPORTS

A. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers. Install supports with maximum spacings complying with MSS SP-69. Do not use wire or perforated metal to support piping, and do not support piping from other piping. Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

B. Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment, and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

C. Insulated Piping:

1. Clamps: Insulation on pispes must run continuously. Provide insulation shields, 12" long as required.

2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold water piping, install coated protective shields. For pipe eight inches and over, install wood insulation saddles.

D. Install building attachments within concrete or on structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional supports at concentrated loads and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

E. Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with suggested hanger spacing and rod sizes for straight horizontal runs according to MSS SP-69 as tabulated below:

	Hanger Spacing in Feet				
Pipe Size	Std. Wt. Steel Pipe		Copper Tube	PVC	Rod Size
(Inches)	Water	Steam	Water	Water	(Inches)
½	5	6	5	4	¼
¾	6	7	5	4	¼
1	7	9	6	4½	¼
1½	9	12	8	4½	⅜
2	10	13	8	5	⅜
2½	11	14	9	5	⅜
3	12	15	10	6	⅜
4	14	17	12	6½	½
6	17	19	14	7½	½
8	19	21	24	16	⅝
10	20	26	18	8½	¾
12	23	30	19		⅞
14	25	32			1
16	27	35			1
18	28	37			1¼
20	30	39			1¼

3.3 ADJUSTING AND CLEANING

A. Adjust hangers so as to distribute loads equally on attachments.

B. Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 230553 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of mechanical identification work required by this Section is indicated on drawings and/or specified in other Division 23 sections. Types of identification devices specified in this Section include painted identification materials, plastic pipe markers, valve tags, valve schedule frames, and plastic equipment markers.

B. Refer to Division 26 sections for identification requirements of electrical work; not work of this Section.

C. Painting specifications and color coding for pipes and equipment are also included in this Section.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Comply with ANSI A13.1 for lettering sizes, enamel paint and plastic tape colors, and pressure sensitive vinyl pipe markers.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8" x 11" bond paper. Tabulate valve number, piping system, system abbreviation location of valve and variations for identification. Mark valves which are intended for emergency shut-off and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering mechanical identification materials which may be incorporated in the work include Allen Systems, Inc., Brady (W.H.) Co. (Signmark Div.), Industrial Saftey Supply Co., Inc., and Seton Name Plate Corp.

2.2 MECHANICAL IDENTIFICATION MATERIALS

A. Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Provide single selection for each product category.

B. Painted Identification Materials: Provide standard fiberboard stencils, with not less than 1¼" high letters for ductwork and not less than ¾" high letters for access door signs and similar operational instructions. Provide standard exterior type stenciling enamel, either brushing grade or pressurized spray-can form and grade, and standard identification enamel of colors indicated.

C. Plastic Pipe Markers: Provide manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers. Print each pipe marker with arrows to indicate flow direction. For pipes with external diameters less than 6" (including insulation), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by adhesive lap joint in pipe marker overlap. For pipes with external diameters of 6" and larger (including insulation) provide either full-band or strip-type pipe markers, but not narrower than three times letter height, laminated or bonded to pipe (or insulation), or taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than ¾" wide; full circle at both ends of pipe marker, tape lapped 3".

D. Plastic Tape: Provide manufacturer's standard color-coded pressure sensitive (self-adhesive) vinyl tape, not less than three mils thick. Provide 1" wide tape markers on pipes with outside diameters (including insulation) of less than 6", 2½" wide tape for larger pipes.

E. Valve Tags: Provide 19 gauge polished brass valve tags with stamp-engraved piping system abbreviation in ¼" high letters and valve numbers ½" high, and with 5/32" hole for fastener. Provide 1½" diameter tags and manufacturer's standard solid brass chain or solid brass S-hooks for attachment of tags to valves. Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to the concealed valve.

F. Valve Schedule Frames: For each page of valve schedule, provide removable glazed display frame. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.3 LETTERING AND GRAPHICS

A. Designations used in mechanical identification work should correspond with those shown on plans. If not otherwise indicated, provide designations which allow proper identification and operation/maintenance of mechanical systems and equipment.

2.4 COLOR CODING FOR PIPES AND EQUIPMENT

A. Color coding is to be in accordance with standard color code as developed by the Consulting Engineer. Colors to be selected by Consulting Engineer from Standard Colors of manufacturer. Color code painting shall be provided for all exposed conduits, through items and pipelines for the transport of gases, liquid and semiliquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and all operating accessories which are integral to the whole functional pipe and electrical conduit system. See Color Code Schedule attached at the end of this Section.

B. Pipelines which are not listed on the Color Code Schedule shall be assigned a color by the Consulting Engineer and shall be treated as an integral part of the Contract.

C. Color Code Schedule:

Description	**Color**
Chilled Water Pipe	Blue or match existing color
Exterior Pipe Supports	Match exterior finish of building and coordinate with Owner for finish color.
Support Steel, Equipment tanks, etc.	Battleship gray
Valves	Green body, red handles
Housekeeping Pads/Inertia Bases	Green
Heating Hot Water	Orange

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install identification after completion of surfacing covering and painting, and prior to installation of acoustical ceilings and similar removable concealment.

B. Provide duct markers or stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information. Where access doors are concealed, plasticized tags may be installed for identification in lieu of specified signs.

3.2 PIPING SYSTEM IDENTIFICATION

A. Install stenciled pipe markers including color-coded background band or rectangle, and contrasting lettering, for each system indicated to receive identification, and include arrows to show normal direction of flow.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior nonconcealed locations.

1. Near each valve and control device.

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch where there could be question of flow pattern.

3. Near locations where pipes pass through walls or floors/ ceilings, or enter nonaccessible enclosures.

4. At access doors, manholes and similar access points which permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

3.3 VALVE IDENTIFICATION

A. Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibbs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

B. To identify such valves zone "Control Valves" and inspector test valves for fire protection system located above finished ceiling, identification shall be placed on access panel, next to access panel, or on to a nonmovable part of the ceiling system such as a tee-bar grid of a lay-in type ceiling.

C. Mount valve schedule frames and schedules in machine rooms where indicated or where directed by Architect/Engineer.

3.4 EQUIPMENT IDENTIFICATION

A. Paint the equipment identification abbreviation as shown on the plans for all major pieces of mechanical equipment such as air handlers, chillers, pumps, exhaust fans, etc., installed under this contract.

3.5 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.6 PAINTING

A. No paint containing lead will be allowed.

B. All paint materials and equipment used on the job shall be stored in a single space designated by the Architect and Owner. The storage area shall be kept neat and clean. Floors shall be adequately protected from paint spillage. All cloths and cotton waste which might constitute a fire hazard shall be placed in metal containers and destroyed at the end of each work day. All damage caused to surfaces within the storage area shall be repaired. A fire extinguisher shall be provided and fully charged at all times for this area.

C. Provide primers and other undercoat paint produced by same manufacturer as finish coats. Primers shall be compatible with finish paints.

D. All work shall be guaranteed by this Contractor against defects caused by use of inferior materials or workmanship for a period of 1 year from date of final acceptance of building.

E. All hangers and pipe support floor stands shall be painted. The system shall be painted up to but not including the flanges attached to the mechanical equipment nor the flexible conduit connected to electrical motors. Colors shall be as noted in the Color Code Schedule.

F. All systems which are an integral part of the equipment, that is originated from the equipment and returning to the same piece of equipment, shall be painted between and up to but not including the fixed flanges or connections on the equipment.

G. All metal surfaces to be painted shall be thoroughly cleaned of objectionable matter before priming or field coat are applied. Wire brushes shall not be used on galvanized and shop painted surfaces.

1. Unpainted Ferrous Metal: Surfaces shall be cleaned with wire brushes or by other proper and acceptable means. Grease and oil shall be removed with gasoline, benzine, or other similar volatile cleaners. The surface shall be free from moisture or frost.

2. Zinc-Coated (Galvanized) Surfaces: Grease and oil shall be removed with gasoline, benzine, or other similar volatile cleaner. Surfaces shall then be treated with an approved chemical compound such as phosphoric acid wash. The chemical compound shall be completely removed with clean, fresh water, and the surfaces thoroughly dried prior to priming.

3. Zinc-Chromate Shop Painted Ferrous Metal: Grease and oil shall be removed with gasoline, benzine, or other similar volatile cleaner.

H. Structural and miscellaneous metals are specified to be shipped to the job site with prime coat. Items shall be touched-up as necessary at the job site prior to erection.

1. Ferrous materials delivered to the job site without shop coats shall be thoroughly cleaned and primed in the field. Cleaning shall be in accordance with Steel Structures Painting Council Surface Preparations Specifications #2. After cleaning, all surfaces except galvanized shall be primed with zinc-chromate iron oxide primer, equal to Pittsburgh's formulation 17-6. Galvanized surfaces shall be prepared as previously specified and given a special galvanized primer.

I. After erection, all weld splatter shall be removed and additional cleaning done, as required, to ensure a proper paint bond. The prime shall be applied to all surfaces as soon as possible after cleaning.

J. Pipe and equipment insulation such as canvas jacket insulation to be painted shall be cleaned of all loose foreign and objectionable material prior to priming.

K. Wherever previously primed or painted surfaces have been destroyed or defaced, they shall be restored with materials of like kind. Gouges or scratches in factory-applied finishes shall be filled with suitable fillers and sanded smooth prior to priming and painting or for special finishes, refinished in accordance with manufacturer's recommendations.

L. The premises shall at all times be kept free from accumulation of waste material and rubbish by employees or work. At the completion of the painting remove all tools, scaffolding, surplus materials, and all rubbish from and about the buildings and leave work area "broom clean" unless more exactly specified.

M. Upon completion, remove all paint where it has been spilled, splashed, or splattered on floors, fixtures, equipment, furniture, and all other surfaces, leaving the work ready for inspection.

3.7 EXTRA STOCK

A. Furnish minimum of five percent extra stock of each mechanical identification material required, including additional numbered valve tags for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

B. This Contractor shall furnish the Owner with two full gallon cans of each finished color and complete manufacturer label and formula, and color chip with manufacturer's color name and/or code and location at which paint occurs.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections:

1. Other Division 23 sections specify balancing devices and their installation, and materials and installations of mechanical systems.

1.2 SUMMARY

A. This Section specifies the requirements and procedures to be utilized for new installations and as indicated for mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. Test, adjust, and balance the following mechanical systems:

1. Supply air systems.
2. Return air systems.
3. Exhaust air systems.
4. Verify temperature control system operation.

C. This Section does not include:

1. Testing boilers and pressure vessels for compliance with safety codes.

2. Specifications for materials for patching mechanical systems.

3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

4. Requirements and procedures for piping and ductwork systems leakage tests.

1.3 DEFINITIONS

A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. The balance of air distribution.

2. Adjustment of total system to provide design quantities.
3. Electrical measurement.
4. Verification of performance of all equipment and automatic controls.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

H. Main: Duct or pipe containing the system's major or entire fluid flow.

I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.

J. Branch main: Duct or pipe serving two or more terminals.

K. Branch: Duct or pipe serving a single terminal.

1.4 SUBMITTALS

A. Engineer and Technicians Data: Submit proof that the Test and Balance Engineer assigned to supervise the procedures and the technicians proposed to perform the procedures meet the qualifications specified below.

B. Procedures and Agenda:

1. Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

2. Pre-Construction Plan Check: Contractor shall review the Plans and/or visit the site prior to the start of construction of the project (new or existing systems). Notify the installing contractor and Architect/Engineer in writing of any modifications or changes to the system(s), and how they should be made to allow the most effective total system balance.

C. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below.

D. Draft Reports: Within one week of completion of testing, adjusting, and balancing procedures, submit draft report directly to the Engineer on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit two (2) complete sets of draft reports. Only 1 complete set of draft reports will be returned.

1. Immediately notify the Architect/Engineer in writing of any system(s) that do not provide the design quantities as scheduled and specified.

2. Coordinate with installing contractor, those items or systems that require corrective action to meet design performance, in a timely manner. Retest after corrections have been accomplished.

E. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit four (4) complete sets of final reports.

F. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

1. General Information and Summary.
2. Air Systems.
3. Temperature Control Systems.

G. Report Contents: Provide the following minimum information, forms and data:

1. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name, address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

2. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

H. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.5 QUALITY ASSURANCE

A. Agency Qualifications:

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

2. The independent testing, adjusting, and balancing agency certified by National Environmental Balancing Bureau (NEBB) or Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified as a Test and Balance Engineer.

B. Codes and Standards:

1. AABC: "National Standards for Total System Balance".

2. ASHRAE: "ASHRAE Handbook," 1987 Systems Volume, Chapter 57, Testing, Adjusting, and Balancing.

C. Compliance with the latest approved edition of the "Florida Energy Code for Building Construction".

1.6 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps:

1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.

2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.

3. Compare design to installed equipment and field installations.

4. Walk the system from the central equipment to terminal units to determine variations of installation from design.

5. Check filters for cleanliness.

6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.

7. Prepare report test sheets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a cross-check.

8. Determine best locations in main and branch ductwork for most accurate duct traverses.

9. Place outlet dampers in the full open position.

10. Prepare schematic diagrams of system "as-built" ductwork layouts to facilitate reporting.

11. Lubricate all motors and bearings.

12. Check fan belt tension.

13. Check fan rotation.

3.2 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

G. Take all reading with the eye at the level of the indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

3.3 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation and ductwork for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.4 RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR

A. The mechanical contractor shall complete the installation and start all HVAC systems to ensure they are working properly, and shall perform all other items as described hereinafter to assist the balancing agency in performing the testing and balancing of the HVAC systems.

B. Air Distribution Systems:

1. Verify installation for conformity to design.

2. Ensure that all supply, return, and exhaust ducts are installed in such a manner that maximum allowable leakage rates as required by specifications are not exceeded.

3. Ensure that all volume, splitter, extractor, and fire dampers are properly located and functional. Dampers serving requirements of minimum and maximum outside, return, relief, and exhaust air shall provide tight closure and full opening, with a smooth and free operation.

4. Verify that all supply, return, exhaust, and transfer grilles; registers; diffusers; and high-pressure terminal units are installed and operational.

5. Ensure that air-handling systems, units, and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., are blanked and/or sealed to eliminate excessive bypass or leakage of air.

6. Ensure that all fans (supply, return, relief, and exhaust) are operating and free of vibration. All fans and drives shall be checked for proper fan rotation and belt tension. Overload protection shall be of proper size and rating. A record of motor current and voltage shall be made to verify that the motors do not exceed nameplate rating.

7. Make any necessary changes to the sheaves, belts, and dampers, as required by the balancing agency, at no additional cost to the Owner.

8. Install clean filters.

3.5 RESPONSIBILITIES OF THE TEMPERATURE CONTROL CONTRACTOR

A. The temperature-control contractor shall complete the installation of the temperature control system, and operate and test all controls systems to ensure they are functioning properly as designed. The temperature control contractor shall assist the balancing agency in testing and balancing the HVAC systems, as described hereinafter.

1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, and fire and freeze stats.

2. Verify that all controlling instruments are calibrated and set for design operating conditions.

3. Calibrate room thermostats after installation, and before the thermostat control verification tests are performed. The balancing agency shall prove the accuracy of final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.

4. The temperature-control contractor shall allow sufficient time in the project to provide assistance and instruction to the balancing agency in the proper use and setting of control components such as but not limited to, computers, static pressure controllers, or any other device that may need set points changed so that the testing and balancing work can be performed.

3.6 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

END OF SECTION

SECTION 230700 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of mechanical insulation required by this Section is indicated on drawings and schedules, and by requirements of this Section. Types of mechanical insulation specified in this Section include the following:

1. Insulation of piping, tanks, fittings and other surfaces.

2. Insulation of ductwork, air devices and all equipment pertaining to the air distribution system.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications: Firm with at least five years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of twenty-five or less, and smoke-developed index of fifty or less, in accordance with NFPA 90A.

D. Comply with the latest approved edition of the "Florida Energy Code for Building Construction".

E. Insulation materials: Insulation materials must be manufactured at facilities certified and registered with an approved registrar to conform to ISO 9000 quality standard.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation.

1.5 DELIVERY AND STORAGE OF MATERIALS

SCHEDULE 1 - Deliver all materials to the job site and protect the insulation against dirt, water, chemical, and mechanical damage before, during, and after installation. Do not install damaged or wet insulations; remove it from the job site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering products which may be incorporated in the work include Armstrong World Industries, Inc., Knauf Fiber Glass GmbH., Johns-Manville Products Corp., Owens-Corning Fiberglass Corp., Pittsburgh Corning Corp., and Rubatex Corp.

2.2 PIPING INSULATION MATERIALS

A. Fiberglass Piping Insulation: Preformed sectional fiberglass insulation and factory-applied vapor barrier, all service jacket with pressure sensitive self-sealing longitudinal laps and butt strips. Suitable for operating temperatures from 0ºF to +850ºF and similar to Johns-Manville's Micro-lok AP-T. Must be Type I, rigid, molded, non-combustible, and must meet ASTM C547.

B. Cellular Glass Piping Insulation: Preformed split sectional pipe insulation of rigid foamed cellular glass for piping and flat block formed to fit for equipment. Apply with all joints tightly butted and bettered with joint sealer. Secure in place with tape, twelve inches on center, secured with at least two points per section. Cover outdoor insulation with one-eight inch layer of white fire-retardant vapor-barrier mastic; apply layer of white open weave glass fabric (10" x 20" mesh) with all joints overlapped two inches, and cover with second one-eight inch layer of same mastic or VentureClad 1577CW-embossed 5-ply self-adhesive vapor barrier/weather proofing membrane with a permeance of 0.0000 when tested per ASTM-E-96; exceeds both UL-723 and ASTM-E84 flame spread and smoke develop. Indoor insulation may be covered with factory-applied white fire-retardant foil-scrim-kraft all purpose jacket or VentureClad 1577CW-embossed 5-ply self-adhesive vapor barrier/weather proofing membrane with a permeance of 0.0000 when tested per ASTM-E-96; exceeds both UL-723 and ASTM-E84 flame spread and smoke develop.

C. Flexible unicellular piping insulation (Armaflex): Preformed split sectional closed-cell pipe insulation. Suitable for operating temperatures of -40ºF to +220ºF. Thermal conductivity "K" factor of 0.27.

D. Jackets:

1. Type A: Smooth or embossed aluminum jacket, 0.016" minimum thickness secured with ½-inch aluminum bands, for all exterior installations.

2. Type B: Pre-sized reinforced glass cloth, smoothly adhered to insulation or cement surface with lagging adhesive; lap joints a minimum of three inches and adhere with lagging adhesive.

3. Type C: PVC plastic, Zeston 2000, one-piece molded-type fitting covers and Jekting material, gloss-white.

4. Type D: White or embossed, self-adhesive jacket: VentureClad 5-ply laminate for exterior installations.

E. Fittings: Provide fitting coverings of a similar material and thickness as adjacent pipe coverings. Cover all elbows, tees, valves, flanges and other fittings of piping system.

F. Accessories: All staples, bands, wires, adhesives, cements, sealers and protective finishes to be as recommended by insulation manufacturers.

2.3 DUCTWORK INSULATION MATERIALS

A. Rigid Fiberglass Insulation: Foil-backed, 3 pound per cubic foot density, operating range of 0℉ to +450℉ and meeting ASTM C612, Type IA and IB, rigid. Similar to Johns-Manville's 814 spin-glass.

B. Flexible Fiberglass Ductwork Insulation: Foil-backed, ¾ pound per cubic foot density blanket, 2.3 inches thick with an installed R-value of 6.5 and meeting ASTM C1136, Type II.

C. Rigid duct lining: 1½ pound per cubic foot density, one inch minimum thickness, containing an EPA registered anti-microbial coating, having a NRC=0.70 and meeting ASTM C1071.

D. Lap, Seam and Pin Head Sealing: Presized reinforced glass mesh adhered to insulation or ductwork with fire retardant vapor barrier mastic, or dead soft foil tape.

E. Provide accessories (staples, bands, wires, etc.) and compounds (cements, adhesives, coatings, etc.) as recommended by insulation manufacturer.

2.4 EQUIPMENT INSULATION MATERIALS

A. Rigid Fiberglass Insulation: Board with factory applied all service jacket, suitable for operating temperatures of 0℉ to +450℉. Similar to Johns-Manville's 800 spin-glass.

B. Cellular Glass Insulation: Preformed flat block cut for equipment with factory applied all service jacket, or Pittcote 4045 with PC79 fabric or VentureClad 1577CW-embossed 5-ply self-adhesive vapor barrier/weather proofing membrane.

C. Flexible Unicellular Equipment Insulation: Closed-cell insulation suitable for operating temperatures of -40℉ to +220℉. Exterior applications, apply VentureClad 1577CW – white, highly UV resistant.

D. High Temperature Insulation: Calcium-silicate insulation, suitable for up to 1200°F service, K factor of 0.49 at 600°F, and density of 14 ½ pounds per cubic foot. Apply VentureClad 1577CW-white, on interior/exterior hot lines.

E. Jacketing Material: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard or VentureClad 1577CW-embossed 5-ply self-adhesive vapor barrier/weather proofing membrane.

F. Provide accessories (staples, bands, wire, etc.) and compounds (adhesives, cements, sealers, etc.) as recommended by insulation manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSULATION INSTALLATION, GENERAL

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices.

B. Install insulation materials with smooth and even surfaces. Do not use cut pieces or scraps abutting each other.

C. Clean and dry surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered. Maintain integrity of vapor-barrier, and protect to prevent puncture or other damage.

D. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

E. Protect outdoor insulation from weather or ultraviolet deterioration by installing outdoor protective finish or jacketing; VentureClad 1577CW – white, UV resistant.

3.3 HVAC PIPING SYSTEM INSULATION

A. Omit insulation on hot piping within radiation enclosures or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan; on heating piping beyond control valve, located within heated space; and on unions.

B. Insulate refrigerant suction lines between evaporators and compressors, and refrigerant hot gas piping with flexible unicellular insulation: ¾” thick for pipe sizes up to 2"; 1" thick for pipe sizes 2½” and larger. Jacket for exterior application shall be VentureClad 1577-CW – white.

C. Insulate condensate drain piping inside of the building with flexible unicellular insulation ½" thick for all pipe sizes. Jacket for exterior application shall be VentureClad 1577-CW – white.

D. Insulate HVAC chilled water supply and return piping with cellular glass insulation, 1½" thick for pipe sizes up to and including 5"; 2½" thick for pipe 6" and larger. Jacketing material shall be VentureClad 1577-CW – embossed high performance self-adhesive vapor barrier/weather proofing membrane.

E. Insulate HVAC hot water supply and return piping, and steam and condensate piping, with fiberglass insulation of one of the following thickness. Runout piping shall not exceed ten feet in length to an individual terminal unit.

INSULATION THICKNESS FOR TEMPERATURE RANGE

Pipe Size	120°F-200°F	201°F-250°F	251°F-305°F	306°F-450°F
Up to 1"	1"	1½"	2"	2½"
1¼" to 2"	1"	1½"	2½"	2½"
2½" to 4"	1½"	2"	2½"	3"
5" to 6"	1½"	2"	3"	3½"
8" and larger	1½"	2"	3"	3½"
Individual runouts: up to 2", not exceeding 12' in length	½"	1"	1½"	1½"

F. Insulate ice storage-brine piping systems with cellular glass insulation, 1½" thick for pipe sizes up to and including 5"; 2½" thick for pipe 6" and larger. Runout piping shall not exceed ten feet in length to an individual terminal unit.

G. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units except where specific form or type is indicated.

H. Butt pipe insulation against pipe insulation inserts. For hot pipes, apply 3" wide vapor barrier tape (VentureClad butt strip tape) or band the butt joints. For cold piping apply a wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

3.4 DUCTWORK SYSTEM INSULATION

A. Do not insulate fibrous glass ductwork, or ductwork where internal insulation or sound absorbing linings have been installed unless otherwise indicated. Do not insulate return ductwork located in return air ceiling plenums.

B. Insulate outdoor air intake ductwork between air entrance and fan inlet or HVAC unit inlet; HVAC supply ductwork between fan discharge, or HVAC unit discharge, and room terminal outlet, including neck and plenum of supply diffusers; HVAC return ductwork between room terminal inlet and return fan inlet or HVAC unit inlet; and HVAC plenums and unit housings not

preinsulated at factory or lined; with one of the following types and thicknesses of external insulation.

1. Rigid Fiberglass: 1½" thick

2. Flexible Fiberglass: 2" thick, ¾ pounds per cubic foot density, application limited to concealed locations.

C. Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

3.5 EQUIPMENT INSULATION

A. Omit insulation on factory insulated breechings and stacks, double wall breechings, and boilers and other equipment preinsulated at factory.

B. Insulate refrigeration equipment, including chillers and chilled water pumps, chemical pot feeders, and air separators with cellular glass, 2" thick for surfaces above 35F, including chilled water pumps and seals. Jacketing material shall be VentureClad 1577CW – embossed.

C. Insulate the following hot equipment with fiberglass insulation, 2" thick, except 3" thick for low pressure boilers and steam heat exchangers. Jacketing material shall be VentureClad 1577CW – white.

1. Boilers.
2. Hot water storage tanks.
3. Water heaters.
4. Heat exchangers.
5. Condensate receivers.
6. Hot water pumps.
7. Condensate pumps.

D. Insulate breechings between heating equipment outlet and stack chimney connection and stacks from bottom to top with high temperature insulation, 2" thick.

E. Do not apply insulation to equipment, breechings, or stacks while hot. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide removable insulation sections to cover parts or equipment which must be opened periodically for maintenance.

F. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship. Apply insulation using staggered joint method for both single and double layer construction. Apply each layer of insulation separately. Impale breeching and stack insulation over weld pins or secure with ½" steel bands on twelve inch centers.

G. Finish with ½" coat of finishing cement. Fill in with cement of sufficient thickness to remove surface irregularities. Cover insulated surfaces with all-service jacketing. Jacketing material shall be VentureClad 1577CW – white self adhesive jacket. Lap seams at least two inches. Apply over vapor barrier where applicable.

3.6 REPAIR, REPLACEMENT AND PROTECTION

A. Repair or replace damaged sections of existing mechanical insulation, including units with vapor barrier damage and moisture saturated units both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.

B. Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating and air conditioning systems in pressure classes from minus 2 inches to plus 10 inches water gauge.

1.3 DEFINITIONS

A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:

1. Seams: A seam is defined as the joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.

2. Joints: Joints include girth joints; branch and subbranch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system.

B. Changes or alterations to the layout or configuration of the duct system must be specifically approved in writing. Accompany requests for layout modifications with calculations showing that the proposed layout will provide the original design results without increasing the system total pressure.

1.5 SUBMITTALS

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

B. Product data including details of construction relative to materials, dimensions of individual components, profiles, and finishes for duct liner, sealing materials, and fire-stopping materials.

C. Submittals for Seismic Restraints:

1. The seismic and vibration control manufacturer shall determine the number, size, and type of anchor bolts, cable restraints, etc. for each section of ductwork.

2. Complete engineering calculations and drawings for all vibration and seismic requirements for all piping, except calculations are not required where restraints conform to SMACNA “Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Systems”.

3. Details for steel frames to be used in connection with the isolation and seismic restraint of the items.

E. Record Drawings: Include duct systems routing, fittings details, and installed accessories and devices.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 90A-2002, "Standard for the Installation of Air Conditioning and Ventilating Systems".

B. Comply with NFPA 96-1998, "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations”.

C. Comply with the latest approved edition of the "Florida Energy Code for Building Construction".

D. Comply with the latest approved edition of the SMACNA “Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Systems”.

E. Comply with UL 723 and UL 181B for duct sealants for metal ductwork.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Sheet Metal, General: Provide sheet metal in thicknesses indicated, packaged and marked as specified in ASTM A 700.

B. Galvanized Sheet Steel: Lock-forming quality, ASTM A 653, Coating Designation G 90. Provide mill-phosphatized finish for duct surfaces exposed to view.

C. PVC-coated Galvanized Steel: Shall be UL-181 Class 1 listing, lock-forming quality, galvanized sheet steel with ASTM A 527, Coating Designation for exposed surfaces of ducts and fittings (exterior of ducts and fittings for underground applications, and the interior of ducts and fittings

for fume-handling applications) and 2-mil PVC coating on the reverse side of the ducts and fittings.

D. Carbon Steel Sheets: ASTM A 366, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.

E. Stainless Steel: ASTM A 480, Type 316, sheet form, with No. 4 finish on exposed surface for ducts exposed to view; Ype 304, sheet form, with No. 1 finish for concealed ducts.

F. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish where ducts are exposed to view, and mill finish for concealed ducts.

G. Copper Sheet: Where indicated, provide copper sheet complying with ASTM B 370; H00 temper, except where 060 temper is required for unusual forming.

H. Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts. For aluminum and stainless steel ducts, provide reinforcing of compatible materials.

I. Tie Rods: Galvanized steel, ¼" minimum diameter for 36" length or less; ⅜" minimum diameter for lengths longer than 36".

2.2 DUCT LINER

A. General: Comply with NFPA Standard 90A-1989 and TIMA Standard AHC-101.

B. Materials: ASTM C 1071, Type I, with coated surface exposed to airstream to prevent erosion of glass fibers. Thickness shall be 1", with 1½ pound per cubic foot density, and "K-Factor" equal to 0.24 or better, at a mean temperature of 75°F. Liner shall have a flame-spread rating of not more than 25 and a smoke-developed rating of not higher than 50, when tested in accordance with ASTM C 411. Comply with ASTM C 916 for liner adhesive. Minimum noise reduction coefficient (NRC) for 1" liner shall be 0.70.

C. The air stream surface shall have 100% coverage of an acrylic polymer coating formulated with an immobilized EPA registered preservative proven resistant to microbial growth as determined by ASTM G21 and G22.

D. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct. Provide fasteners that do not damage the liner when applied as recommended by the manufacturer; that do not cause leakage in the duct; and will indefinitely sustain a 50-pound tensile dead load test perpendicular to the duct wall.

1. Fastener Pin Length: As required for thickness of insulation, and without projecting more than ⅛-inch into the airstream.

2. Adhesive For Attachment of Mechanical Fasteners: Comply with the "Fire Hazard Classification" of duct liner system.

2.3 FLEXIBLE DUCTS

A. Either spiral-wound spring steel with flame-proof vinyl sheathing, or corrugated aluminum; complying with UL 181. Provide one inch (1") thick continuous flexible fiberglass sheath with vinyl vapor barrier jacket.

2.4 SEALING MATERIALS

A. Joint and Seam Sealants, General: Seal all joints and seams. The term sealant used here is not limited to materials of adhesive nature, but also includes tapes and combinations of open weave fabric strips and mastics.

B. Joint and Seam Sealant: One-part, nonsag, solvent-release curing, polymerized butyl sealant complying with FS TT-S-001657 and UL 723, Type I; formulated with a minimum of 75 percent solids.

C. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.5 FIRE-STOPPING

A. Fire-resistant Sealant: Provide one-part, elastomeric sealant formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
2. "Pensil 851"; General Electric Co.
3. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
4. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
5. "RTV 7403"; General Electric Co.
6. "Fyre Putty"; Standard Oil Engineered Materials Co.
7. Fire Temp”; Johns Manville.

2.6 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder-actuated concrete fasteners, unless approved in writing by the structural engineer.

B. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod. Straps and rod sizes shall conform with Table 4-1 in SMACNA HVAC Duct Construction Standards, 1985 Edition, for sheet width and gauge and steel rod diameters. Hangers installed in corrosive atmospheres shall be electro-galvanized all-thread rod or hot-dipped-galvanized rods with threads painted after installation.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36.

1. Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.

2. For stainless steel ducts, provide stainless steel support materials.

3. For aluminum ducts, provide aluminum support materials, except where materials are electrolytically separated from ductwork.

4. For copper ducts, provide copper, bronze or brass support materials.

2.7 RECTANGULAR DUCT FABRICATION

A. General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA "HVAC Duct Construction Standards", Tables 1-3 through 1-19, including their associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

B. Static Pressure Classifications: Except where otherwise indicated, construct duct systems to the following pressure classifications:

1. Supply Ducts: 3 inches water gauge.
2. Return Ducts: 2 inches water gauge, negative pressure.
3. Exhaust Ducts: 2 inches water gauge, negative pressure.

C. Cross-breaking or Cross Beading: Cross-break or bead duct sides that are 19 inches and larger and are 20-gauge or less, with more than 10 square feet of unbraced panel area, as indicated in SMACNA "HVAC Duct Construction Standard", Figure 1-4, unless they are lined or are externally insulated.

2.8 RECTANGULAR DUCT FITTINGS

A. Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Metal Duct Construction Standard", 1985 Edition, Figures 2-1 through 2-10.

2.9 SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with 100 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness is prohibited. Apply a coat of adhesive to liner facing in direction of airflow not receiving metal nosing. Butt transverse joints without gaps and coat joint with adhesive. Fold and compress liner in corners of rectangular ducts or cut and fit to assure butted edge overlapping. Coat all exposed raw edges with superseal coating.

B. Avoid longitudinal joints in rectangular ducts wherever possible.

C. Secure liner with mechanical fasteners 4" from corners and at intervals not exceeding 12 inches transversely around perimeter; at 3" from transverse joints and at intervals not exceeding 18 inches longitudinally.

D. Secure transversely oriented liner edges facing the airstream with metal nosings that are either channel or "Z" profile or are integrally formed from the duct wall at the following locations:

1. Fan discharge.
2. Intervals of lined duct preceding unlined duct.

E. Terminate liner with duct build-outs installed in ducts to attach dampers, turning vane assemblies, and other devices. Fabricated build-outs (metal hat sections) or other build-out means are optional; when used, secure build-outs to the duct wall with bolts, screws, rivets, or welds. Terminate liner at fire dampers at connection to fire damper sleeve through fire separation.

2.10 ROUND AND FLAT OVAL DUCT FABRICATION

A. General: "Basic Round Diameter" as used in this article is the diameter of the size of round duct that has a circumference equal to the perimeter of a given sized of flat oval duct. Except where interrupted by fittings, provide round and flat oval ducts in lengths not less than 12 feet.

B. Round Ducts: Fabricate round supply ducts with spiral lock-seam or longitudinal seam construction. Comply with SMACNA "HVAC Duct Construction Standards", Table 3-2 for galvanized steel gauges.

C. Flat Oval Ducts: Fabricate flat oval supply ducts with standard spiral lock-seams (without intermediate ribs) or with butt-welded longitudinal seams in gauges listed in SMACNA "HVAC Duct Construction Standards", Table 3-4.

D. Double-wall (Insulated) Ducts: Fabricate double-wall insulated ducts with an outer shell, insulation, and an inner liner as specified below. Dimensions indicated on internally insulated ducts are nominal inside dimensions.

1. Thermal Conductivity: 0.27 Btu/square foot/degree F./inch thickness at 75ºF mean temperature.

2. Outer Shell: Base outer shell gauge on actual outer shell dimensions. Provide outer shell lengths 2" longer than inner shell and insulation, and in gauges specified for single-wall duct.

3. Insulation: Unless otherwise indicated, provide 1" thick fiberglass insulation. Provide insulation ends where internally insulated duct connects to single-wall duct or noninsulated components. The insulation end shall terminate the insulation and reduce the outer shell diameter to the inner liner diameter.

4. Solid Inner Liner: Construct round and flat oval inner liners with solid sheet metal of the gauges listed below. For flat oval ducts, the diameter indicated in the table below is the "basic round diameter".
   a. 3 to 8 inches: 28-gauge with standard spiral construction.
   b. 9 to 42 inches: 28-gauge with single-rib spiral construction.
   c. 44 to 60 inches: 26-gauge with single-rib spiral construction.
   d. 62 to 88 inches: 22-gauge with standard spiral construction.

5. Maintain concentricity of liner to outer shell by mechanical means. Protect insulation from discoloration by mechanical means.

2.11 ROUND AND FLAT OVAL SUPPLY AND EXHAUST FITTINGS FABRICATION

A. Laterals and 90-degree Conical Tees: Fabricate to conform to SMACNA "HVAC Duct Construction Standards", 1985 Edition, Figures 3-4 and 3-5 and with metal thicknesses specified for longitudinal seam straight duct.

B. Diverging-flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from the body onto branch tap entrance.

C. Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate the bend radius of die-formed, gored, and pleated elbows 1.5 times the elbow diameter. Unless elbow construction type is indicated, provide elbows meeting the following requirements:

1. Mitered Elbows: Fabricate mitered elbows with welded construction in gauges specified below.
   a. Mitered Elbows Radius and Number of Pieces: Unless otherwise indicated, construct elbow to comply with SMACNA "HVAC Duct Construction Standards", Table 3-1.
   b. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from minus 2 inches to plus 2 inches:
      1) 3 to 26 inches: 24-gauge.
      2) 27 to 36 inches: 22-gauge.
      3) 37 to 50 inches: 20-gauge.
      4) 52 to 60 inches: 18-gauge.
      5) 62 to 84 inches: 16-gauge.
   c. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from 2 inches to 10 inches:

1) 3 to 14 inches: 24-gauge.
2) 15 to 26 inches: 22-gauge.
3) 27 to 50 inches: 20-gauge.
4) 52 to 60 inches: 18-gauge.
5) 62 to 84 inches: 16-gauge.

d. Flat Oval Mitered Elbows: Solid welded and with the same metal thickness as longitudinal seam flat oval duct.

e. 90-degree, 2-piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material handling classes A and B; and only where space restrictions do not permit the use of 1.5 bend radius elbows. Fabricate with single-thickness turning vanes.

2. Round Elbows - 8 Inches and Smaller: Die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend angle configurations or ½" diameter (e.g. 3½- and 4½-inch) elbows with gored construction.

3. Round Elbows - 9 Through 14 Inches: Gored or pleated elbows for 30, 45, 60, and 90 degrees, except where space restrictions require a mitered elbow. Fabricate nonstandard bend angle configurations or ½" diameter (e.g. 9½ and 10½ inch) elbows with gored construction.

4. Round Elbows - Larger Than 14 Inches and All Flat Oval Elbows: Gored elbows, except where space restrictions require a mitered elbow.

5. Die-formed Elbows for Sizes Through 8 Inches and All Pressures: 20-gauge with 2-piece welded construction.

6. Round Gored Elbows Gauges: Same as for nonelbow fittings specified above.

7. Flat Oval Elbows Gauges: Same as longitudinal seam flat oval duct.

8. Pleated Elbows Sizes Through 14 Inches and Pressures Through 10 Inches: 26-gauge.

D. Double-wall (Insulated) Fittings: Fabricate double-wall insulated fittings with an outer shell, insulation, and an inner liner as specified below. Dimensions indicated on internally insulated ducts are nominal dimensions.

1. Thermal Conductivity: 0.27 Btu/square foot/degree F/inch thickness at 75ºF mean temperature.

2. Outer Shell: Base outer shell gauge on actual outer shell dimensions. Provide outer shell lengths 2" longer than inner shell and insulation. Gauges for outer shell shall be same as for uninsulated fittings specified above.

3. Insulation: Unless otherwise indicated, provide 1" thick fiberglass insulation. Provide insulation ends where internally insulated duct connects to single-wall duct or noninsulated components. The insulation end shall terminate the insulation and reduce the outer shell diameter to the nominal single-wall size.

4. Solid Inner Liner: Construct round and flat oval inner liners with solid sheet metal of the gauges listed below. For flat oval ducts, the diameter indicated in the table below is the "basic round diameter."
   a. 3 to 34 inches: 24-gauge.
   b. 35 to 58 inches: 22-gauge.
   c. 60 to 88 inches: 20-gauge.

5. Maintain concentricity of liner to outer shell by mechanical means. Protect insulation from discoloration by mechanical means.

E. PVC-coated Elbows and Fittings: Fabricate elbows and fittings as follows:

1. Round Elbows 4 to 8 Inches: Two-piece, die stamped, with longitudinal seams spot welded, bonded, and painted with PVC aerosol spray.

2. Round Elbows 9 to 26 Inches: Standing seam construction.

3. Round Elbows 28 to 60 Inches: Standard gore construction, riveted and bonded.

4. Other Fittings: Riveted and bonded joints.

5. Couplings: Slip-joint construction with a minimum of a 2-inch insertion length.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

A. Install ducts with the fewest possible joints. Use fabricated fittings for all changes in directions, changes in size and shape, and connections. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.

B. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct usable space of block access for servicing building and its equipment. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Provide clearance of 1 inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any. Install insulated ducts with 1-inch clearance outside of insulation. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

C. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures. Do not route ducts above electrical panel boards.

D. Nonfire-rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1½ inches.

3.2 INSTALLATION OF FLEXIBLE DUCTS

A. For any duct run using flexible ductwork, do not exceed 8'-0" extended length. Install in accordance with Section III of SMACNA's, "HVAC Duct Construction Standards, Metal and Flexible".

3.3 PVC-COATED DUCT INSTALLATION

A. Install PVC-coated duct and fittings in accordance with the manufacturer's instructions.

B. Seal all joints and seams. Apply sealer to male end connectors before insertion, and afterwards to cover the entire joint and sheet metal screws.

C. Secure couplings with sheet metal screws. Install screws at an interval of 12 inches, with a minimum of 3 screws in each coupling.

D. Repair damage to PVC coating with a PVC aerosol spray.

3.4 HANGING AND SUPPORTING

A. Install metal ducts with support systems indicated in SMACNA "HVAC Duct Construction Standards", tables 4-1 through 4-3 and Figures 4-1 through 4-8.

B. Support horizontal ducts within 2' of each elbow and within 4' of each branch intersection.

C. Support vertical ducts at a maximum interval of 16' and at each floor.

D. Upper attachments to structures shall have an allowable load not exceeding ¼ of the failure (proof test) load but are not limited to the specific methods indicated.

E. Install concrete insert prior to placing concrete.

F. Restraint of rigidly-mounted ductwork shall conform to SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Systems," SMACNA latest edition. Calculations need not be submitted for restraint systems conforming to these guidelines.

3.5 CONNECTIONS

A. Equipment Connections: Connect equipment with flexible connectors in accordance with Division 23 Section "Duct Accessories".

B. Branch Connections: Comply with SMACNA "HVAC Duct Construction Standards", Figures 2-7 and 2-8.

C. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards", Figures 2-16 through 2-18.

D. Terminal Units Connections: Comply with SMACNA "HVAC Duct Construction Standards", Figure 2-19.

3.6 FIELD QUALITY CONTROL

A. Maximum Allowable Leakage: As described in ASHRAE 1989 Handbook, "Fundamentals" Volume, Chapter 32, Table 6 and Figure 10. Comply with requirements for leakage classification 3 for round and flat oval ducts, leakage classification 12 for rectangular ducts in pressure classifications less than and equal to 2" water gauge (both positive and negative pressures), and leakage classification 6 for pressure classifications greater than 2" water gauge and less than and equal to 10" water gauge.

B. Reseal leaking joints as required and apply sealants to achieve specified maximum allowable leakage.

3.7 ADJUSTING AND CLEANING

A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

D. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION

SECTION 233300 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this Section. Types of ductwork accessories required for project include the following:

1. Dampers:
   a. Balancing dampers.
   b. Control dampers.
   c. Automatic backdraft dampers.
2. Fire and smoke dampers.
3. Turning vanes.
4. Duct hardware.
5. Duct access doors.
6. Flexible connections.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than three years.

B. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

C. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.

D. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers".

E. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

F. Comply with the latest approved edition of the "Florida Energy Code for Building Construction".

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.

PART 2 - PRODUCTS

2.1 DAMPERS

A. Low Pressure Manual Dampers: Provide dampers of single blade type or multi-blade type, constructed in accordance with SMACNA "HVAC Duct Construction Standards".

B. Control Dampers: Provide dampers with parallel blades for 2-position control, or opposed blades for modulating control. Construct blades of 16-gauge steel, provide heavy-duty molded self-lubricating nylon bearings, ½" diameter steel axles spaced on 9" centers. Construct frame of 2" by ½" by ⅛" steel channel for face areas 25 square feet and under; 4" by 1¼" by 16-gauge channel for face areas over 25 square feet. Provide galvanized steel finish with aluminum touch-up.

C. Backdraft Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at 0.1" static pressure. Construct blades of 16-gauge aluminum, provide ½" diameter ball bearings, ½" diameter steel axles spaced on 9" centers. Construct frame of 2" by ½" by ⅛" steel channel for face areas 25 square feet and under; 4" by one and 1¼" by 16-gauge channel for face areas over 25 square feet. Provide galvanized steel finish on frame with aluminum touch-up.

D. Acceptable manufacturers include Air Balance, Inc.; Airguide Corp.; Arrow Louver and Damper; Greenheck; Louvers & Dampers, Inc.; Nailor; Penn Ventilator Co.; and Ruskin Mfg. Co.

2.2 FIRE AND SMOKE DAMPERS

A. Fire Dampers: Construct casings of 20-gauge galvanized steel. Provide fusible link rated at 160°F to 165°F unless otherwise indicated. Dampers shall be meet UL 555 qualifications. Provide damper with positive lock in closed position, and with curtain type damper blade assembly, with curtain 100% out of airstream and 24-gauge galvanized steel blades.

B. Fire/Smoke Dampers: Construct casings of 20-gauge galvanized steel. Provide fusible link rated at 160°F to 165°F unless otherwise indicated. Provide additional frangible link containing explosive charge, connected in series with fusible link. Provide stainless steel spring loaded leakage seals in sides of casing, and 36" long wire leads for connecting smoke link to smoke detector, and low profile multi-formed 16-gauge galvanized steel blades.

C. Ceiling fire dampers: Only all steel constructed air devices to be installed with this type of damper. Construct frame of 20-gauge galvanized steel. Provide fusible link rated at 160°F to 165°F unless otherwise indicated. Provide damper with positive lock in the closed position, and with single or butterfly damper blade assembly with UL Classified insulating mineral board and 22 gauge galvanized steel blades. Provide minimum ¼" thick ceramic insulating blanket as required by air device, and manufacturer's tested assembly. Ceiling damper based on Ruskin model CFD

and CFDR with UL test assembly and sizes based on air device served. Damper may be used as a volume damper for air devices with an approved UL tested assembly.

D. Motor-Driven Fire/Smoke Dampers: Construct casing of 16-gauge galvanized steel, fusible link 160°F to 165°F multi-blade type. Damper manufacturer shall have tested, and listed with UL a complete range of damper sizes covering all combination fire/smoke dampers required by this specification. Electric operator shall be factory installed. Damper and operator shall be supplied as a single entity which must meet UL 555S qualifications. Damper shall be equal to Ruskin model FSD36 Class II.

1. Damper electric operator shall be equal to Ruskin series MP2781 for duct sizes up to three square feet and series MA 418 for ducts above three square feet to 24 square feet.
2. Each combination fire /smoke damper shall have pressure drops in the open position of less than 0.1 inch w.g. with average duct velocities of 2500 fpm.

E. Acceptable manufacturers include Ruskin Mfg. Co., Air Balance, Inc.; Nailor, Greenheck; and Prefco Products, Inc.

2.3 TURNING VANES

A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards" or provide manufactured turning vanes constructed of 1" wide curved blades set at ¾" o.c., supported with bars perpendicular to blades set at 2" o.c., and set into side strips suitable for mounting in ductwork.

B. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of airfoil shaped aluminum extrusions with perforated faces and fiberglass fill.

C. Acceptable manufacturers include Aero Dyne Co., Airsan Corp., Anemostat Products, Barb-Aire Co., Duro Dyne Corp., Environmental Elements Corp., Hart & Cooley Mfg. Co., and Register & Grille Mfg. Co., Inc.

2.4 DUCT HARDWARE

A. Provide duct hardware manufactured by one manufacturer for all items on project.

B. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

C. Acceptable manufacturers include Elgen Manufacturing, Ventfabrics, Inc., and Young Regulator Co.

2.5 DUCT ACCESS DOORS

A. Construct access doors of the same or greater gauge as ductwork served, provide 1" thick insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for

externally insulated duct. Provide one side hinged, other side with one handle-type cam latch for all doors. If space is limited for a hinged door swing, then provide a two handle-type cam latch door. Installation of door shall be accessible, and the size opening shall be large enough to permit maintenance and resetting of device the door serves.

B. Acceptable manufacturers include Air Balance Inc., Louver & Dampers, Inc., and Ruskin Mfg. Co.

2.6 FLEXIBLE CONNECTIONS

A. Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

B. Acceptable manufacturers include American/Elgen Co., Duro Dyne Corp., Flexaust Co., and Ventfabrics, Inc.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

B. Install turning vanes in square or rectangular 90º elbows in supply air systems, and elsewhere as indicated.

C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter. Provide access doors at all duct mounted smoke detectors, fire dampers, smoke/fire dampers and other locations where routine maintenance will be required.

D. Combination Fire/Smoke Dampers:

1. Each combination fire/smoke damper shall be installed in accordance with the conditions of their listing and the manufacturer's installation instructions.

2. Provide wall sleeves. Thickness of sleeves shall not be less than the conditions of rating under UL 555S, standard for fire dampers and ceiling dampers. Provide an expansion gap between the fire rated wall opening and the fire/smoke damper sleeve. The gap shall be sized at ⅛" per linear foot in both dimensions.

3. Smoke seal retaining angles by providing a bead of acoustic sealant or UL rated caulking on the edge of retaining angle at the wall.

E. Install 2 ft long orange plastic strips at all volume dampers to aid in easy identification of locations. These strips are to remain after construction.

3.3 FIELD QUALITY CONTROL

A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak-proof performance.

3.4 ADJUSTING AND CLEANING

A. Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.

B. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.5 EXTRA STOCK:

A. Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range.

END OF SECTION

SECTION 233713 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than five years.

B. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.

C. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A-"Standard for the Installation of Air Conditioning and Ventilating Systems".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:

1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.

2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES, REGISTERS AND LOUVERS

A. Ceiling Diffusers: Rectangular louvered face, aluminum construction, baked white enamel finish, fixed, throw pattern and rectangular or round neck as shown on plan. All units shall be provided with lever operated opposed blade damper in throat (Price VCS3). Provide 2'x 2' lay-in panel for T-bar ceilings. Provide beveled drop face (Price Border 6) for drywall or plaster ceilings. Price AMD or approved equal.

B. Ceiling diffusers: Rectangular perforated face, aluminum construction, baked white enamel finish, adjustable pattern and throw with round neck. Provide 2' x 2' lay-in type for T-bar ceilings. Provide 1" border (Price Border 1) for drywall or plaster ceilings Price APDC or

approved equal.

C. Return or exhaust grilles and registers: Rectangular louvered face, 35° or 45° fixed blades on ½-inch centers, all aluminum construction, white baked enamel finish. Blades shall be horizontal in wall-mounted applications and run the short dimension in ceiling applications. Provide opposed blade dampers in registers (Price D). Delete screw holes for lay-in ceiling applications and provide 2' X 2' lay-in panel. Provide gasket around frame for drywall or plaster installation. Price model 630 or approved equal.

D. Supply grilles or registers: Rectangular louvered face, double deflection, ¾-inch blade spacing, all adjustable, aluminum construction, white baked enamel finish. Front blades shall run the short direction. Price model 620 or approved equal.

E. For fire-rated ceilings, provide diffusers of steel construction to match standard diffusers. Provide radiation blanket and fire damper with air volume adjustment option.

1. Louvered face diffusers shall be Price model SMD with Ruskin CFD with adjustment option or approved equal.

2. Perforated face diffusers shall be Price model PDC with Ruskin CFD damper with air volume adjustment or approved equal. Mount damper in strict accordance with manufacturer's recommendation.

F. Approved manufacturers of grilles and diffusers: Price, Titus, Krueger, Nailor, Metal-Aire, or Carnes, subject to compliance with specification.

G. Louvers: 6-inch deep, drainable, fixed 35° blade, mill-finished extruded aluminum, minimum 0.081 inch thick blades, high free area with ¾" x ½" aluminum bird screen. Unit shall have a water penetration rate of 0.05 ounces per square foot of free area or less at 1000 fpm. Air pressure drop shall be less than 0.1 inch w.g. at 800 fpm. Provide flanged frame where required and anodized finish or insect screen where shown on plan. Louver must have current Miami-Dade County, Florida notice of acceptance number. Ruskin ELF637DXD or approved equal by Arrow, Carnes, Louvers & Dampers, Inc., or Vent Products.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

3.3 SPARE PARTS

A. Furnish to Owner, with receipt, three operating keys for each type of air outlet and inlet.

END OF SECTION

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DIVISION 26 - ELECTRICAL

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SECTION 26 01 00 – BASIC ELECTRICAL REQUIREMENTS

1.1 RELATED DOCUMENTS:

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

B.

26 01 00	Basic Electrical Requirements
26 05 19	Low-Voltage Electrical Power Conductors and Cables
26 05 20	Electrical Connections for Equipment
26 05 26	Grounds and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
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26 05 53	Identification for Electrical Systems
26 24 16	Panelboards
26 27 26	Wiring Devices
26 51 00	Lighting
28 31 11	Fire Alarm System

1.2 CODES:

A. The work shall be in conformance with the following:

NFPA 70	National Electric Code	2020
NFPA 72		2019
Florida Fire Prevention Code (8th Edition)		2023
Florida Building Code (8th Edition)		2023

B. The installation shall also comply with all applicable rules and regulations of local and state laws and ordinances. Include in the work, without extra cost, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations. Inform the architect of any work or materials which conflict with any of the applicable codes, standards, laws, and regulations before submitting their bid.

1.3 ROUGH-IN:

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 23 for rough-in requirements.

1.4 ELECTRICAL INSTALLATIONS:

A. Existing services shall not be interrupted without prior consent of the owner's authorized representative and may be interrupted only at, and for, the specific time designated by the owner's authorized representative.

B. Make a thorough examination of the site and the contract documents. No claim for extra compensation will be recognized if difficulties are encountered which an examination of site conditions and contract documents prior to executing contract would have revealed.

C. Coordinate electrical equipment and materials installation with other building components.

D. Verify all dimensions by field measurements.

E. Arrange for chases, slots, and openings in other building components to allow for electrical installations.

F. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

G. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.

H. Install electrical equipment to facilitate 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.

I. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.

J. Temporary electrical service and construction lighting shall be provided under this section. Provide for all electrical service for construction period, making all connections and removal of same at job conclusion. Furnish and install temporary lighting for construction period. At job completion, all temporary lamps shall be removed and replaced with new lamps.

1.5 CUTTING AND PATCHING:

A. Do not endanger or damage installed work through procedures and processes of cutting and patching.

B. Arrange for repairs required to restore other work because of damage caused as a result of electrical installations.

C. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

D. Perform cutting, fitting, and patching of electrical equipment and materials 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 equipment and materials in existing structures.

6. Upon written instructions from the architect/engineer, uncover and restore work to provide for architect/engineer observation of concealed work.

E. Cut, remove and legally dispose of, selected electrical equipment, components, and materials as indicated; including, but not limited to, removal of electrical items indicated to be removed and items made obsolete by the new work.

F. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

G. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

H. Locate, identify, and protect electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the owner prior to the changeover.

1.6 ELECTRICAL SUBMITTALS:

A. Refer to the Conditions of the Contract (General and Supplementary) and Division 1 Section 01 33 00: SUBMITTAL PROCEDURES for submittal definitions, requirements, and procedures.

B. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the contractor. Data submitted from subcontractors and material suppliers directly to the architect/engineer will not be processed.

1.7 PRODUCT OPTIONS AND SUBSTITUTIONS:

A. Refer to the Instructions to Bidders and the Division 1 Section "PRODUCT REQUIREMENTS" for requirements in selecting products and requesting substitutions.

1.8 PRODUCT LISTING:

A. Prepare listing of major electrical equipment and materials for the project.

B. Submit this listing as a part of the submittal requirement specified in the Division 1 Section: PRODUCT REQUIREMENTS.

C. When two or more items of the same material or equipment are required, they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.

D. Provide products which are compatible within systems and other connected items.

E. No substitution will be considered unless written request has been submitted to the architect at least ten (10) days prior to the date for receipt of bids.

F. If the architect approves any proposed substitutions, such approval will be set forth in an addendum.

1.9 DELIVERY, STORAGE, AND HANDLING:

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installation.

1.10 RECORD DOCUMENTS:

A. Refer to the Division 1 Section 01 77 00: CLOSEOUT PROCEDURES for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark drawings to indicate revisions to conduit size and location, both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; change orders; concealed control system devices.

C. Mark Specifications to indicate approved substitutions; change orders; actual equipment and materials used.

D. Provide record documents in PDF format.

1.11 WARRANTIES:

A. Refer to the Division 1 Section: PRODUCT REQUIREMENTS for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Divisions 26, 27, and 28 into a separated set of vinyl- covered, three-ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment; date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.12 CLEANING:

A. Refer to the Division 1 Section: CLOSEOUT PROCEDURES for general requirements for final cleaning.

B. Clean all light fixtures, lamps, and lenses prior to final acceptance. Replace all inoperative lamps.

END OF SECTION 26 01 00

SECTION 26 05 19 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26, Division 27, and Division 28 section making reference to wires and cables specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical wire and cable work is indicated by drawings and schedules.

B. Types of electrical wire, cable, and connectors specified in this Section include the following:

Copper conductors.
Fixture wires.
Split-bolt connectors.
Wirenut connectors.

C. Applications of electrical wire, cable, and connectors required for project are as follows:

1. For power distribution circuits.

2. For lighting circuits

3. For appliance and equipment circuits.

4. For motor-branch circuits.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience with projects utilizing electrical wiring and cabling work similar to that required for this project.

C. NEC Compliance: Comply with NEC requirements as applicable to construction, installation, and color coding of electrical wires and cables.

D. IEEE Compliance: Comply with applicable requirements of IEEE Stds. 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std. 241, "IEEE

Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.

E. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8 and D-753. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).

F. The following systems of color coding shall be strictly adhered to:

grounded leads	Green
grounded neutral leads	White
120/208 volt, ungrounded phase wires	Black, Red and Blue
277/480 volt, ungrounded phase conductors	Yellow, Orange, Brown

G. The Contractor shall verify the the code followed in the existing facility and advise the Engineer of any deviations from the color code listed above prior to installing conductors. The color code assigned to each phase wire shall be consistently followed throughout.

H. The color code listed above shall be posted at each panel location per NEC 210.5.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA specified type wire and cable reels.

B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

C. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 - PRODUCTS

2.1 BUILDING WIRES:

A. Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated.

B. Conductor insulation shall be dual type THHN/THWN 75°C (167°F) for dry, damp, and wet locations. Conductor insulation with single type marking THHN 90°C (194°F) may be used for dry locations only.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRES AND CABLES:

A. General: Install electrical cables, wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation" and in accordance with recognized industry practices.

B. Unless otherwise noted, all branch circuit conductors shall be No. 12 AWG. Branch circuits over 75 feet in length shall be No. 10 AWG unless noted otherwise.

C. Install UL Type THWN or THHN wiring in conduit, for feeders and branch circuits.

D. Pull conductors simultaneously where more than one is being installed in same raceway.

E. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.

F. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceway.

G. Keep conductor splices to minimum.

H. Install splices and tapes which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced. Use splice and tap connectors which are compatible with conductor material.

3.2 FIELD QUALITY CONTROL:

A. Prior to energization of circuitry, check installed feeder wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled. A list of feeders tested shall be submitted to the engineer indicating the insulation resistance level for each cable.

B. Prior to energization, test wires and cables for electrical continuity and for short-circuits.

C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 26 05 19

SECTION 26 05 20 – ELECTRICAL CONNECTIONS FOR EQUIPMENT

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 section making reference to electrical connections for equipment specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.

B. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Division 21, Division 22, Division 23, and other Division 26 sections, and are work of this Section.

C. Motor starters and controllers not furnished as integral part of equipment are specified in applicable Division 26 sections and are work of this Section.

D. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 26 sections, and are work of this Section.

E. Electrical identification for wire/cable conductors is specified in Division 26 section, "IDENTIFICATION FOR ELECTRICAL SYSTEMS", and is work of this Section.

F. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division 26 sections, and are work of this Section.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties; whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firms with at least three (3) years of successful installation experience with projects utilizing electrical connections for equipment similar to that required for this project.

C. NEC Compliance: Comply with applicable requirements of NEC as to type products used and installation of electrical power connections (terminals and splices) for junction boxes, motor starters, and disconnect switches.

D. UL Compliance: Comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL listed and labeled.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS:

A. General: For each electrical connection indicated, provide complete assembly of materials; including, but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, cable ties, solderless wirenuts, and other items and accessories as needed to complete splices and terminations of types indicated.

B. Metal Conduit, Tubing and Fittings, General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Division 26 Basic Electrical Materials and Methods section "Raceways", and in accordance with the following listing of metal conduit, tubing and fittings:

Galvanized rigid steel conduit.
Rigid metal conduit fittings.
Electrical metallic tubing.
EMT fittings.
Flexible metal conduit.
Flexible metal conduit fittings.
Liquid-tight flexible metal conduit.
Liquid-tight flexible metal conduit fittings.

C. Wires, Cables, and Connectors:

1. General: Provide wires, cables, and connectors complying with Division 26 basic electrical materials and methods section "LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES".

2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match (including sizes and ratings) wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).

D. Connectors and Terminals: Provide electrical connectors and terminals which mate and match (including sizes and ratings) with equipment terminals, and are recommended by equipment manufacturer for intended applications.

PART 3 - EXECUTION

3.1 OBSERVATION:

A. Observe area and conditions under which electrical connections for equipment are to be installed and notify contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.2 INSTALLATION OF ELECTRICAL CONNECTIONS:

A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions, with recognized industry practices, and complying with applicable requirements of UL and NEC to ensure that products fulfill requirements.

B. Coordinate with other work, including wires/cables, raceway, and equipment installation as necessary to properly interface installation of electrical connections for equipment with other work.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Maintain existing electrical service and feeders to occupied areas and operational facilities unless otherwise indicated, or when authorized otherwise in writing by owner or architect/engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.

E. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.

F. Prepare cables and wires by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

G. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing, and maintenance.

H. Provide flexible conduit for motor connections and other electrical equipment connections where subject to movement and vibration.

I. Provide liquid-tight flexible conduit for connection of motors and other electrical equipment where subject to movement and vibration; and also where connections are subjected to one or more of the following conditions:

1. Exterior location.
2. Moist or humid atmosphere where condensate can be expected to accumulate.
3. Corrosive atmosphere.
4. Water spray.
5. Dripping oil, grease, or water.

3.3 FIELD QUALITY CONTROL:

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION 26 05 20

SECTION 26 05 26 – GROUNDS AND BONDING FOR ELECTRICAL SYSTEMS

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Materials and Methods section, and is part of each Division 26, Division 27, and Division 28 making reference to grounding specified herein.

1.2 SUMMARY:

A. The extent of electrical grounding and bonding work is indicated by drawings and schedules, and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.

B. The type of electrical grounding and bonding work specified in this Section includes the following:

Solidly grounded.

C. Applications of electrical grounding and bonding work in this Section includes the following:

Electrical power systems.
Grounding electrodes.
Separately derived systems.
Raceways.
Service equipment.
Enclosures.
Equipment.
Lighting standards.

D. Refer to other Division 26 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work; not work of this section.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.

1.4 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of grounding and bonding products, of types and ratings required, and ancillary grounding materials; including stranded cable, copper braid and bus, grounding electrodes and plate electrodes,

and bonding jumpers; whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience on projects with electrical grounding work similar to that required for project.

C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits, and equipment.

2. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment", and 869, "Electrical Service Equipment", pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL listed and labeled for their intended usage.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING:

A. Materials and Components, General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is installer's option. Where materials or components are not indicated, provide products which comply with NEC and UL, requirements, and with established industry standards for those applications indicated.

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.

C. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs, and clamps as recommended by bonding plate, connector, terminal, and clamp manufacturers for indicated applications.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which electrical grounding and bonding connections are to be made, and notify contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.2 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS:

A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions; applicable portions of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices, to ensure that products comply with requirements.

B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

C. Ground each separately-derived system neutral to separate grounding electrode.

D. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

E. All raceways with No. 10 or 12 AWG phase conductors for receptacles, lighting fixtures, and similar circuits shall be provided with a parity-sized green equipment ground conductor. Ground conductor shall be installed in entire raceway system, including wall switches and flexible conduit to light fixtures. Equipment ground conductor sizes for circuits with phase conductors larger than No. 12 AWG are indicated on drawings. Ground conductors shall be connected to ground buss in panelboards.

F. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing. Conductors looped under screw or bolt heads will not be permitted.

G. Connect grounding electrode conductors to one inch (1") diameter or greater metallic cold water pipe, using a suitably sized ground clamp. Provide connections to flanged piping at street side of flange.

H. Install clamp-on connectors on clean metal contact surfaces to ensure electrical conductivity and circuit integrity.

I. Provide a grounding bushing and a continuous copper bonding jumper from the bushing to the equipment ground bus in all feeders. The bonding jumper shall be the same size as the equipment ground conductor.

3.3 FIELD QUALITY CONTROL:

A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over twenty-five (25) ohms, take appropriate action to reduce resistance to twenty-five (25) ohms or less by driving additional ground rods; then retest to demonstrate compliance.

END OF SECTION 26 05 26

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is a part of each Division 26, Division 27, and Division 28 section making reference to electrical supporting devices specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of supports, anchors, sleeves, and seals is indicated by drawings and schedules and/or specified in other Division 26 sections.

B. Types of supports, anchors, sleeves, and seals specified in this Section include the following:

Clevis hangers.
One-hole conduit straps.
Two-hole conduit straps.
Round steel rods.
Expansion anchors.
Toggle bolts.
Wall and floor seals.
Korn Clamps.

C. Supports, anchors, sleeves, and seals furnished as part of factory fabricated equipment are specified as part of that equipment assembly in other Division 26 sections.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience with projects utilizing electrical supporting device work similar to that required for this project.

C. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation", pertaining to anchors, fasteners, hangers, supports, and equipment mounting.

D. UL Compliance: Provide electrical components which are UL listed and labeled.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's data on supporting devices, including catalog cuts, specifications, and installation instructions for each type of support, anchor, sleeve, and seal.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES:

A. General: Provide supporting devices which comply with manufacturer's standard materials, design and construction, in accordance with published product information and as required for complete installation and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is installer's option.

B. Supports: Provide supporting devices of types, sizes, and materials indicated and having the following construction features:

1. Clevis Hangers: For supporting metal conduit; galvanized steel, with ½" diameter hole for round steel rod, approximately 54 pounds per 100 units.

2. Reducing Couplings: Steel rod reducing coupling, ½" by $^{5}/_{8}$", approximately 16 pounds per hundred 100 units.

3. One-Hole Conduit Straps: For supporting metal conduit; galvanized steel, approximately 7 pounds per 100 units.

4. Two-Hole Conduit Straps: For supporting metal conduit; galvanized steel.

5. Hexagon Nuts: For ½" rod size, galvanized steel, approximately 4 pounds per 100 units.

6. Round Steel Rod: ½" diameter, approximately 67 pounds per 100'.

7. Offset Conduit Clamps: For supporting 2" rigid metal conduit; galvanized steel, approximately 200 pounds per 100 units.

C. Anchors: Provide anchors of types, sizes, and materials indicated with the following construction features:

1. Expansion Anchors: ½", approximately thirty-eight 38 pounds per hundred 100 units.

2. Toggle Bolts: Springhead, $^{3}/_{16}$" by 4"; approximately five (5) pounds per hundred 100 units.

D. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated, with the following construction features:

1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated, suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves,

malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws. Seals shall be fire-rated where required.

E. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment; 12-gauge hot-dip galvanized steel of types and sizes indicated. Construct with $^{3}/_{16}$" diameter holes, 8" O.C. on top surface, and with the following fittings which mate and match with U-channel:

Fixture hangers.
Channel hangers.
End caps.
Beam clamps.
Wiring studs.
Thinwall conduit clamps.
Rigid conduit clamps.
Conduit hangers.

2.2 FABRICATED SUPPORTING DEVICES:

A. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Steel Pipe: Fabricate from schedule 40 galvanized steel pipe. Remove burrs.

B. Sleeve Seals: Provide sleeves for piping which penetrate foundation walls below grade or exterior walls. Caulk between sleeve and pipe with nontoxic, UL classified caulking material to ensure watertight seal. Seals shall be fire-rated where required.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES:

A. Install hangers, anchors, sleeves, and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacings indicated and in compliance with NEC requirements.

END OF SECTION 26 05 29

SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this Section.

B. This Section is a Division 26 Basic Electrical Materials and Methods section and is part of each Division 26, Division 27, and Division 28 section making reference to electrical raceways specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of raceway, electrical box, and associated fitting work is indicated by drawings and schedules.

B. Types of raceways specified in this section include the following:

Electrical metallic tubing (EMT).
Liquid-tight flexible metal conduit.
Rigid metal conduit.
Flexible metal conduit.
Wireways.

C. Types of electrical boxes and fittings specified in this section include the following:

Outlet boxes.
Junction boxes.
Pull boxes.
Floor boxes.
Poke-throughs.

1.3 QUALITY ASSURANCE:

A. Raceway Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Electrical Box and Fitting Manufacturers: Firms regularly engaged in the manufacture of electrical boxes and fittings of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

C. Installer's Qualifications: Firms with at least three (3) years of successful installation experience on projects with electrical raceway work similar to that required for this project.

D. Codes and Standards:

1. UL Compliance and Labeling

a. Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL listed and labeled.

b. Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL listed and labeled.

2. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING:

A. General: Provide metal conduit, tubing, and fittings of types, grades, sizes, and weights (wall thicknesses) for each service indicated.

B. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.

C. Rigid Steel Conduit: Provide rigid steel, hot dipped galvanized, threaded type.

D. Flexible Metal Conduit: UL 1 formed from continuous length of spirally-wound, interlocked, zinc-coated strip steel.

E. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit. Construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside. Coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).

F. Rigid Metal Conduit Fittings: Cast malleable iron, galvanized or cadmium plated.

1. Use Type 1 fittings for rain-tight connections.

2. Use Type 2 fittings for concrete tight connections.

G. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless, hinged clamp type.

1. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

2. 45° or 90° Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

H. Liquid-Tight Flexible Metal Conduit Fittings: Provide cadmium plated, malleable iron fittings with compression-type, steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.

I. Electrical Metallic Tubing (EMT): UL 797.

J. EMT Fittings: Couplings and connectors for conduit sizes 2" and smaller shall be steel hex-nut, expansion-gland type, zinc or cadmium plated. Set screw type fittings may be used for conduit sizes 2½" and larger.

2.2 WIREWAYS:

A. General: Provide electrical wireways of types, grades, sizes, and number of channels for each type of service as indicated. Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other components and accessories as required for complete system.

B. Lay-in Wireways: Construct lay-in wireways with hinged covers in accordance with UL 870 and with components UL-listed, including lengths, connectors, and fittings. Select units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wireways with knockouts.

1. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached so that removal is not necessary to utilize the lay-in feature.

2. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.

C. Rain-tight Wireway: Construct rain-tight lay-in wireways with hinged covers, in accordance with UL 870 and with components UL listed, including lengths, connectors, and fittings. Design units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wireway units with knockouts only in bottom of troughs.

D. Rain-tight Troughs: Construct in accordance with UL 870, with components UL-listed.

1. Construction: 16-gauge galvanized sheet metal parts for 4"x4" to 6"x6" sections, and 14-gauge parts for 8"x8" and larger sections. Provide knockouts only in bottom of troughs, with suitable adapters to facilitate attaching to other NEMA 3R enclosures. Do not use gasketing that can rip or tear during installation, or would compromise rain-tight capability of the trough. Do not use cover screws that will protrude into the trough area and damage wire insulation.

2. Finish: Provide 14-gauge and 16-gauge galvanized sheet metal parts with corrosion-resistant phosphate primer and baked enamel finish. Plate hardware to prevent corrosion.

2.3 FABRICATED MATERIALS:

A. Outlet Boxes: Provide galvanized coated flat-rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes (including box depths as indicated), suitable for installation at respective locations. Construct outlet boxes with mounting holes and with cable and conduit-size knockout openings in bottom and sides.

1. Outlet Box Accessories: Provide outlet box accessories as required for each installation; including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations.

2. Ceiling boxes shall be 4" square (or octagonal, $1^1/_8$") deep for exposed work or furred ceiling work and 3" deep for concrete work. Plaster rings and/or fixture studs shall be provided where required.

B. Device Boxes: Provide galvanized coated flat-rolled sheet-steel, non-gangable device boxes, of shapes, cubic inch capacities, and sizes (including box depths as indicated), suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps and for equipment type grounding.

1. Device Box Accessories: Provide device box accessories as required for each installation; including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations.

2. Flush mounted wall outlets shall be 4" square boxes or gang boxes, not less than 1½" deep. Boxes shall be provided with extension rings and/or covers with sufficient depth to bring the covers flush with the finished wall.

3. Boxes for flush mounting in concrete block work with one or two devices shall have covers with square corners on the raised portion of the cover. The covers shall have a sufficient amount of depth to be flush with the face of the block. Covers shall be Steel City 52-C series. Boxes for more than two devices shall be Steel City "GW" gang boxes. The bottom side of the covers or boxes shall be installed at the masonry course nearest to the dimension specified or noted.

4. Outlet boxes for exposed wall mounting and outdoor installation shall be cast metal type "FS" or "FD" boxes with suitable cast aluminum covers. Weatherproof receptacle covers shall have spring hinged lids.

C. Rain-Tight Outlet Boxes: Provide corrosion-resistant, cast-metal, rain-tight outlet wiring boxes; of types, shapes and sizes (including depth of boxes), with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring-hinged watertight caps

suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.

D. Junction and Pull Boxes: Provide galvanized, code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

PART 3 - EXECUTION

3.1 OBSERVATION:

A. Examine areas and conditions under which raceways are to be installed and substrate which will support raceways. Notify contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 INSTALLATION OF RACEWAYS:

A. General: Raceways run below grade, under floors on grade, or in concrete shall be rigid steel conduit. All other raceways may be thin wall conduit.

B Conduit run above accessible ceilings shall be supported from the structure and shall not be supported from, or attached to, ceiling suspension system. Double locknuts shall be used on all rigid conduit terminations except threaded hubs. All conduit shall be made up tight and no running threads will be permitted. "Erickson" couplings shall be used where necessary. All metallic conduit runs below grade or under floors on grade shall be given one (1) coat of Rust-Oleum 'Gray Primer' and one (1) heavy coat of Rust-Oleum 'Flat Black' acrylic paint or a heavy coat of an approved non-bitumastic asphaltic type compound.

C. Sizes of raceways shall be not less than NEC requirements and shall not in any case be less than indicated on the drawings. Larger size raceways and/or pull boxes shall be installed if there is excessive length of unbroken run or excessive number of bends. Combining of circuits other than those indicated on the drawings will not be permitted.

D. Coordinate with other work, including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.

1. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.

2. Use roughing-in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.

3. Provide nylon pull cord in empty conduits where indicated. Test all empty conduits with ball mandrel. Clear any conduit which rejects ball mandrel. Pay

costs involved for restoration of conduit and surrounding surfaces to original condition.

4. Use liquid-tight flexible conduit where subjected to one or more of the following conditions:

   a. Exterior location.
   b. Moist or humid atmosphere where condensate can be expected to accumulate.
   c. Corrosive atmosphere.
   d. Subjected to water spray or dripping oil, water, or grease.

E. Cut conduits straight, ream properly, and cut threads for heavy wall conduit deep and clean.

F. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.

G. Fasten conduit terminations in sheet metal enclosures by two (2) locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.

H. Conduits are not to cross pipe shafts or ventilating duct openings.

I. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes, or other sources of heat. Do not install horizontal raceway runs below water and steam piping.

J. Support riser conduit at each floor level with clamp hangers.

K. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.

L. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

M. Concealed Conduits:

1. Metallic raceways installed underground or in floors below grade, or outside are to have conduit threads painted with corrosion-inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure water tightness.

2. For floors-on-grade, install conduits under concrete slabs.

3. Install underground conduits a minimum of 24" below finished grade.

N. Conduits in Concrete Slabs:

1. Place conduits between bottom reinforcing steel and top reinforcing steel. Place conduits either parallel or at 90 degrees to main reinforcing steel.

2. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.

3. Conduits crossing in slab must be reviewed for proper cover by engineer.

4. Embedded conduit diameter is not to exceed one-third (1/3) of slab thickness.

O. Install conduits as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.

P. Exposed Conduits:

1. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.

2. Install exposed conduit work as not to interfere with ceiling inserts, lights, or ventilation ducts or outlets.

3. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed 8'-0".

4. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.

5. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings, and in crawl spaces.

Q. Conduit Fittings:

1. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.
2. Bushings for terminating conduits smaller than 1" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.

3. Install insulated type bushings for terminating conduits 1" and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.

4. Bushing of standard or insulated type to have screw type grounding terminal.

5. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs to be specifically designed for their particular application.

3.3 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

C. Provide weather-tight outlets for interior and exterior locations exposed to weather or moisture.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring. All existing and new junction boxes within the project area shall be made accessible. Relocate existing junction boxes as required to comply with the NEC.

F. Metallic and approved nonmetallic electrical outlet boxes may be installed in vertical fire resistive assemblies classified as 2-hour or less without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 square inches. Boxes located opposite sides of walls or partitions shall be separated by a horizontal distance of 24".

G. In openings larger than 16 square inches, the wall shall be built around openings so as not to interfere with the integrity of the wall rating.

H. All clearances between such boxes and the gypsum board shall be completely filled with joint compound or other approved material.

I. Position recessed outlet boxes accurately to allow for surface finish thickness.

J. Set floor boxes level and flush with finish flooring material.

K. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

L. Subsequent to installation of boxes, protect boxes from construction debris and damage.

3.4 FIELD QUALITY CONTROL:

A. General: Mechanically assemble metal enclosures and raceways for conductors to form continuous electrical conductor, and connect to electrical boxes, fittings and cabinets as to provide effective electrical continuity and rigid mechanical assembly.

B. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion-inhibiting compound before assembling.

C. Install expansion fittings in all raceways wherever structural expansion joints are crossed.

D. Make changes in direction of raceway run with proper fittings supplied by raceway manufacturer. No field bends of raceway sections will be permitted.

E. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported.

F. Use boxes as supplied by raceway manufacturer wherever junction, pull, or devices boxes are required. Standard electrical "handy" boxes, etc. shall not be permitted for use with surface raceway installations.

G. Raceway penetrations of fire-rated walls and/or floors shall be sealed to maintain integrity of construction. All products, materials, and methods of installation shall be UL approved and meet NFPA requirements.

H. Fire rating of construction assemblies are specified under architectural section of the contract documents.

I. Unless otherwise noted on drawings, notified by architect and/or authorities having jurisdiction, the following materials may be used.

1. Rock wool: Minimum four pound per cubic foot density; flame spread 15, smoke developed 0, fuel contribution 0 by ASTM 384; minimum melting point 2000°F.

2. Concrete and masonry are also approved firestop materials by NFPA 90A.

3. UL approved products such as Nelson Type CLK Silicon Sealant. Manufacturers recommendations shall be strictly followed.

J. Submit complete data on fire-stopping materials and construction methods for review by architect before proceeding with work.

END OF SECTION 26 05 33

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26, Division 27, and Division 28 section making reference to electrical identification specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical identification work is indicated by drawings and schedules.

B. Types of electrical identification work specified in this Section include the following:

Equipment/system identification signs.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIALS:

A. Engraved Plastic-Laminate Signs:

1. General: Provide engraving stock melamine plastic laminate in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated; black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

2. Signs shall be black face with white core plies (letter color).

a. Thickness: 1/16", except as otherwise indicated.

b. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot, or should not, penetrate substrate.

2.2 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations, and other designations used in electrical identification work with corresponding designations shown, specified, or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION:

A. General Installation Requirements:

1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions and requirements of NEC.

2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.

3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Equipment/System Identification:

1. General: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/ control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:

a. Panelboards, electrical cabinets and enclosures.
b. Access panels/doors to electrical facilities.
c. Transformers.
d. Call system master station.
e. Disconnect switches, motor starters, contactors, including current origination.

2. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not, or cannot, penetrate substrate.

END OF SECTION 26 05 53

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is a part of each Division 26, Division 27, and Division 28 section making reference to panelboards specified herein.

1.2 SUMMARY:

A. Extent of panelboard work, is to re-use existing breakers and add breakers into existing panelboards, as indicated by drawings and schedules and as specified herein.

B. Refer to other Division 26 Sections for wires/cables, electrical boxes and fittings, and raceway work required in conjunction with installation of panelboards and enclosures.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's data on panelboards and enclosures. Shop drawings shall indicate arrangement of busses, branch circuits, enclosures, dimensions, etc.

1.4 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of panelboards and enclosures, of types, sizes, and ratings required; whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: A firm with a least three (3) years of successful installation experience on projects utilizing panelboards similar to those required for this project.

C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Article 384 as applicable to the installation and construction of electrical panelboards and enclosures.

2. UL Compliance: Comply with applicable requirements of UL 67, "Electric Panelboards", and UL codes 50, 869, and 1053 pertaining to panelboards, accessories and enclosures. Provide panelboard units which are UL listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electrical panelboard products which may be incorporated in the work include, but are limited to, the following:

1. Square D
2. Siemens
3. Eaton
4. ABB

Square D products are listed as the basis of design. Equivalent equipment from the manufacturers listed above. Contractor shall confirm the submitted equipment fits in the allocated space and code required clearances are maintained.

2.2 PANELBOARDS:

A. General: Except as otherwise indicated, provide panelboards, enclosures, and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials; with the design and construction in accordance with published product information. Equipped with proper number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL, and established industry standards for those applications indicated.

B. Power Distribution Panelboards: Provide dead-front, safety-type power distribution panelboards as indicated; with panelboard switching and protective devices in quantities, ratings, types, and with arrangement shown; with anti-turn, solderless pressure type main lug connectors approved for use with copper conductors. Select unit with feeders connecting at top of panel. Equip with copper bus bars with not less than 98 percent conductivity, and with full-sized neutral bus. Provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Provide bolt-on, molded-case circuit breaker types for each circuit, with toggle handles that indicate when tripped. Provide panelboards with are uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards which mate and match properly with panelboards.

1. Power panelboards shall be Square D type 'I Line'. Voltage shall be as indicated.

C. Lighting and Appliance Panelboards: Provide dead-front safety type lighting and appliance panelboards as indicated; with switching and protective devices in quantities, ratings, types and arrangements shown; with anti-burn solderless pressure type lug connectors approved for use with copper conductors. Construct unit for connecting feeders at top of panel. Equipped with copper bus bars, full-sized neutral bar, with bolt-in type heavy-duty, quick-make, quick-break, circuit-breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required, and provide bare uninsulated grounding bars suitable for bolting to enclosures.

Select enclosures fabricated by same manufacturer as panelboards which mate and match properly with panelboards.

1. Panelboards shall be Square D type 'NQ' or 'NF'. Panelboard boxes shall be five and three-fourths inches (5 ¾") deep. Voltage shall be as indicated.

D. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated; code-gauge, minimum 16-gauge thickness. Cabinets shall be furnished without knock-outs and all holes for raceways shall be drilled and punched on the job. Panelboard enclosures shall be five and three-fourths inches (5 ¾") deep. Provide fronts with adjustable trim clamps and doors with flush locks and keys; all panelboard enclosures keyed alike, with concealed piano door hinges and door swings as indicated. Provide baked gray enamel finish over a rust inhibitor coating. Design enclosures for recessed mounting. Provide enclosures which are fabricated by same manufacturer as panelboards which mate and match properly with panelboards to be enclosed.

E. All panelboards shall be connected distributed phase with circuit numbering as indicated on the drawings. Panelboards shall be numbered with odd numbers on the left side of the panel and even numbers on the right side of the panel. Panelboards shall have a circuit directory card mounted in a frame with plastic cover, mounted on the inside of the door, and directory cards shall be completed with a typewriter to indicated areas and/or devices served by each circuit. All new and existing panelboards being used for this project shall have new typed directories.

F. Panelboards shall be installed complete with connectors and associated hardware for all circuit breakers and circuit breaker spaces listed in the panelboard schedule.

G. When connecting equipment to existing panelboards, the new and existing circuit breakers shall be identified. A new circuit directory card shall be provided.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which panelboards and enclosures are to be installed and notify contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.2 GROUNDING:

A. Provide equipment grounding connections for panelboard enclosures as indicated.

B. Prior to energization, check panelboards for electrical continuity of circuits and for short-circuits.

3.4 ADJUSTING AND CLEANING:

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finishes.

END OF SECTION 26 24 16

SECTION 26 27 26 – WIRING DEVICES

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26, Division 27, and Division 28 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.

B. Types of electrical wiring devices in this section include the following:

Receptacles.
Ground-fault circuit interrupters.
Switches.
Wallplates.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience on projects utilizing wiring devices similar to those required for this project.

C. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.

D. UL Compliance: Provide wiring devices which are UL listed and labeled.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's data on electrical wiring devices.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, manufacturers providing wiring devices which may be incorporated in the work include; but are not limited to, the following (for each type and rating of wiring device):

Arrow-Hart, Cooper Industries
Bryant Electric, Inc.
Eagle Electric Manufacturing Co., Inc.
Harvey Hubbell Inc.
Pass and Seymour Inc.
Leviton Manufacturing Co. Inc.

2.2 FABRICATED WIRING DEVICES:

A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds. Pub/No. WD 1. Provide ivory color devices except as otherwise indicated.

B. Receptacles:

1. All receptacles shall be the grounding type with ground connection made through an extra pole which shall be permanently connected to the green grounding conductor.

2. Duplex receptacles for 20 ampere, 120 volt service shall be two-pole, three-wire receptacles, rated 20 amperes at 125 volts. Receptacles shall be Specification Grade.

3. Single receptacles for 20 amps, 120 volts service shall be two-pole, three-wire rated 20 amperes at 125 volts. Receptacles shall be Specification Grade.

4. Ground-fault interrupters duplex receptacles for 20 ampere, 120 volt service shall be two-pole, three-wire receptacles, rated 20 amperes at 125 volts. Receptacles shall be Specification Grade.

C. Switches:

1. Snap: Provide toggle switches, rated 20 amperes at 120/277 volts, quiet type, and shall be UL approved without derating for tungsten lamp loads or inductive loads. All switches shall have a grounding terminal which shall be connected to the green grounding conductor. The following catalog numbers are Legrand Pass & Seymour.

Type	Catalog No.
Single Pole	PS20AC1
Three Way	PS20AC3
Four Way	PS20AC4

2. Single pole switches with pilot light handle shall be Legrand Pass & Seymour Catalog No. PS20AC1-CPL7.

2.3 WIRING DEVICE ACCESSORIES:

A. Wallplates: Provide wallplates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached.

B. Cover plates for flush mounted wall boxes shall be .035 inch thick, type 302 stainless steel with satin finish and suitable for the device covered and/or purpose intended. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES:

A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.

B. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.

C. Install wiring devices after wiring work is completed.

D. Install wallplates after painting work is completed.

3.2 PROTECTION OF WALLPLATES AND RECEPTACLES:

A. Upon installation of wallplates and receptacles, advise contractor regarding proper and cautious use of convenience outlets. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.3 GROUNDING:

A. Provide equipment grounding connections for all wiring devices, unless otherwise indicated.

3.4 TESTING:

A. Prior to energizing circuitry, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 26 27 26

SECTION 26 51 00 – LIGHTING

1.1 RELATED DOCUMENTS:

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

B. This is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26, Division 27, and Division 28 referring to lighting fixtures specified herein.

1.2 SUMMARY:

A. Extent, location, and details of lighting work are indicated on drawings and in schedules.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's product data and installation instructions on each type building lighting fixture, and component.

B. Shop Drawings: Submit fixture shop drawings in booklet form, with separate sheet for each fixture assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet. Submit details indicating compatibility with ceiling grid system

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of lighting fixtures of sizes, types, and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer Qualifications: Firms with at least three (3) years of successful installation experience on projects with lighting fixture work similar to that required for this project.

C. Codes and Standards:

1. UL Compliance: Comply with UL standards pertaining to lighting fixtures. Provide lighting fixtures and components which are UL listed and labeled.

2. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.5 STORAGE, AND HANDLING:

A. Store lighting fixtures inside well-ventilated area, protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat and blocked off ground.

B. Handle lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.6 SEQUENCING AND SCHEDULING:

A. Coordinate with other work, including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of lighting fixtures with other work.

B. Sequence lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

PART 2 - PRODUCTS

2.1 LED FIXTURES

A. Except as otherwise indicated; provide LED luminaires, of types and sizes indicated on fixture schedules.

B. Include the following features unless otherwise indicated:

1. Each Luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).

2. Each luminaire shall be rated for a minimum operational life of 50,000 hours utilizing a minimum ambient temperature of (25°C).

3. Light Emitting Diodes tested under LM-80 Standards for a minimum of 12,000 hours.

4. Color Rendering Index (CRI) of 82 at a minimum.

5. Color temperature 4,000 K, unless otherwise indicated.

6. Rated lumen maintenance at 70% lumen output for 50,000 hours, unless otherwise indicated.

7. Fixture efficacy of 60 Lumens/Watt, minimum.

8. 5 year luminaire warranty, minimum.

9. Photometry must comply with IESNA LM-79.

10. The individual LEDs shall be constructed such that a catastrophic loss of the failure of one LED will not result in the loss of the entire luminaire.

11. Luminaire shall be constructed such that LED modules may be replaced or repaired without the replacement of the whole fixture.

C. Technical Requirements

1. Luminaire shall have a minimum efficacy of 60 lumens per watt. The luminaire shall not consume power in the off state.

2. Operation Voltage: The luminaire shall operate from a 50 HZ to 60 HZ AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.

3. Power Factor: The luminaire shall have a power factor of 0.9 or greater.

4. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 15 percent.

5. Operational Performance: The LED circuitry shall prevent visible flicker to the unaided eye over the voltage range specified above.

D. Thermal Management

1. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.

2. The LED manufacturer’s maximum thermal pad temperature for the expected life shall not be exceeded.

3. Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.

4. The luminaire shall have a minimum heat sink surface such that LED manufacturer’s maximum junction temperature is not exceeded at maximum rated ambient temperature.

F. DRIVERS FOR LED FIXTURES:

Electronic Driver for LED Fixtures: Comply with UL 1310 Class 2 requirements for dry and damp locations. Include the following features unless otherwise indicated:

1. Rated for 50,000 hours of life, unless otherwise noted.

2. Sound Rating: Class A.

3. Total Harmonic Distortion Rating: 15 percent or less.

4. Current Crest Factor: 1.5 or less.

5. 0-10V Dimming Standard (Step Dimming does not qualify)

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures. Notify contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 INSTALLATION OF LIGHTING FIXTURES:

A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by architect/engineer.

C. Install flush-mounted fixtures properly to eliminate light leakage between fixture frame and finished surface.

D. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

E. Fasten fixtures securely to indicated structural supports and ensure that pendant fixtures are plumb and level.

F. Recessed incandescent or high intensity discharge fixtures shall be centered in the ceiling tile, structural pan, or other visually controlling feature, unless otherwise noted on drawings. Verify architectural drawings for applicable notes and details.

G. Lay-in fixtures shall be independently supported with two supports on opposite corners and have T-bar clips installed.

H. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacture's published torque tightening values for equipment connectors.

I. Support surface mounted fixtures greater than two feet (2') in length at a point in addition to the outlet box fixture stud.

3.3 ADJUSTING AND CLEANING:

A. Clean lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses. Fixtures shall be lamped with new lamps at the time of final inspection.

B. Protect installed fixtures from damage during remainder of construction period.

3.4 GROUNDING:

A. Provide equipment grounding connections for lighting fixtures as indicated.

3.5 DEMONSTRATION:

A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance. Otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 26 51 00

SECTION 28 31 11 - FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 Section making reference to fire alarm systems specified herein.

1.2 DESCRIPTION OF WORK:

The existing Fire Alarm system shall be reworked and the existing devices shall be modified and relocated as indicated on the contract documents. Provide new devices as required per the contract documents. All new devices shall be compatible with the existing Edwards fire alarm system. The electrical contractor shall provide the conduit, back boxes, and system devices as noted.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. NEC Compliance: Comply with applicable requirements of NEC standards pertaining to fire alarm systems.

2. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to fire alarm systems, and provide products and components which are UL listed and labeled.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of fire alarm system equipment. Include standard or typical riser and wiring diagrams and operation and maintenance instructions for inclusion in maintenance manuals.

B. Maintenance Data: Submit maintenance data and parts lists for each type of fire alarm equipment installed, including furnished specialties and accessories. Include this data, product data, and shop drawings in maintenance manual in accordance with requirements of Division 1.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Handle fire alarm equipment carefully to prevent damage, breaking, and scoring. Do not install damaged equipment or components; replace with new.

B. Store fire alarm equipment in clean, dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: The Subject to compliance with requirements, manufacturers offering fire alarm systems which may be incorporated in the work include, but are not limited to, the following:

1. Siemens.

2.2 Scope of Work:

A. The Contractor, during remodeling, shall relocate/provide devices as shown on drawings to match existing. Reconnect to existing circuit in respective fire zone.

2.3 SYSTEM OPERATION

A. Upon activation of any alarm initiating device (manual station, flow switch, heat detector, or smoke detector) the following shall occur:

1. Energize all alarm signaling devices.

2. Sound all audible alarms and flash visual signals throughout the facility.

3. Alert the local fire department directly by way of the proprietary system.

4. Cause the alarm location to be displayed on the annunciator section of the control panel and at each remote annunciator.

5. Close all doors held open by automatic release devices throughout the facility.

6. Fan shut down relays shall be de-energized and shall interrupt control power to air handling units and associated exhaust fans. Isolation room fans shall not shut down.

2.4 SYSTEM COMPONENTS

A. Strobe units shall match existing and shall be compatible with existing Siemens fire alarm system.

B. Wiring

1. All fire alarm system wiring must be new.

2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits and signaling line circuits, and 14 AWG (1.63 mm) for notification appliance circuits.

3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).

5. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

6. All analog voice speaker and analog telephone circuits shall use twisted/shielded pair to eliminate cross talk.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which fire alarm systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 INSTALLATION OF BASIC WIRING SYSTEM MATERIALS:

A. Install wiring, raceways, and electrical boxes and fittings in accordance with Division 16 Basic Electrical Materials and Methods sections, "Raceways", "Wires and Cables", and "Electrical Boxes and Fittings" for wiring of non-power-limited circuits.

B. The manufacturer shall furnish complete wiring diagrams and installation and operation instruction for the system. The required interconnecting wiring may vary with different equipment manufacturers; therefore, the wiring indicated on the drawings is intended only a guide, and necessary adjustments in number of conductors and raceway sizes shall be made to suit the particular system being furnished at no extra cost.

C. All wiring shall be in conduit color coded in accordance with the facility standard color code and manufacturer's recommendations and shall be terminated with spade type lugs. Termination at the control unit shall be identified as to zone and use. All wiring shall test free from opens and grounds prior to final connections.

D. Install wires and cables without splices. Make connections at terminal strips in cabinets or at equipment terminals. Make soldered splices in electronic circuits in control cabinets.

E. Wiring control equipment incorporating standby power: The control equipment shall be provided with operating power from a fused 2 wire, 120 volt, single phase, 60 hertz source. This power shall be converted to 24 volts DC for system operation. Transformers must be mounted with the cabinet. In the event of failure of the operating supply, the system shall transfer automatically to a standby battery. The battery shall be of the nickel cadmium type, with sufficient capacity to operate the system under normal supervision for up to 24 hours.

F. Wiring of control equipment not incorporating standby power. The system shall operate from 2 phase and a neutral of a 208 volt, 3 phase, 4 wire service. The main operating power shall be taken from one side to neutral; the trouble signal circuit shall be taken from the other side to neutral.

G. Conductors color coding:

ITEM	COLOR
Fire Alarm Station, Smoke Detector Alarm, Heat Detector	Violet & Pink
Alarm Signal Devices	Yellow & Blue
Recall Signal	Yellow & Blue
Flashing Lights	Orange
Door Holders	White
Air Handler Shutdown Relays	Purple
Smoke Detector Power	Black & Red
Smoke Detector Supervisory	Brown
Fire Alarm Panel Power	Black & White

3.3 FIELD QUALITY CONTROL:

A. Where work consists of additions or extensions to existing system, prior to starting work, establish that system is in proper working order. If condition exists which prevents normal operation of specified additions and extensions, bring this fact to the architect/engineer's attention prior to doing work affecting existing system. Where work is done without such notification, it is assumed that connections have been made to a working system, and performance requirements and guarantee will apply to entire system.

B. System Test and Approval: Prior to final acceptance of systems, manufacturer of system shall, in presence of contractor, owner's representative and architect's/engineer's representative, test each sensing or detection and alarm device.

C. Submit copy of test results in duplicate after signed by owner's representative to architect/engineer.

3.4 TESTING:

A. All new and existing detectors within the project fire alarm zones shall be tested per NFPA 72. A detector sensitivity test report shall be completed prior to AHCA final inspection. A sample test report is included at the end of this Section.

B. To assure that each smoke detector is operative and produces the intended response, it shall be caused to initiate an alarm at its installed location with smoke or other aerosol acceptable to the manufacturer that demonstrates that smoke can enter the chamber and initiate an alarm.

C. The detector sensitivity shall not be tested or measured using any spray device that administers an unmeasured concentration of aerosol into the detector. To assure that each smoke detector is within its listed and marked sensitivity range, it shall be tested using either:
   1. A calibrated test method, or

2. The manufacturer's calibrated sensitivity test instrument, or
3. Listed control equipment arranged for the purpose, or
4. Other calibrated sensitivity test method acceptable to the authority having jurisdiction.

D. Smoke Detectors are to be sensitivity tested at start of project and devices should be replaced as indicated by test. Detectors found to have a sensitivity outside the approved range shall be replaced. As an exception, detectors listed as field adjustable may be either adjusted within an approved range or replaced.

E. After demonstration tests for Fire Marshal and for AHCA, system report is to be completed and submitted to the Project Superintendent.

END OF SECTION 28 31 11

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

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

1.3 INSTRUCTION PROGRAM

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

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

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

    a. Equipment function.
    b. Operating characteristics.

2. Documentation: Review the following items in detail:

    a. Systems and equipment operation manuals.
    b. Systems and equipment maintenance manuals.
    c. Product maintenance manuals.
    d. Warranties and bonds.
    e. Maintenance service agreements and similar continuing commitments.

3. Operations: Include the following, as applicable:

a. Routine and normal operating instructions.
b. Special operating instructions and procedures.

4. Adjustments: Include the following:

a. Checking adjustments.

5. Troubleshooting: Include the following:

a. Test and inspection procedures.

6. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

7. Repairs: Include the following:

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

1.4 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training.

B. Set up instructional equipment at instruction location.

1.5 INSTRUCTION

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

B. Scheduling: Provide instruction at mutually agreed-on times.

1. Schedule training with Owner, with at least fourteen days' advance notice.

C. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.6 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. Provide video recordings used as a component of training.

PART 2 - PRODUCTS

A. Toilet Partitions

B. Automatic Flush Valves

C. Automatic Faucets

D. Soap Dispensers

E. Sanitary Napkin Dispensers

F. Lighting & Lighted Mirrors

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 MATERIALS OWNERSHIP

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

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

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

1.2 FIELD CONDITIONS

A. Conduct selective demolition so Owner's operations will not be disrupted.

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

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition. Conduct investigative demo as described in plans for Architect review prior to proceeding with full demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.sd

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

1. Maintain fire-protection facilities in service during selective demolition operations.

1.3 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

C. Sustainable Design Requirements for Building Reuse:

1. Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 PROTECTION

A. Remove temporary barricades and protections where hazards no longer exist.

3.3 CLEANING

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

END OF SECTION

SECTION 033053 – MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL (Not Applicable)

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

    a. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft..

2. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

B. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S240.

2.2 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

3.4 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.5 REPAIR

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

3.6 PROTECTION

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

END OF SECTION

SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.3 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Composites, Inc.
b. Glasteel.
c. Marlite.
d. Parkland Plastics, Inc.

2. Surface Finish: Molded pebble texture As selected by Architect from manufacturer's full range.

3. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: As selected by Architect from manufacturer's full range.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer.

E. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

1. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches wide.

1. Mark plumb lines on substrate at panel joint locations for accurate installation.
2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.

1. Drill oversized fastener holes in panels and center fasteners in holes.
2. Apply sealant to fastener holes before installing fasteners.

D. Install factory-laminated panels using concealed mounting splines in panel joints.

E. Install trim accessories with adhesive. Do not fasten through panels.

F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 071210 - FLUID APPLIED

WATERPROOFING PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Furnish all labor, materials, tools, equipment, taxes, and insurance, etc., as well as necessary services and incidentals to the complete preparation of surfaces, delivery and material installation of this Section as shown, noted, detailed, necessary to provide a waterproof and sealed system, as indicated on the Drawings and in the Specifications.

1.3 SECTION INCLUDES

A. Fluid applied membrane waterproofing and flashing.

1.4 RELATED SECTIONS

A. Coordinate work of this Section with work of other Sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other Sections, including:

1. Section 07 90 00 – Caulking and Sealants
2. Section 09 31 00 – Ceramic Tile for Tiled Floor Waterproofing System

1.5 REFERENCES

A. The latest versions of all referenced standards, whether indicated or not, shall be applied to the work of this Section.

B. ASTM C 836 - Tests for High Solids Content, Fluid Applied Membranes.

C. ASTM D 412 - Tests for Rubber Properties in Tension.

D. ASTM D 624 - Tests for Rubber Properties - Tear Resistance.

E. ASTM D 2240 - Tests for Rubber Properties - Durometer Hardness.

F. ASTM E 96 - Tests for Water Vapor Transmission of Materials in Sheet Form.

1.6 SYSTEM DESCRIPTION

A. Provide labor, materials, equipment, insurance and incidentals required to apply fluid applied membrane waterproofing, water repellant sealer, and special application waterproofing. Work shall include but not be limited to, the installation of fluid applied liquid waterproofing, sealers, primers, protective flashings, drainage boards/fabric and protection course as indicated on the drawings and within these specifications.

1. Provide primary materials from Tremco, Inc. Sealant/ Waterproofing Division.
2. Provide secondary materials as required and as recommended by Tremco.

B. All work shall conform to applicable Federal, State and local laws andregulations.

1.7 SUBMITTALS

A. Product Data: Submit the following to the Architect in accordance with Division 01 Submittals:

1. Copy of the fluid applied waterproofing manufacturer's specifications, recommendations, and installation instructions for the fluid applied waterproofing membrane system, including priming protection board, and drainage requirements where applicable including priming and protection for specific waterproofing system.
2. Copy of the special applications waterproofing manufacturer's specifications, recommendations, and installation instructions for the cementitious waterproofing coating.
3. Copy of manufacturer's published data, letter of certification, or certified testing laboratory report that each material complies with requirements and is intended for application shown and that warranty of the product can be achieved based on specified millages.
4. Copy of written itemized listing of all products proposed for use at this project.
5. Copies of a written sample warranty, and associated application and report forms required by the manufacturer for warranty purposes.
6. Copy of tile waterproofing system material manufacturer's test data or certified report confirming compatibility between waterproofing materials, tile waterproofing system and rated-floor penetration sealant materials.

B. Shop Drawings: Submit the following drawings:

1. Contractor shall furnish supplementary waterproofing details depicting special joint or terminal conditions and conditions of interface with other materials.

C. Submit (2) two copies of certifications per Article 1.8 – Quality Assurance.

1.8 QUALITY ASSURANCE

A. Inspection: Upon completion of the installation, an inspection shall be made by a technical representative of the fluid applied waterproofing manufacturer to ascertain that the "system"

has been installed in accordance with published specifications and details.

B. Contractor Qualifications: Contractor shall be approved by the fluid applied waterproofing manufacturer for installation of their products.

C. Pre-Installation Conference:

1. Prior to beginning construction, manufacturer's representative and installing contractor shall meet at project site with the Owner's Representative(s), the Architect and the Contractor. Meeting minutes will be recorded. Decisions made at the meeting will be made part of the Project Record.
2. Discuss and finalize the following at the meeting:

a. Review fluid applied waterproofing system requirements (Drawings, Specifications and other Contract Documents).

b. Resolve conflicts, if any, and clarify manufacturer's specifications, and specifications included herein.

c. Review required submittals, both completed and yet to be completed.

d. Limitations imposed by airport operations or other special requirements.

e. Establish areas on site for use as storage areas and working area.

f. Review and finalize construction schedule related to fluid applied waterproofing applications and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

g. Ventilation requirements for non-low VOC materials that may be used.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site with packages intact and with labels identifying the manufacturer, and product name and lot numbers when appropriate.

B. Store approved materials per manufacturer's recommendations.

1.10 PROJECT CONDITIONS

A. Environmental Requirements: Comply with manufacturer’s requirements for environmental conditions under which the waterproofing and sealing systems can be applied.

B. Substrate Requirements:

1. Provide applicator with surfaces that are broom clean, dry, sound and free of voids, bugholes, rockpockets, honeycombs, protrusions, excessive roughness, foreign matter, frost, ice and other contaminants which may inhibit application or performance of the waterproofing membrane system.
2. Using suitable abrasive methods, remove residue of form release, curing compound, chemical retarders and other surface treatments, laitance, mortar smear, sawcutting residue, mill scale, rust, loose material and other contaminants from concrete, masonry and ferrous metal surfaces to receive the work of this Section.

C. Concrete: Where work of this Section will be applied to concrete, provide applicator with surfaces that are smooth with finish equal to one that is light steel troweled followed by a fine hair broom. No curing compounds or sealers shall be used or must be removed prior to appllication of membrane.

D. Chaseways:

1. Slope concrete surfaces at perimeter of drains that have flanges at membrane level which are not flush with deck surfaces.
2. Rigidly install pipe, vents and other surface protrusions, properly flash them, and cover to prevent entry of membrane materials.

E. Metal and Pipe flashings: Where metal or pipe flashings are substrate to waterproofing membrane, set the flashings in continuous bedding bead of urethane sealant; install sealant S-bead between metal laps and mechanically fasten to substrate along leading edges at every 4" on center, staggered linearly, to lay flat without fishmouths.

F. Joints: Configuration shall be consistent with this Section and with all other requirements of the Contract Documents.

1.11 SEQUENCING AND SCHEDULING

A. The Contractor shall coordinate each portion of this work with work of other Sections to ensure that all construction can be completed once it is begun, and to provide for appropriate inter-discipline interfacing.

1.12 WARRANTY

A. Contractor: Provide a written three (3) year warranty against defective materials and defective workmanship, as well as moisture penetration, at 100 percent replacement value. Contractor shall reapply all materials in order to provide a complete correction of moisture penetration, including any/all defective materials and workmanship. The Contractor shall bare all costs associated with such work, including cost(s) to uncover.

B. Manufacturer: Provide a written five (5) year material warranty from the manufacturer against defective materials and leakage. Warranty shall cover 100 percent replacement of the fluid applied waterproofing system, as well as all future work required to maintain the

installations in watertight condition for a period of five (5) years from the date of completion and final acceptance of the original construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Materials and systems as manufactured by Tremco Construction Products constitute the Basis of Design for fluid applied waterproofing. Refer to Article 2.2 – Materials for other manufacturers listed by product.

B. The following listed manufacturers provide materials and systems acceptable for the Work of this section. Note that warranty provisions submittal requirements, quality assurance requirements, etc., also apply, as specified, to these systems.

1. Recommended systems by Tremco, Inc.

2.2 MATERIALS

A. Fluid applied membrane waterproofing system (basis of design) to be installed within the chaseways (non-tiled) areas of the project as scheduled or shown on theDrawings.

1. TREMproof 250GC by Tremco; horizontal, roller and vertical grades.
2. Vulkem 350 and 351 by Tremco; base coat, aggregate protective course, and top coat.
3. Vulkem 350R by Tremco; base coat system.

B. Substrate / Equipment Cleaner: #200 cleaner by Tremco.

C. Component Materials Manufactured by Tremco:

1. Dymeric 240 FC for Cants.
2. Primer #181 for Metal and PVC.
3. Bonding Primer #171 for Dymeric 2240 FC and Tremproof 250GC, if required by manufacturer.
4. Tremco Dual-Flex Sheeting.
5. Elastomeric sheet flashing: Tremco Dual-Flex Flashing System or Sika "Combiflex" System.
6. Sealant: As recommended by membrane manufacturer and equal to Tremco THC 900/901 or Dymeric 240FC or Vulkem 227 or Vulkem 45SSL.

D. Other component materials not manufactured by Tremco:

1. Aggregate for the Vulkem 350 base coat / aggregate protective course to be a silica composition of at least 6.5 on the MOH's scale of hardness. Aggregate shape to be round to sub-angular in the 16-40 mesh size. A minimum of 80 percent of the aggregate to be 16-30 mesh size. No more than 2 percent fines passing a 70 mesh

screen is acceptable. Aggregate shall contain not more than 1/2 of 1 percent of iron oxide.
2. Joint backer to be closed cell polyethylene backer rod.
3. Cant strip for changes in direction of waterproofing: small cant strip for use in planters, large cant strip for use under pavers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The applying Contractor shall be responsible for inspecting the substrate and verifying that no conditions are present which may prevent or otherwise interfere with installation of the fluid applied waterproofing system or sealer or with obtaining the required manufacturer's warranty.

B. Any adverse condition which might affect the performance of the waterproofing must be reported in writing to the Architect prior to the start of work.

3.2 PREPARATION

A. General:

1. Poured-in-place concrete shall have a smooth, light trowel finish followed by fine hair broom or equivalent finish.
2. Poured-in-place concrete shall have a minimum curing period of 28 days prior to the application of fluid applied waterproofing, unless products are specifically approved by the manufacturer for application over “green” concrete, which has cured for less than 28 days.
3. Prepare surfaces to be free of defects such as holes; cracks; contamination consisting of dirt, dust, grease, efflorescence and other foreign material.

a. All shrinkage shall be pretreated with not less than 60 wet mils of coating extending a minimum of 3" either side of crack.
b. Cracks 1/16" and over, and cold joints shall be routed to 3/8" wide by 1/2" deep, insert approved joint backing and seal with manufacturer's fluid applied membrane material.

B. Protect all adjacent surfaces not designated to receive waterproofing. Mask off adjoining surfaces not to receive membrane system

C. Beginning the installation shall be interpreted as acceptance of the substrate / deck as an acceptable surface for the application of the waterproofing system.

D. Surface preparation and detailing procedures to be in accord with waterproof membrane system manufacturer's instructions and recommendations except where more stringent requirements are indicated.

E. Clean all deck surfaces to receive membrane system in accordance with manufacturer's instructions; vacuum clean or blow clean with oil-free compressed air all surfaces to receive sealants, detailing materials or membranes immediately prior to installation.

F. Clean metal surfaces to bright metal by wire brushing or mechanical etching; scuff-sand lead flashing and plastic surfaces.

G. Prime surfaces in accord with manufacturer's instructions.

H. Install 1/4" diameter backer rod into corner of all horizontal-to-vertical junctures subject to movement and cover with 1/2" minimum detail cant of approved sealant; install 1" detail cants at projections, curbs and other horizontal-to-vertical junctures.

I. Install detail coats, joint and crack treatments, and liquid flashings in accord with manufacturer's instructions. Detail with 12 inch 60 mil coat of 250GC membrane over joint and embed reamy cloth strip 12 inch wide into wet membrane and apply second 30 mil detail coat of 250GC membrane over cloth.

J. Verify that all patching, sealants, etc. work in related sections have been performed, as well as fully cured in accord with manufacturer's instructions prior to application of fluid applied waterproofing.

K. Insure that all surfaces are completely dry prior to fluid applied waterproofing membrane application.

1. Prior to initiating work, moisture content of the substrate shall be tested by placing a section of rubber mat against the surface of the deck and allowed to stand for a minimum period of 12 hours. Upon removal, if moisture can be detected, the concrete substrates must be given ample time to fully cure.
2. Retesting is required, until such time that no moisture can be detected.

3.3 APPLICATION

A. General: Install waterproofing system in accord with manufacturer's recommendations and instructions as applies to the Work except where more stringent requirements are indicated.

1. Waterproofing membrane shall average 120 mil dry-film thickness.
2. Grid deck surfaces to assure proper coverage rates and verify membrane wet-film mil thickness with gauges as work progresses.
3. Retain empty product containers during course of work to aid in determining whether completed membrane complies with required average dry-film thickness.

B. Provide fluid applied waterproofing membrane per manufacturer's installation instructions including deck primer.

C. Provide clear water repellant sealer per manufacturer's installation instructions.

D. Provide special applications waterproofing per manufacturer's installation instructions.

E. Wipe clean all detail coats with white rags wetted with Xylene solvent; do not saturate detail coat.

F. Apply membrane uniformly and allow to cure in accord with manufacturer's instructions.

G. Feather terminating edge when entire area cannot be completed in one day; clean area 6" wide along terminating edge of membrane with Xylene solvent on clean white rags prior to startup on next working day; use interlaminary primer per manufacturer's instructions as needed; overlap existing work by 6" with new work.

H. At changes of plane and at existing walls, apply V-grade waterproofing membrane, reinforced fabric flashings, and cant strips as recommended by manufacturer.

I. Fluid Applied Membrane:

1. Apply fluid applied membrane waterproofing to all properly prepared concrete substrates at a coverage rate per Tremco's installation instructions.

    a. The "wet" film thickness of each coat shall be checked periodically during the application by averaging numerous measurements taken with standard film gauge.

    b. "Holidays" will not be accepted and are to be repaired with additional material until specified minimum mil thicknesses are achieved.

2. Upon completion of waterproofing procedures, allow fluid applied membrane materials to achieve a full cure (36 hours minimum at 70EF / 60 percent RH) prior to flood testing of the system.
3. Tremco 250GC waterproofing may be required to be applied in multiple coats to achieve the 120 mil thickness, per manufacturer’s installation procedure.

L. Flood Test:

1. Prior to framing chase way walls, plug all drains to allow surface flooding (minimum 1/4" depth to cover tops of drains) of chaseway areas to be tested.
2. Flood areas with clean, potable water. After 24 hours, inspect the test areas for leak activity.
3. If leaks are discovered, patch using new waterproofing membrane materials and repeat flood test procedures. Repair or replace damages to construction & existing finishes.

3.4 CLEAN-UP

A. Surfaces adjacent to where fluid applied waterproofing was applied shall be cleaned free of excess material or other soiling due to waterproofing operations. The surfaces shall be cleaned as work progresses.

B. Prevent accidental spilling of waterproofing materials; in event spill:

1. Remove spilled material and waste or other equipment used to clean up spill.
2. Clean surfaces to their original undamaged conditions.

3.5 PROTECTION

A. The Contractor shall protect his work at all times and shall also protect adjacent work and materials by suitable covering or other methods during the progress of his work. Protect against any possibility of over-spray.

B. Freshly coated surfaces located in trafficable areas shall be legibly posted as such immediately following their completion. Provide barricades to protect work, if necessary.

C. The coated surface should not be disturbed for at least 24 to 48 hours.

PART 4 - FLUID APPLIED WATER PROOFING SCHEDULE

4.1 SCHEDULE

A. Install Tremco's "Vulkem 350, including aggregate and 351 where indicated or scheduled on the Drawings, and as noted below:

1. At chaseways over enclosed and un-enclosed spaces below, that are not scheduled to receive a finished tiled surface.
2. Provide aggregate and 351 topping at areas where waterproofing will be left exposed to traffic for a prolonged length of time.
3. Extend water proofing under new metal stud walls and mop sinks at the chase ways. Overlap tiled floor waterproofing systems if products are compatible; however not beyond the restroom face of the metal stud runner.

END OF SECTION 07 12 10

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Insulation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.

1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. For wood-framed construction, install blankets according to ASTM C1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

6. Vapor-Retarder-Faced Blankets: Tape joints in vapor-retarder facings, and seal each continuous area of insulation to ensure insulation is secured in wall cavity where exposed.

    a. Interior Walls: Set units with facing placed on exposed side of wall.

3.7 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass.
2. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
3. Install insulation to fit snugly without bowing.

3.8 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mildew-resistant joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Joint-sealants.
2. Joint sealant backing materials.

1.3 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
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.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

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

2.2 JOINT SEALANTS, GENERAL

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

2.3 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

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

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

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

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 CLEANING

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

3.5 PROTECTION

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

3.6 JOINT-SEALANT SCHEDULE

A. Exterior joints in horizontal traffic surfaces[**JS-#**]:

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.
b. Tile control and expansion joints.
c. Joints between different materials listed above.

B. Interior joints in horizontal traffic surfaces:

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs.
b. Control and expansion joints in tile flooring.
c. Other joints as indicated on Drawings.

C. Interior joints in vertical surfaces and horizontal nontraffic surfaces:

1. Joint Locations:

a. Tile control and expansion joints.
b. Other joints as indicated on Drawings.

D. Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces:

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated on Drawings.

2. Joint Sealant: .
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 081213 - HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

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

B. Coordinate requirements for installation of door hardwares.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal 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 hollow-metal 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 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

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 hollow-metal frames of type indicated.

2.2 FABRICATION

A. Hollow-Metal 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. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. 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.

3. Terminated Stops: Terminate stops 4 inches above finish floor with a 45 -degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

B. Hardware Preparation: Factory prepare hollow-metal frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal frames for hardware.

PART 3 - EXECUTION

3.1 PREPARATION

A. Drill and tap frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. General: Install hollow-metal frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions. Comply with SDI A250.11.

B. 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.

1. 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.
2. Install frames with removable stops located on secure side of opening.

C. Solidly pack mineral-fiber insulation inside frames.

D. Installation Tolerances: Adjust hollow-metal 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.

3.3 CLEANING AND TOUCHUP

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. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

END OF SECTION

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Factory flush wood doors.

1.2 ACTION SUBMITTALS

A. Shop Drawings:

1. Door schedule indicating door location, size, fire protection rating, and swing.
2. Doors to be factory finished and application requirements.

B. Samples for Initial Selection: For finish stain color selection.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.4 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

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

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood 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 UL 10C.

2.3 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR SEMI-TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. VT Industries Inc.

2. Performance Grade: ANSI/WDMA I.S. 1A Standard Duty.
3. Performance Grade by Location:

a. ANSI/WDMA I.S. 1A Standard Duty: .

4. Architectural Woodwork Standards Grade: .
5. Faces: Single-ply wood veneer not less than 1/50 inch thick.

    a. Species: Aspen, Select white ash, Select white birch, Select white maple, Sycamore.
    b. Cut: Rift cut.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

    a. Secure with countersunk, concealed fasteners and blind nailing.
    b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

        1) For factory-finished items, use filler matching finish of items being installed.
3. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

    a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

    a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
    b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
    c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
    d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

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

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

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.

E. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

F. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

B. Related Requirements:

1. Section 081213 "Hollow Metal Frames" for door silencers provided as part of hollow-metal frames.
2. Section 081416 "Flush Wood Doors" for integral intumescent seals provided as part of labeled fire-rated assemblies.

1.2 COORDINATION

A. Floor-Recessed Door Hardware: Coordinate layout and installation with floor construction.

1. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

B. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule [**after**][**or**][**concurrent with**] submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format[**and use same door numbers**] as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

a. Identification number, location, hand, fire rating, size, and material of each door and frame.
b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
e. Fastenings and other installation information.
f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
g. Mounting locations for door hardware.
h. List of related door devices specified in other Sections for each door and frame.

C. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 CLOSEOUT SUBMITTALS

A. Schedules: Final door hardware schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

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

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Manual Closers: 10 years from date of Substantial Completion.
b. Concealed Floor Closers: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested in accordance with UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design".

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
    c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

    a. Wood or Machine Screws: For the following:

        1) Strike plates to frames.
        2) Closers to doors and frames.

    b. Steel Through Bolts: For the following unless door blocking is provided:

        1) Surface hinges to doors.

2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 MAINTENANCE SERVICE

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

B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.8 DOOR HARDWARE SCHEDULE

A.

Abbreviation	Name
BES	Best Locking Systems
IVE	H.B. Ives
LCN	LCN Commercial Division
SCH	Schlage Lock Company

Hardware Group No. 01 Concourse A & B, Plumbing Chase Access

201 208 223* 303 305 308
311

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE*		652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER	FINAL CORES BY OWNER	626	BES
1	EA	WALL STOP	WS406CCV	630	IVE
1	SET	GASKETING			
1	EA	DOOR BOTTOM			
3	EA	SILENCER	SR64	GRY	IVE

* CONCEALED HINGES - 223 only

Hardware Group No. 01 EXT Bagclaim Janitor rooms

104E 106E

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER	FINAL CORES BY OWNER	626	BES
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS436/FS438	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

EXISTING FRAME TO REMAIN - NEW DOOR & HARDWARE. CONTRACTOR/HARDWARE SUPPLIER TO VERIFY EXISTING CONDITIONS FOR NEW HARDWARE REQUIREMENTS.

Hardware Group No. 02 Bagclaim Entrance Hallway Janitor room

101
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER	FINAL CORES BY OWNER	626	BES
1	EA	SURFACE CLOSER	4050A RW/PA TBSRT	689	LCN
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS436/FS438	626	IVE
1	SET	GASKETING			
1	EA	DOOR BOTTOM			
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 02 EXT Concourse B – Janitor Room

306E 307E
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER	FINAL CORES BY OWNER	626	BES
1	EA	SURFACE CLOSER	4050A RW/PA TBSRT	689	LCN
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

EXISTING FRAME TO REMAIN - NEW DOOR & HARDWARE. CONTRACTOR/HARDWARE SUPPLIER TO VERIFY EXISTING CONDITIONS FOR NEW HARDWARE REQUIREMENTS.

Hardware Group No. 03 Concourse A – Family room

209E
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4050A RW/PA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 03 EXT Concourse B - Family room

302E
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4050A RW/PA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

EXISTING FRAME TO REMAIN - NEW DOOR & HARDWARE. CONTRACTOR/HARDWARE SUPPLIER TO VERIFY EXISTING CONDITIONS FOR NEW HARDWARE REQUIREMENTS.

Hardware Group No. 04 Concourse A Janitor Rooms

202E 206E
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER	FINAL CORES BY OWNER	626	BES
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

EXISTING FRAME TO REMAIN - NEW DOOR & HARDWARE. CONTRACTOR/HARDWARE SUPPLIER TO VERIFY EXISTING CONDITIONS FOR NEW HARDWARE REQUIREMENTS.

Hardware Group No. 05 Temporary Barrier Doors

219 220 229
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER	FINAL CORES BY OWNER	626	BES
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

END OF SECTION

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors in accordance with 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.

PART 2 - PRODUCTS

2.1 FABRICATION

A. Shop fabricate mirrors to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Rounded polished.

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. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

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

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

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. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. NGA Publications: "Laminated Glazing Reference Manual," "Glazing Manual" and "Installation Techniques Designed to Prolong the Life of Flat Glass Mirrors."

B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with 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.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 DELIVERY, STORAGE AND HANDLING

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

1.2 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, 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 Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

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

2.2 GYPSUM BOARD, GENERAL

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

3.4 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Face Size: Actual tile size, excluding spacer lugs.

C. Module Size: Actual tile size plus joint width indicated.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

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

D. Store liquid materials in unopened containers and protected from freezing.

1.3 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/8 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.
    b. Tile floors consisting of tiles 8 by 8 inches or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

3.4 ADJUSTING AND CLEANING

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.

B. 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.

3.5 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.

END OF SECTION

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.3 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 resilient products 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. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

1. Installation of resilient products indicates acceptance of surfaces and 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; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Primers.
2. Floor sealers and paints.
3. Dry fall coatings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. Behr Paint Company; Behr Process Corporation.
2. Benjamin Moore & Co.
3. PPG Paints.
4. Pratt & Lambert.
5. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
6. Sherwin-Williams Company (The).
7. Valspar Corporation (The).

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. VOC Emissions: For field applications inside the building, wall paints shall contain no more than half of the chronic REL of VOCs when tested according to the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.3 PRIMERS

A. Interior, Institutional Low-Odor/VOC Primer Sealer: Water-based primer sealer with low-odor characteristics and a VOC of less than 10 grams per liter for use on new interior plaster, concrete, and gypsum wallboard surfaces that are subsequently to be painted with latex finish coats.

B. Water-Based Rust-Inhibitive Primer: Corrosion-resistant, water-based-emulsion primer formulated for resistance to flash rusting when applied to cleaned, interior ferrous metals subject to mildly corrosive environments.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Behr Paint Company; Behr Process Corporation.
b. Benjamin Moore & Co.
c. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
d. Sherwin-Williams Company (The).

2.4 WATER-BASED FINISH COATS

A. Interior, Latex, High-Performance Architectural Coating, Low Sheen: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Behr Paint Company; Behr Process Corporation.
b. Benjamin Moore & Co.
c. PPG Paints.
d. Sherwin-Williams Company (The).

2. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.

2.5 SOLVENT-BASED FINISH COATS

A. Interior, Alkyd, Flat: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Behr Paint Company; Behr Process Corporation.
b. Benjamin Moore & Co.
c. PPG Paints.
d. Sherwin-Williams Company (The).

2. Gloss and Sheen Level: Manufacturer's standard flat finish.

2.6 FLOOR SEALERS AND PAINTS

A. Water-Based Concrete Floor Sealer: Clear, water-based, acrylic-copolymer-emulsion sealer formulated for oil, gasoline, alkali, and water resistance and for use on concrete traffic surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Behr Paint Company; Behr Process Corporation.
b. H&C® Decorative Concrete Products; a brand of Sherwin-Williams Co.
c. PPG Paints.
d. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
e. Sherwin-Williams Company (The).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Wood: 15 percent.
3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. 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 the following:

1. SSPC-SP 2.
2. SSPC-SP 3.
3. SSPC-SP 7/NACE No. 4.
4. SSPC-SP 11.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

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

3.5 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Water-Based Concrete Floor Sealer System: Concrete Floors.

a. First Coat: Matching topcoat.
b. Topcoat: Water-based concrete floor sealer.

B. Steel Substrates:

1. Alkyd over Surface-Tolerant Primer System: Hollow Metal Door Frames.

a. Prime Coat: Surface-tolerant metal primer.
b. Intermediate Coat: Matching topcoat.

c. Topcoat: Interior, alkyd, flat.

C. Gypsum Board Substrates:

1. High-Performance Architectural Latex System: Ceilings, Walls.

a. Intermediate Coat: Matching topcoat.
b. Topcoat: Interior, latex, high-performance architectural coating, low sheen.

END OF SECTION

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers
2. Wood stains.

B. Related Requirements:

1. Section 099123 "Interior Painting" for stains and transparent finishes on concrete floors.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
2. Include preparation requirements and application instructions.
3. Indicate VOC content.

B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.4 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures of less than 5 deg F above the dew point, or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. Behr Paint Company; Behr Process Corporation.
2. Benjamin Moore & Co.
3. Lenmar Lacquers; Benjamin Moore & Co.
4. Sherwin-Williams Company (The).
5. Vista Paint Corporation.

2.2 SOURCE LIMITATIONS

A. Source Limitations: Obtain each coating product from single source from single manufacturer.

2.3 MATERIALS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

B. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Stain Colors: As selected by Architect from manufacturer's full range As indicated in a color schedule.

2.4 PRIMERS

A. Alkyd Sanding Sealer, Interior, Solvent Based, Clear: Solvent-based, quick-drying, clear, sandable alkyd sealer used on new interior wood surfaces that are to be top-coated with an alkyd varnish.

2.5 WOOD STAINS

A. Stain, Interior, Semitransparent, for Interior Wood: Solvent-based, oil or oil/alkyd, semitransparent, pigmented stain for new interior wood surfaces that are to be finished with a clear varnish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Interior Wood Substrates: 13 percent, when measured with an electronic moisture meter.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

B. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

C. Exterior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Prime edges, ends, faces, undersides, and backsides of wood.

a. For solid hide stained wood, stain edges and ends after priming.
b. For varnish-coated stained wood, stain edges and ends and prime with varnish. Prime undersides and backsides with varnish.

3. Countersink steel nails, if used, and fill with putty or plastic wood filler tinted to final color. Sand smooth when dried.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions.

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

END OF SECTION

SECTION 102113.14 - STAINLESS STEEL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 COORDINATION

A. Coordinate requirements for overhead supports, blocking, reinforcing, and other supports concealed within wall and ceiling to ensure that toilet compartments can be supported and installed as indicated.

1.2 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain stainless steel toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:

1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf applied at any direction and at any point, without deformation of panel.

C. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" for toilet compartments designated as accessible.

2.3 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221.

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

E. Zamac: ASTM B86, commercial zinc-alloy die castings.

2.4 FABRICATION

A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories and solid blocking within panel where required for attachment of toilet accessories.

B. Ceiling-Hung Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.

C. Urinal-Screens: Manufacturer's standard corrosion-resistant anchoring assemblies at walls. Wall mount only.

D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide inswinging doors for standard toilet enclosures and 36-inch- wide outswinging doors with a minimum 32-inch- wide clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels or Screens: 1/2 inch.
b. Panels or Screens and Walls: 1 inch.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 COORDINATION

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

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

B. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.2 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

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

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Shower Seats: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 124000 - QUARTZ COUNTERTOPS AND SINKS PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Quartz agglomerate surfacing countertops and sinks.

B. Quartz agglomerate backsplashes.

C. Quartz agglomerate splashes where shown or indicated on the drawings.

D. Adhesives and sealants.

1.3 RELATED SECTIONS

A. Section– Metal Fabrications.

B. Section– Rough Carpentry.

C. Section– Joint Sealants.

1.4 RELATED REQUIREMENTS:

A. ASTM C 97: Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension
B. Stone.

C. ASTM C 170: Standard Test Method for Compressive Strength of Dimension Stone.

D. ASTM C 834: Standard Specification for Latex Sealants.

E. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.

F. ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

G. ASTM E 84: Standard Test Method for Surface Burning Characteristics of BuildingMaterials.

H. SCAQMD Rule 1168: Adhesive and Sealant Applications.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Submit product data for each specified product. Include manufacturer's technical data sheets and published instructions.

2. Low VOC certifications content for adhesives and sealants.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

1. Submit fully dimensioned shop drawings showing countertop and sink layouts, back splashes, ends plashes, vanities, joinery and seam locations, edge conditions, terminations, substrate construction, cutouts and holes. Show support framing and plumbing installation provisions. Include elevations, section details, and large-scale details.

C. Samples

1. Submit selection and verification samples for each color and pattern required, and a single sink mock-up and prototype. The mock-up shall be constructed off site prior to demolition of the existing restrooms and shall include all components of the in-place installation. Refer to the Drawings for the extent and mock-up area to be provided for review and acceptance by the Architect and the Owner.

D. Quality Assurance Submittals:

1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties, if required.

2. Warranty: Specimen copy of specified warranty.

E. Closeout Submittals:

1. Maintenance Data: Submit manufacturer's published Care & Maintenance manual with closeout submittals.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling: Comply with manufacturer's recommendations for shipping and handling quartz surfacing materials to preclude breakage or damage. Brace quartz surfacing units as necessary during shipment, transporting in near-vertical position with finished face towards finished face. Do not allow finished surfaces to rub during shipping andhandling.

B. Storage and Protection: Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer. Store quartz surfacing sheet materials on rack in near-vertical position to preclude damage. Store with finished face towards finished face. Prevent warpage and breakage.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements and opening by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

B. Adhesive: Acclimate adhesives to occupancy room temperatures with maximum temperature not to exceed 75 degrees Fahrenheit.

1.7 WARRANTY

A. Manufacturer's Limited Warranty: Provide manufacturer's standard 10 Year Commercial Limited Warranty against defects in quartz surfacing sheet materials.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: Wilsonart

2.2 QUARTZ SURFACING SHEET MATERIAL

A. Acceptable Product: Basis of Design: "Wilsonart Silicone", or Architect and Owner approved manufacturer.
B. Composition: Up to 93 percent quartz aggregate combined with polyester resin binders and proprietary pigments that are fabricated into slabs using vacuum vibro-compaction technology.
C. Quartz Finish: Polished finish with Gloss-o-meter reading greater than 45.
D. Color, Pattern and shape/size: Haida Quartz; custom trough sink and counter per the

drawings.

E. Material Thickness: Product Type 063 – 1.18 inch (3cm), nominal.
F. Material Weight: 15 lbs./ft^2 for 3 cmthick surfacing.
G. Sink and Countertop Dimensions: Indicated on Drawings, varying lengths andsizes.
H. Conformance Standards:

1. NSF/ANSI Standard 51.

F. Physical Characteristics:

1. Flexural Strength: Greater than 4,000 psi; ASTM D 790.

2. Flexural Strain: Less than 0.375 percent; ASTM D 790.

3. Flexural Modulus: Greater than 3.75 MPsi; ASTM D 790

4. Stain Resistance (24 Hour): No effect to moderate effect; NEMA LD-3

5. Abrasion Resistance: Greater than 100 in.-lbs.; ASTM C 501

6. Density: Greater than 2.1 g/cm^3; ASTM C 97.

7. Compressive Strength: (One Axis – Dry): Greater than 20,000 psi; ASTM C 170

8. Moisture Absorption: Maximum 0.022 percent; ASTM C 97.

J. Edge Detail: Straight and 1/4” Radius as indicated on the Drawings.

2.3 ACCESSORY MATERIALS

A. Joint Adhesive: Methacrylate-based adhesive for chemically bonding quartz surfacing seams. Color complementary to quartz surfacing sheet material. UL 2818 GREENGUARD Gold certified and complies with SCAQMD Rule 1168.

1. Basis of Design: “Wilsonart Hard Surface Adhesive”

2. Other Acceptable Products: Pigmented knife grade adhesives suitable for use with quartz surfacing that are also acceptable, to the manufacturer.

B. Siliconized Acrylic Sealant: Siliconized acrylic latex sealant. For general applications to fill gaps between countertops and at terminating substrates. Complies with ASTM C 834, Type OP, Grade NF, and SCAQMD Rule 1168.

1. Product: “Wilsonart Color Matched Silicone” or Architect and Owner approvedproduct.

2. Color: Complementary to quartz surfacing color.

C. Construction Adhesive: Countertop manufacturer's recommended silicone-based low VOC construction adhesive for backsplashes, end splashes, and other applications according to manufacturer's published fabrication instructions.

2.4 FABRICATION

A. Fabricate components in shop, to greatest extent practicable, in sizes and shapes indicated according to approved shop drawings and manufacturer's approved procedures.

B. Form joint seams between quartz surfacing components with specified seam adhesive. Completed joints inconspicuous in appearance and without voids. Provide joint reinforced if required by manufacturer for particular installation conditions. Joints to be seamless.

C. Provide holes and cutouts for plumbing fixtures, trash openings and accessories indicated on approved shop drawings. Rout cutouts and finish edges smooth.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions that could adversely affect the work of this Section.

B. Substrates must be sound, flat, smooth, and free from dust or other surface contaminants.

C. Commencement of work will constitute acceptance of substrates and conditions to receive the work.

3.2 COUNTERTOP AND SINK INSTALLATION

A. Install quartz surfacing components plumb, level, and true according to approved shop drawings and manufacturer's published installation instructions. Use woodworking and specialized fabrication tools acceptable to manufacturer.

1. Fasten quartz surfacing components to base cabinets or other supporting substrates with suitable adhesives acceptable to manufacturer.

B. Form joint seams with specified seam adhesive. Seams to be inconspicuous in completed work. Seams in locations shown on approved shop drawings. Promptly remove excess adhesive.

1. Clamp or brace quartz surfaces in position until adhesive sets.

C. Fill gaps between countertop and terminating substrates with specified silicone sealant.

D. Install backsplashes and end splashes where indicated on Drawings. Adhere to countertops

with specified construction adhesive.

E. Counters: Secure front panels to solid substrate with specified construction adhesive.

3.3 REPAIRS

A. If permissible to Architect, minor surface marring for quartz surfacing components may be repaired according to manufacturer's published installation instructions.

B. Remove and replace quartz surfacing components that are damaged and cannot be satisfactorily repaired.

3.4 CLEANING AND PROTECTION

A. Clean quartz surfacing components according to manufacturer's published maintenance instructions. Completely remove excess adhesives and sealants from finished surfaces.

B. Protect completed work from damage during remainder of construction period.

END OF SECTION 12 40 00

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SECTION 210150 - PRODUCT SUBSTITUTIONS - FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. Procedural requirements governing the Contractor's selection of products and product options are included in other sections.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions". The following are not considered substitutions:

1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.

2. Revisions to Contract Documents requested by the Owner or Architect.

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

4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if received within sixty days after commencement of the Work. Requests received more than sixty days after commencement of the Work may be considered or rejected at the discretion of the Architect/Engineer.

1. Submit three copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

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

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

   b. Samples, where applicable or requested.

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

   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.

   e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

   f. Cost information, including a proposal of the net change, in the Contract Sum.

   g. Assurance that the substitution is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

B. Action: Within one week of receipt of the request for substitution, the Architect/Engineer will request additional information or documentation necessary for evaluation of the request. Within two weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect will notify the Contractor of acceptance or refection of the proposed substitution. Acceptance will be in the form of a Change Order. If a decision on used of a proposed substitute cannot be made or obtained within the time allocated, use one of the products specified as approved.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Contractor's substitution request will be received and considered by the Architect/Engineer when one or more of the following conditions are satisfied, as determined by

the Architect/Engineer; otherwise requests sill be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.

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

3. The request is timely, fully documented and properly submitted.

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

5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

6. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinates.

9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution can provide the required warranty.

10. Where a proposed substitution involves more than one Sub Contractor, each Contractor shall cooperate with the other Contractors involved to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.

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

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 210200 - SHOP DRAWINGS AND SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF REQUIREMENTS

A. This Section specifies procedural requirements for non-administrative submittals including shop drawings product data, samples, and other miscellaneous submittals.

B. Shop drawings are technical drawings and data that have been specially prepared for this project. Information required on shop drawings includes dimensions, identification of specific products and materials which are included in the work, compliance with specified standard and notations of coordination requirements with other work. Provide special notation of dimensions that have been established by field measurement. Indicate deviations from the contract documents on the shop drawings.

C. Product data includes standard printed information on manufactured products that has not been specially-prepared for this project. General information required specifically as product data includes manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies, and the application of their labels and seals special notation of dimensions which have been verified by way of field measurement, and special coordination requirements for interfacing the material, product or system with other work.

D. Samples are physical examples of work. Documentation required specifically for sample submittals includes a generic description of the sample, the sample source or the product name or manufacturer, compliance with governing regulations and recognized standards. In addition, indicate limitations in terms of availability, sizes, delivery time, and similar limiting characteristics.

E. Miscellaneous submittals are work-related, nonadministrative submittals that do not fit in the three previous categories.

1.3 SUBMITTAL PROCEDURES

A. Submit all Division 21 Shop Drawings, product data samples, and related documents in one package. Submittal should be as complete as possible and include the following:

1. Enclose submittal in 3-ring or similar loose leaf booklet.
2. Include title page and table of contents.
3. Include list of subcontractors' qualifications and suppliers.

4. Provide tabs in front of major submittal sections relating back to table of contents.

B. No individual submittal sections will be considered and will be returned marked "No Action", with the following exceptions:

1. Items with long "Lead Time" may be submitted early if all such items are packaged together.

2. Sheet metal, piping and control drawings may be submitted after initial submittal due to preparation time required.

C. Prepare and transmit the submittal to the Architect/Engineer sufficiently in advance of the scheduled performance of related work and other applicable activities. Advise the Architect/Engineer if processing time is critical to the progress of the work.

1. Allow two weeks minimum for the Architect/Engineer's initial processing of each submittal. The Architect/Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.

2. Allow one week for processing each resubmittal.

3. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.

D. Mark each submittal with a permanent label for identification. Provide the following information on the label for proper processing and recording of action taken.

1. Project name.
2. Date.
3. Name and address of Architect/Engineer, Contractor, subcontractor and supplier.
4. Name of manufacturer.
5. Number and title of appropriate specification section.
6. Drawing number and detail references, as appropriate.
7. Similar definitive information as necessary.
8. Provide a space on the label for the Contractor's review and approval markings, and a space for the Architect/Engineer's "Action" marking.

E. Transmit each submittal from the Contractor to the Architect/Engineer, and to other destinations as indicated, by use of a transmittal form. Submittals received from sources other than the Contractor will be returned to the sender marked "No Action".

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

A. Shop Drawings: Provide six prints plus two additional prints where they are required for maintenance manuals. Two prints will be retained; the remainder will be returned. One of the prints returned will be marked-up and maintained by the Contractor as a "Record Document". Provide coordination drawings where required for the integration of the work. Show sequencing and relationship of separate units of work which are located in areas with restricted space. Submit newly prepared information, drawn to accurate scale on sheets not less than 8 inches by 11 inches; except for actual pattern or template type drawings, the maximum sheet size shall not exceed 36

inches by 48 inches. Indicate the name of the firm that prepared each shop drawing and provide appropriate project identification in the title block.

B. Product Data: Submit six copies. Do not proceed with installation of materials, products and systems until a copy of product data applicable to the installation is in the possession of the installer. Do not permit the use of unmarked copies of product data in connection with the performance of the work.

C. Samples: Submit three sets of samples for the Architect/Engineer's visual review; one set will be returned with comments. Maintain the reviewed submittal set of samples, as returned by the Architect/Engineer, at the project site, available for quality control comparisons throughout the course of performing the work.

D. Miscellaneous Submittals:

1. Inspection and Test Reports: Classify each inspection and test report as being either "shop drawings" or "product data" depending on whether the report is specially prepared for the project, or a standard publication of workmanship control testing at the point of production. Process inspection and test reports accordingly.

2. Warranties: Refer to other sections for specific general requirements on warranties, product bonds, workmanship bonds and maintenance agreements. In addition to copies desired for the Contractor's use, furnish two executed copies of such warranties, bonds or agreements. Provide two additional copies where required for maintenance manuals.

3. Standards: Where submittal of a copy of standards is indicated, and except where copies of standards are specified as an integral part of a "Product Data" submittal, submit a single copy of standards for the Architect/Engineer's use.

4. Closeout Submittals: Refer to other sections of these specifications for specific submittal requirements of project closeout information, materials, tools, and similar items.

a. Record Documents: Furnish set of original documents as maintained on the project site. Along with original marked-up record drawings, provide two copies of marked-up drawings which may be reduced to not less than half size.

b. Operation And Maintenance Data: Include description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts. Also include manufacturer's printed operating procedures, maintenance procedures, and servicing instructions, lubrication charts and schedules.

c. Materials and Tools: Refer to individual sections of these specifications for required quantities of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

1.5 ARCHITECT/ENGINEER'S ACTION

A. Except for submittals for the record and similar purposes, where action and return on submittals is required or requested, the Architect/Engineer will review each submittal, mark with appropriate "Action Taken", and where possible return within two weeks of receipt. The Architect/Engineer will stamp each submittal to be returned with a uniform, self-explanatory action stamp, appropriately marked to indicate one of the following:

1. Final Unrestricted Release: Where the submittals are marked "No Exception Taken", the work covered by the submittal may proceed provided it complies with the requirements of the contract documents; acceptance of the work will depend upon that compliance.

2. Final-But-Restricted Release: When the submittals are marked "Exception Taken as Noted", the work covered by the submittal may proceed provided it complies with both the Architect's/Engineer's notations or corrections on the submittal and with the requirements of the contract documents; acceptance of the work will depend on that compliance.

3. Returned for Resubmittal: When the submittal is marked either "Revise and Resubmit" or "Not Accepted Resubmit", do not proceed with the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise the submittal or prepare a new submittal in accordance with the Architect's/Engineer's notations stating the reasons for returning the submittal; resubmit the submittal without delay. Repeat if necessary to obtain a different action marking. Do not permit submittals with this marking to be used at the project site, or elsewhere where work is in progress.

4. Other Action: Where the submittal is returned, marked with the Architect/Engineer's explanation, for special processing or other Contractor activity, or is primarily for information or record purposes, the submittal will be marked "For Information Only".

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION

SECTION 210500 - BASIC FIRE PROTECTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division 21. It expands and supplements the requirements specified in sections of Division 1.

1.3 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. Extend all grease fittings to an accessible location.

1.4 FIRE PROTECTION INSTALLATIONS

A. Coordinate mechanical equipment and materials installation with other building components. Verify all dimensions by field measurements. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

B. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

C. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible. Coordinate the installation of mechanical materials and equipment above ceilings with suspension system, light fixtures, and other installations.

D. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

1.5 DRAWINGS AND SPECIFICATIONS

A. Separate divisional drawings and specifications shall not relieve the Contractor from full responsibility to complete all work which may be indicated on any of the drawings or in any division of the specification.

B. The specifications and drawings are complementary and are to be taken together for a complete interpretation of the work.

C. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Therefore, no interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for a complete installation are excluded.

D. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

E. Examine the architectural, structural, electrical and mechanical drawings and specifications prior to submitting bid. Architectural and structural drawings take precedence over mechanical drawings with reference to building construction, location of risers, and any other similar fixed items.

F. The Architect shall be notified of any discrepancies, omissions, conflicts or interferences which occur between drawings and specifications. If such notification is received in adequate time additional data or changes will be issued by addendum to all bidders.

1.6 CUTTING AND PATCHING

A. Do not endanger or damage installed Work through procedures and processes of cutting and patching. Do not cut structural members without prior written approval of the structural Engineer or Architect.

B. Arrange for repairs required to restore other work, because of damage caused as a result of fire protection installations. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

C. Perform cutting, fitting, and patching of equipment and materials required to: uncover Work to provide for installation of ill-timed Work; remove and replace defective Work; remove samples of installed Work as specified for testing; install equipment and materials in existing structures; upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

D. Cut, remove and legally dispose of selected fire protection equipment, components, and materials as indicated, including, but not limited to removal of piping, compressors, sprinklers and trim, and other items made obsolete by the new Work.

E. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Locate identify, and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to change over.

1.7 FIRE PROTECTION SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary), Division 1 and Division 21 Section: SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES for submittal definitions, requirements, and procedures. Submittal of shop drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.

1.8 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders, Division 1 and Division 21 Section “PRODUCTS AND SUBSTITUTION” for requirements in selecting products and requesting substitutions.

1.9 PRODUCT LISTING

A. Prepare listing of major fire protection equipment and materials for the project. Submit this listing as a part of the submittal requirement specified.

1.10 PRODUCTS

A. When two or more items of same material or equipment are required (sprinklers, pumps, valves, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated. Provide products which are compatible within systems and other connected items.

1.11 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications: adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

1.13 RECORD DOCUMENTS

A. Refer to the Division 1 Section: PROJECT CLOSEOUT or PROJECT RECORD DOCUMENTS for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark drawings to indicate revisions to piping, size and location both exterior and interior: including locations of valves and other control devices, compressors and similar units requiring periodic maintenance or repair: actual equipment locations, dimensioned from column lines: actual inverts and locations of underground piping: concealed equipment, dimensioned to column lines: mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., fire protection devices, expansion compensators, tanks, etc.): Change Orders: concealed control system devices.

C. Mark specifications to indicate approved substitutions: Change Orders; actual equipment and materials used.

D. Reproducible record drawings shall be on disk.

1.14 OPERATION AND MAINTENANCE DATA

A. In addition to the information required by Division 1 for Maintenance Data, include the following information:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions: regulation, control, stopping, shut-down, and emergency instructions: and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting: disassembly, repair, and reassembly: aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

1.15 WARRANTIES

A. Refer to the Division 1 Section: SPECIFIC WARRANTIES for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division 21, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond: duration of warranty or bond: and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.16 CLEANING

A. Refer to the Division 1 Section: PROJECT CLOSEOUT or FINAL CLEANING for general requirements for final cleaning.

1.17 FIRE PROTECTION WORKING

A. Prepare and submit a set of working plans in accordance with NFPA 13(Chapter 22) showing major elements, components, piping, and materials in relationship with other building components. Prepare drawings to an accurate scale of 1/8"=1'-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing and maintaining equipment, valve stem movement, and similar requirements.

B. Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the Work.

C. If the contractor’s working plans deviate significantly from the engineer’s plans, the contractor shall employ the services of a licensed professional engineer to sign and seal the working plans and hydraulic calculations and become the delegate engineer.

END OF SECTION

SECTION 211313 - FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies automatic sprinkler systems and standpipe and hose systems for buildings and structures. Materials and equipment specified in this Section include pipe, fittings, valves, and specialties; sprinklers and accessories.

B. Products furnished but not installed include sprinkler cabinet with spare sprinklers. Furnish to the Owner's maintenance personnel.

1.3 DEFINITIONS

A. Pipe sizes used in this specification are nominal pipe size (IPS).

B. Other definitions for fire protection systems are listed in NFPA Standards 13, 14, and 24.

C. Working Plans as used in this Section means those documents (including drawings and calculations) prepared pursuant to the requirements contained in NFPA 13 for obtaining approval of the authority having jurisdiction.

1.4 SYSTEM DESCRIPTION

A. Fire protection system is a "Wet-Pipe" system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by fire.

1.5 SUBMITTALS

A. Product Data: Include each type of sprinkler, valve, piping specialty, fire protection specialty, fire department connection specified.

B. Shop Drawings: Submit drawings which have been prepared in accordance with NFPA 13 identified as "Working Plans," and which have been approved by the authority having jurisdiction. Where the engineer has performed the hydraulic calculations and provided drawings with pipe routing and sizing, the contractor must install the system as designed. Any major rerouting or

resizing of piping must be approved by the engineer prior to installation. Any system redesign costs, incurred by the engineer, will be the responsibility of the contractor.

C. Coordination Drawings: Detail fire protection piping systems in accordance with Division 23 Section "Basic Mechanical Requirements".

D. Maintenance Data: For each type sprinkler, valve, piping specialty, fire protection specialty, fire department connection specified, for inclusion in operating and maintenance manual specified in Division 1 and Division 21 Section "Basic Fire Protection Requirements".

E. Quality Control Submittals: Test Reports and Certificates: Include "Contractor's Material & Test Certificate for Above Ground Piping" and "Contractor's Material & Test Certificate for Underground Piping" as described in NFPA 13.

F. Fire protection products shall be shown on drawings and product submittals and shall be specifically identified with the applicable Victaulic series or number.

G. Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installation and alterations of fire protection piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by a qualified installer. The term qualified means experienced in such work (experienced shall mean having a minimum of five previous projects similar in size and scope to this project), familiar with all precautions required, and has complied with all the requirements of the authority having jurisdiction. Upon request, submit evidence of such qualifications to the Architect. Refer to Division 1 Section "Definitions and Standards" for definitions for "Installers".

B. Regulatory Requirements: Comply with the requirements of the following codes.

1. NFPA 13 - Standard for the Installation of Sprinkler Systems.

2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

3. UL and FM Compliance: Fire protection system materials and components shall be Underwriter's Laboratories listed and labeled, and Factory Mutual approved for the application anticipated.

C. All grooved Fire Protection components (including couplings, fittings, valves and accessories) to be supplied by one manufacturer and shall be UL listed and/or FM Global approved. Grooving tools shall be of the manufacturer as the grooved components.

1.7 EXTRA MATERIALS

A. Valve Wrenches: Furnish to Owner, two valve wrenches for each type of sprinkler installed.

B. Sprinklers and Cabinets: Furnish six extra sprinklers of each style included in the project. Furnish each style with its own sprinkler cabinet and special wrenches as specified in this Section.

PART 2 - PRODUCTS

2.1 PIPE AND TUBING MATERIALS

A. General: Refer to Part 3 Article "PIPE APPLICATIONS" for identification of systems where the below specified pipe and fitting materials are used.

B. Steel Pipe: ASTM A 120 or ASTM A 53 or A 795 or A 135, seamless, black steel pipe, plain ends.

1. Schedule 40 for 2" and smaller.
2. Schedule 5 for 2" and smaller, Victaulic Pressfit® system.
3. Schedule 10 for 2½" and larger.
4. Schedule 10 for 2 ½" and larger, roll grooved ends as per ANSI/AWWA C-606.

2.2 FITTINGS

A. Cast-Iron Threaded Fittings: ANSI B16.4, Class 125, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.

B. Malleable-Iron Threaded Fittings: ANSI B16.3, Class 150, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.

C. Grooved Mechanical Fittings: ASTM A 47, malleable-iron fittings with grooves or shoulders designed to accept grooved end couplings. Acceptable manufacturers include Stockham, and Victaulic.

D. Victaulic Pressfit® Fittings: Fitting housings shall be Pressfit® products formed of precision cold drawn steel pipe, as manufactured by Victaulic, with self contained O-ring seals in the fitting ends. Fittings shall be zinc electroplated ASTM B-633 (external only).

E. Grooved Mechanical Couplings: Consist of ductile iron housing ASTM A-536, Grade 65-45-12, a synthetic rubber gasket of a central cavity pressure-responsive design, grade to suit the intended service conforming to ASTM D-2000, with nuts and bolts heat treated carbon steel track head conforming to ASTM A-449 and A-183, locking pin, locking toggle, or lugs to secure roll-grooved pipe and fittings. Grooved mechanical couplings including gaskets used on dry-pipe systems shall be listed for dry-pipe service. Acceptable manufacturers include Stockham, and Victaulic.

1. Rigid Type:

a) 1¼" through 4": Housings shall be cast ductile iron with offsetting, angle-pattern bolt pads. Coupling shall be "Installation Ready" rigid joints designed for direct "stab" installation onto grooved pipe without prior disassembly of the coupling. Victaulic Firelock EZ Style 009.

b) 5" & larger: Housings shall be cast ductile iron with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. Standard rigid joints shall be Victaulic Style Firelock 005 or 07 Zero-Flex.

2. Flexible Type:

a) 1½" and larger: Use in seismic areas where required by NFPA 13. Victaulic Style 75 or 77.
b) 2 through 8": Victaulic Style 791 One piece hinged boltless coupling with locking pin and installation tool for assembly and disassembly and EPDM gasket.

F. Ductile Iron Flanged Adapters: Flat faced for use with grooved end pipe and fittings for joining ANSI Class 125/150 flanged components to a grooved piping system. Victaulic Style 741 or 744.

G. Cast-Iron Threaded Flanges: ANSI B16.1, Class 125, raised ground face, bolt holes spot faced.

H. Cast Bronze Flanges: ANSI B16.24, Class 125, raised ground face, bolt holes spot faced.

I. Gasket Materials: Thickness, material, and type suitable for fluid or gas to be handled, and design temperatures and pressures. Coupling gaskets shall be UL listed for fire protection services as follows:

Fire Protection Service	Temperature Range	Gasket Recommendation
Dry Systems	Ambient	Flushseal® or EZ Style 009 design, Grade EPDM, Type A
Freezer Applications	-30°F to 0°F (-34°C to -18°C)	Flushseal®, Grade L, Silicone
Water/Wet Systems	Ambient	C-Shape or EZ Style 009 design, Grade EPDM, Type A

2.3 BASIC VALVES

A. Gate Valves - Two Inch (2") and Smaller: Body and bonnet of cast bronze, 175 pound cold water working pressure - nonshock, threaded ends, solid wedge, outside screw and yoke, rising stem, screw-in bonnet, and malleable iron handwheel. Valves shall be capable of being repacked under pressure, with valve wide open. Acceptable manufacturers include Fairbanks, Jenkins, Kennedy Valve, (Div. of ITT Grinnell Valve Co., Inc.), and Stockham.

B. Ball Valve (2") and Smaller: Standard port ball valve with carbon steel PressFit® ends, 175 psi forged brass body, chrome plated brass ball and stem with TFE seats and EPDM O-ring seal. Victaulic Series 522.

C. Gate Valves - Two and One-half Inch (2½") and Larger: Iron body; bronze mounted, 175 pound cold water working pressure - nonshock. Valves shall have solid taper wedge; outside screw and

yoke, rising stem; flanged bonnet, with body and bonnet conforming to ASTM A 126 Class B; replaceable bronze wedge facing rings; flanged ends; and a packing assembly consisting of a cast iron gland flange, brass gland, packing, bonnet, and bronze bonnet bushing. Valves shall be capable of being repacked under pressure, with valve wide open.

D. OS&Y Gate Valves 2½" through 12": Ductile iron body, 250 psi grooved ends. ASTM A-536; cast iron yoke and hand wheel, ASTM A-126-B; EPDM coated cast iron disc; ASTM B16 brass rising stem; flanged and epoxy coated cast iron bonnet; EPDM o-ring stem seals and body gasket. Victaulic Series 771.

E. NRS Gate Valves 2½" through 12": Ductile iron body, ASTM A-536, bronze mounted 250 psi grooved ends; EPDM coated cast iron disc; ASTM B16 brass rising stem; flanged and epoxy coated cast iron bonnet; EPDM o-ring stem seals and body gasket. Victaulic Series 772.

F. Butterfly Valve 2½" and larger in lieu of Gate Valve: 300 psi grooved ends. Ductile iron body, ASTM A536; ductile iron disc, ASTM A536 with EPDM coating; stainless steel stem and handwheel operated with weather proof actuator. Victaulic Series 705W.

G. Swing Check Valves: MSS SP-71; Class 175, cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends. Valve shall be capable of being refitted while the valve remains in the line. Acceptable manufacturers include Fairbanks, Jenkins, Kennedy Valve, (Div. of ITT Grinnell Valve Co., Inc.) and Stockham

H. Spring Assisted Check Valve 2½" through 12": PPS coated Ductile iron body, ASTM A-536, Grade 65-45-12, aluminium bronze non-slam tilting disc, stainless steel spring and shaft, rubber seat suitable for intended service, stainless steel spring and shaft, 250 psi. Victaulic Series 717.

I. Spring Assisted Riser Check Valve 4" through 8": Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, aluminium bronze non-slam tilting disc, stainless steel spring and shaft, rubber seat suitable for intended service, stainless steel spring and shaft, welded-in nickel seat, 200 psi, designed to accept a riser check kit. Victaulic Series 717R.

J. Alarm Check Valve 1½" through 8": Black enamel coated ductile iron body conforming to ASTM A-536, grade 65-45-12, aluminum bronze clapper, stainless steel spring and shaft, EPDM seal, and Nitrile seat O-ring. Valve internal parts shall be replaceable without removing the valve from the installed position. Water working pressure is 300 psi up to 6" and 225 psi for 8" sizes. Suitable for constant and variable pressure systems with optional Series 752 retard chamber. Victaulic FireLock® Series 751.

2.4 AUTOMATIC SPRINKLERS

A. Sprinklers: Fusible link type, and style as indicated or required by the application. Unless otherwise indicated, provide sprinklers with nominal one-half inch (½") discharge orifice, for "Ordinary" temperature range. Provide quick response sprinklers in all light hazard occupancies. Die-cast brass frame, Teflon encapsulated Belleville spring seal and frangible glass bulb. Body cast with hex shaped wrench boss. (Sprinklers shall not contain O-rings.) Quick or standard response type. Acceptable manufacturers include Automatic Sprinkler Corp. of America,

Firematic Sprinkler Devices, Inc., Globe Fire Equipment Co., Guardian Automatic Sprinkler Co., Inc., ITT Grinnell, Viking Corp and Victaulic Company.

B. Sprinkler Finishes: Provide sprinklers with the following finishes.

1. Upright, Pendent, and Sidewall Styles: Chrome plated in finish spaces, exposed to view; rough bronze finish for sprinklers in unfinished spaces and not exposed to view. Sprinklers shall be wax-coated where installed exposed to acids, chemicals, or other corrosive fumes. Victaulic Model V27.

2. Concealed Style: Rough brass, with painted white cover plate. Victaulic Model V38.

3. Flush Style: Bright chrome, with painted white escutcheon plate, Victaulic Model V29.

4. Recessed Style: Bright chrome, with bright chrome escutcheon plate, Victaulic Model V27.

5. Intermediate Level Style: Bright chrome.

C. Sprinkler Cabinet and Wrench: Finished steel cabinet, suitable for wall mounting, with hinged cover and space for six (6) or twelve (12) spare sprinkler sprinklers plus two (2) sprinkler wrenches. Provide a separate cabinet for each style sprinkler on the project.

D. Sprinkler Guard and Escutcheons: Guards and Escutcheons shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.

E. Flexible Drops:

1. In lieu of rigid pipe offsets or return bends for sprinkler drops, the Victaulic EasyFlex Flexible Drop System may be used to locate sprinklers as required by final finished ceiling tiles and walls.

2. The drop system shall consist of a braided or corrugated type 304/316 stainless steel hose piece, 1" NPT Male threaded adapter for connection to header piping and a 1/2" or 3/4" NPT Female adapter for connection to the sprinkler head.

3. Unions shall be provided on both ends of the flexible hose for ease of installation. The flexible drop shall attach to the ceiling grid using a one-piece bracket that can be installed without the use of tools and have a 3" minimum bending radius for installation in narrow or confined spaces.

4. The braided drop system is UL Listed and FM Approved and the corrugated system is UL Listed for sprinkler services to 175 psi.

2.5 FIRE DEPARTMENT CONNECTIONS

A. Sidewalk Siamese Connection: Chrome plated cast brass, angle body, two-way, siamese connection. Connection sizes shall be 4" outlet and two (2) and 2½" female inlets, having NH standard threads, for the connection size indicated, as specified in NFPA 1963. Each inlet shall have a clapper valve, and plug and chain. Provide an 18" high chrome plated brass sleeve and

chrome plated brass sidewalk plate, with words "STANDPIPE - FIRE DEPT CONNECTION" or "AUTO SPKR - FIRE DEPT CONNECTION," or "AUTO SPKR & STANDPIPE - FIRE DEPT CONNECTION" in raised letters. Acceptable manufacturer of Fire Department Connection is Valve Guardian Fire Equipment, Inc.

B. Where applicable, install a Victaulic #10-DR 90-degree elbow with drain connection at each Fire Department connection for complete system drainage.

2.6 ALARM DEVICES

A. General: Types and sizes shall mate and match piping and equipment connections.

B. Water Flow Indicators: Vane type water flow detector, rated to 250 psig; designed for horizontal or vertical installation; have 2 SPDT circuit switches to provide isolated alarm and auxiliary contacts, 7-ampere 125-volts AC and 0.25-ampere 24-volts DC; complete with factory-set, field-adjustable retard element to prevent false signals, and tamper-proof cover which sends a signal when cover is removed. Acceptable manufacturer: Viking Corp.

C. Water-Motor Gongs: 10" diameter cast aluminum gong, with factory-finish in red enamel; Pelton Wheel type operator with nylon shaft bearings with internal components of non-corrosive stainless-steel or aluminum, with upstream strainer, and shaft length and sleeve to suit wall thickness and construction; ¾" inlet and 1" drain. Acceptable manufacturer: Victaulic Series 760.

D. Supervisory Switches: SPST, normally closed contacts, designed to signal valve in other than full open position. Acceptable manufacturer: Viking Corp.

PART 3 - EXECUTION

3.1 PIPE APPLICATIONS

A. Install Schedule 40 steel pipe with threaded joints and fittings for 2" or smaller.

B. Install Schedule 10 steel pipe with roll-grooved ends and grooved mechanical couplings for sizes 2½" and larger.

3.2 PIPING INSTALLATIONS

A. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. So far as practical, install piping as indicated.

1. Deviations from approved "Working Plans" for sprinkler piping, require written approval of the authority having jurisdiction. Written approval shall be on file with the Architect prior to deviating for the approved "Working Plans".

B. Install sprinkler piping to provide for system drainage in accordance with NFPA 13.

C. Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions in pipes 2" and smaller, adjacent to each control valve. Unions are not required on flanged devices or in piping installations using grooved mechanical couplings.

E. Install flanges on valves, apparatus, and equipment having 2½" and larger connections.

F. Hangers and Supports: Comply with the requirements of NFPA 13 and NFPA 14. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be in accordance with the grooved mechanical coupling manufacturer's written instructions, for rigid systems.

G. Make connections between underground and above-ground piping using an approved transition piece strapped or fastened to prevent separation.

H. Install mechanical sleeve seal at pipe penetrations in basement and foundation walls.

I. Install test connections sized and located in accordance with NFPA 13 complete with shutoff valve. Test connections may also serve as drain pipes.

J. Install pressure gauge on the riser or feed main at or near each test connection. Provide gauge with a connection not less than ¼" and having a soft metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and where they will not be subject to freezing.

3.3 PIPE JOINTS

A. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint. Align threads at point of assembly. Apply appropriate tape or thread compound to the external pipe threads. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded. Do not use pipe with threads which are stripped, chipped, corroded, or otherwise damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

B. Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.

C. Mechanical Grooved Joints: Cut or roll grooves on pipe ends dimensionally compatible with the couplings. Assemble grooved joints according to manufacturer's (Victaulic) written instructions. Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by Victaulic. A Victaulic factory trained representative shall provide on-site training to contractor's

field personnel in the installation of grooved piping products. Factory trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

D. Steel-Piping, PressFit® Joints: Pipe shall be certified for use with the PressFit system. Pipe shall be square cut, +/- 0.030", properly deburred and cleaned. Pipe ends shall be marked at the required location, using a manufacturer-supplied gauge, to ensure full insertion into the coupling or fitting during assembly. Use a Victaulic "PFT" series tool with the proper sized jaw for pressing.

E. End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

3.4 VALVE INSTALLATIONS

A. Install fire protection specialty valves, fittings, and specialties in accordance with the manufacturer's written instructions, NFPA 13 and 14, and the authority having jurisdiction.

B. Gate Valves: Install supervised-open gate valves so located to control all sources of water supply except fire department connections. Where there is more than one control valve, provide permanently marked identification signs indicating the portion of the system controlled by each valve. Refer to Division 15 Section "Mechanical Identification" for valve tags and signs.

C. Install check valves in each water supply connection.

3.5 SPRINKLER INSTALLATIONS

A. Use proper tools to prevent damage during installations.

B. Where sprinklers are installed in lay-in tile ceilings, install in the center of tile.

C. Do not install sprinklers that have been dropped, damaged or show a visible loss of fluid. Never install sprinklers with cracked bulbs. Sprinkler bulb protector shall be removed by hand after installation. Do not use tools or any other device(s) to remove the protector that could damage the bulb in any way.

3.6 FIRE HOSE AND RACK INSTALLATIONS

A. Install hose and racks in fire hose cabinets specified in Division 10 Section "Fire Extinguishers, Cabinets, and Accessories".

3.7 FIRE DEPARTMENT CONNECTION INSTALLATIONS

A. Install automatic drip valves at the check valve on the fire department connection to the mains.

B. Install mechanical sleeve seal at pipe penetration in outside walls.

3.8 FIELD QUALITY CONTROL

A. Flush, test, and inspect sprinkler piping systems in accordance with NFPA 13.

B. Replace piping system components which do not pass the test procedures specified, and retest repaired portion of the system.

END OF SECTION

SECTION 220150 - PRODUCT SUBSTITUTIONS- PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. Procedural requirements governing the Contractor's selection of products and product options are included in other sections.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions". The following are not considered substitutions:

1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.

2. Revisions to Contract Documents requested by the Owner or Architect.

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

4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if received within sixty days after commencement of the Work. Requests received more than sixty days after commencement of the Work may be considered or rejected at the discretion of the Architect/Engineer.

1. Submit three copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

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

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

   b. Samples, where applicable or requested.

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

   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.

   e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

   f. Cost information, including a proposal of the net change, in the Contract Sum.

   g. Assurance that the substitution is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

B. Action: Within one week of receipt of the request for substitution, the Architect/Engineer will request additional information or documentation necessary for evaluation of the request. Within two weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. Acceptance will be in the form of a Change Order. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use one of the products specified as approved.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Contractor's substitution request will be received and considered by the Architect/Engineer when one or more of the following conditions are satisfied, as determined by

the Architect/Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.

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

3. The request is timely, fully documented and properly submitted.

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

5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

6. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.

9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution can provide the required warranty.

10. Where a proposed substitution involves more than one Sub Contractor, each Contractor shall cooperate with the other Contractors involved to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.

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

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 220200 - SHOP DRAWINGS AND SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF REQUIREMENTS

A. This Section specifies procedural requirements for non-administrative submittals including shop drawings product data, samples, and other miscellaneous submittals.

B. Shop drawings are technical drawings and data that have been specially prepared for this project. Information required on shop drawings includes dimensions, identification of specific products and materials which are included in the work, compliance with specified standard and notations of coordination requirements with other work. Provide special notation of dimensions that have been established by field measurement. Indicate deviations from the contract documents on the shop drawings.

C. Product data includes standard printed information on manufactured products that has not been specially-prepared for this project. General information required specifically as product data includes manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies, and the application of their labels and seals special notation of dimensions which have been verified by way of field measurement, and special coordination requirements for interfacing the material, product or system with other work.

D. Samples are physical examples of work. Documentation required specifically for sample submittals includes a generic description of the sample, the sample source or the product name or manufacturer, compliance with governing regulations and recognized standards. In addition, indicate limitations in terms of availability, sizes, delivery time, and similar limiting characteristics.

E. Miscellaneous submittals are work-related, nonadministrative submittals that do not fit in the three previous categories.

1.3 SUBMITTAL PROCEDURES

A. Submit all Division 22 Shop Drawings, product data samples, and related documents in one package. Submittal should be as complete as possible and include the following:

1. Enclose submittal in 3-ring or similar loose leaf booklet.
2. Include title page and table of contents.
3. Include list of subcontractors' qualifications and suppliers.

4. Provide tabs in front of major submittal sections relating back to table of contents.

B. No individual submittal sections will be considered and will be returned marked "No Action", with the following exceptions:

1. Items with long "Lead Time" may be submitted early if all such items are packaged together.
2. Sheet metal, piping and control drawings may be submitted after initial submittal due to preparation time required.

C. Prepare and transmit the submittal to the Architect/Engineer sufficiently in advance of the scheduled performance of related work and other applicable activities. Advise the Architect/Engineer if processing time is critical to the progress of the work.

1. Allow two weeks minimum for the Architect/Engineer's initial processing of each submittal. The Architect/Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.
2. Allow one week for processing each resubmittal.
3. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.

D. Mark each submittal with a permanent label for identification. Provide the following information on the label for proper processing and recording of action taken.

1. Project name.
2. Date.
3. Name and address of Architect/Engineer, Contractor, subcontractor and supplier.
4. Name of manufacturer.
5. Number and title of appropriate specification section.
6. Drawing number and detail references, as appropriate.
7. Similar definitive information as necessary.
8. Provide a space on the label for the Contractor's review and approval markings, and a space for the Architect/Engineer's "Action" marking.

E. Transmit each submittal from the Contractor to the Architect/Engineer, and to other destinations as indicated, by use of a transmittal form. Submittals received from sources other than the Contractor will be returned to the sender marked "No Action".

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

A. Shop Drawings: Provide six prints plus two additional prints where they are required for maintenance manuals. Two prints will be retained; the remainder will be returned. One of the prints returned will be marked-up and maintained by the Contractor as a "Record Document". Provide coordination drawings where required for the integration of the work. Show sequencing and relationship of separate units of work which are located in areas with restricted space. Submit newly prepared information, drawn to accurate scale on sheets not less than 8 inches by 11 inches; except for actual pattern or template type drawings, the maximum sheet size shall not exceed 36 inches by 48 inches. Indicate the name of the firm that prepared each shop drawing and provide appropriate project identification in the title block.

B. Product Data: Submit six copies. Do not proceed with installation of materials, products and systems until a copy of product data applicable to the installation is in the possession of the installer. Do not permit the use of unmarked copies of product data in connection with the performance of the work.

C. Samples: Submit three sets of samples for the Architect/Engineer's visual review; one set will be returned with comments. Maintain the reviewed submittal set of samples, as returned by the Architect/Engineer, at the project site, available for quality control comparisons throughout the course of performing the work.

D. Miscellaneous Submittals:

1. Inspection and Test Reports: Classify each inspection and test report as being either "shop drawings" or "product data" depending on whether the report is specially prepared for the project, or a standard publication of workmanship control testing at the point of production. Process inspection and test reports accordingly.
2. Warranties: Refer to other sections for specific general requirements on warranties, product bonds, workmanship bonds and maintenance agreements. In addition to copies desired for the Contractor's use, furnish two executed copies of such warranties, bonds or agreements. Provide two additional copies where required for maintenance manuals.
3. Standards: Where submittal of a copy of standards is indicated, and except where copies of standards are specified as an integral part of a "Product Data" submittal, submit a single copy of standards for the Architect/Engineer's use.
4. Closeout Submittals: Refer to other sections of these specifications for specific submittal requirements of project closeout information, materials, tools, and similar items.

    a. Record Documents: Furnish set of original documents as maintained on the project site. Along with original marked-up record drawings, provide two copies of marked-up drawings which may be reduced to not less than half size.
    b. Operation And Maintenance Data: Include description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts. Also include manufacturer's printed operating procedures, maintenance procedures, and servicing instructions, lubrication charts and schedules.
    c. Materials and Tools: Refer to individual sections of these specifications for required quantities of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

1.5 ARCHITECT/ENGINEER'S ACTION

A. Except for submittals for the record and similar purposes, where action and return on submittals is required or requested, the Architect/Engineer will review each submittal, mark with appropriate "Action Taken", and where possible return within two weeks of receipt. The Architect/Engineer will stamp each submittal to be returned with a uniform, self-explanatory action stamp, appropriately marked to indicate one of the following:

1. Final Unrestricted Release: Where the submittals are marked "No Exception Taken", the work covered by the submittal may proceed provided it complies with the requirements of the contract documents; acceptance of the work will depend upon that compliance.

2. Final-But-Restricted Release: When the submittals are marked "Exception Taken as Noted", the work covered by the submittal may proceed provided it complies with both the Architect's/Engineer's notations or corrections on the submittal and with the requirements of the contract documents; acceptance of the work will depend on that compliance.
3. Returned for Resubmittal: When the submittal is marked either "Revise and Resubmit" or "Not Accepted Resubmit", do not proceed with the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise the submittal or prepare a new submittal in accordance with the Architect's/Engineer's notations stating the reasons for returning the submittal; resubmit the submittal without delay. Repeat if necessary to obtain a different action marking. Do not permit submittals with this marking to be used at the project site, or elsewhere where work is in progress.
4. Other Action: Where the submittal is returned, marked with the Architect/Engineer's explanation, for special processing or other Contractor activity, or is primarily for information or record purposes, the submittal will be marked "For Information Only".

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION

SECTION 220500 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division 22. It expands and supplements the requirements specified in sections of Division 1.

1.3 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. Extend all grease fittings to an accessible location.

1.4 PLUMBING INSTALLATIONS

A. Coordinate mechanical equipment and materials installation with other building components. Verify all dimensions by field measurements. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

B. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

C. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible. Coordinate the installation of mechanical materials and equipment above ceilings with suspension system, light fixtures, and other installations.

D. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

1.5 DRAWINGS AND SPECIFICATIONS

A. Separate divisional drawings and specifications shall not relieve the Contractor from full responsibility to complete all work which may be indicated on any of the drawings or in any division of the specification.

B. The specifications and drawings are complementary and are to be taken together for a complete interpretation of the work.

C. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Therefore, no interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for a complete installation are excluded.

D. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

E. Examine the architectural, structural, electrical and mechanical drawings and specifications prior to submitting bid. Architectural and structural drawings take precedence over mechanical drawings with reference to building construction, location of plumbing fixtures, and any other similar fixed items.

F. The Architect shall be notified of any discrepancies, omissions, conflicts or interferences which occur between drawings and specifications. If such notification is received in adequate time additional data or changes will be issued by addendum to all bidders.

1.6 CUTTING AND PATCHING

A. Do not endanger or damage installed Work through procedures and processes of cutting and patching. Do not cut structural members without prior written approval of the structural Engineer or Architect.

B. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

C. Perform cutting, fitting, and patching of mechanical equipment and materials required to: uncover Work to provide for installation of ill-timed Work; remove and replace defective Work; remove samples of installed Work as specified for testing; install equipment and materials in existing structures; upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

D. Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including, but not limited to removal of piping, plumbing fixtures and trim, and other items made obsolete by the new Work.

E. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Locate identify, and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to change over.

1.7 PLUMBING SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary), Division 1 and Division 22 Section: SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES for submittal definitions, requirements, and procedures. Submittal of shop drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.

1.8 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders, Division 1 and Division 22 Section "PRODUCTS AND SUBSTITUTION" for requirements in selecting products and requesting substitutions.

1.9 PRODUCT LISTING

A. Prepare listing of major plumbing equipment and materials for the project. Submit this listing as a part of the submittal requirement specified.

1.10 PRODUCTS

A. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated. Provide products which are compatible within systems and other connected items.

1.11 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications: adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

1.13 RECORD DOCUMENTS

A. Refer to the Division 1 Section: PROJECT CLOSEOUT or PROJECT RECORD DOCUMENTS for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark drawings to indicate revisions to piping, size and location both exterior and interior: including locations of valves and other control devices, boxes, and similar units requiring periodic maintenance or repair: actual equipment locations, dimensioned from column lines: actual inverts and locations of underground piping: concealed equipment, dimensioned to column lines: mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.): Change Orders: concealed control system devices.

C. Mark specifications to indicate approved substitutions: Change Orders; actual equipment and materials used.

D. Reproducible record drawings shall be on disk.

1.14 OPERATION AND MAINTENANCE DATA

A. In addition to the information required by Division 1 for Maintenance Data, include the following information:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions: regulation, control, stopping, shut-down, and emergency instructions: and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting: disassembly, repair, and reassembly: aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.15 WARRANTIES

A. Refer to the Division 1 Section: SPECIFIC WARRANTIES for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division 22, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond: duration of warranty or bond: and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.16 CLEANING

A. Refer to the Division 1 Section: PROJECT CLOSEOUT or FINAL CLEANING for general requirements for final cleaning.

1.17 MECHANICAL COORDINATION DRAWINGS

A. Prepare and submit a set of coordination drawings showing major elements, components, and systems of mechanical equipment and materials in relationship with other building components. Prepare drawings to an accurate scale of 1/4"=1'-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing and maintaining insulation, servicing and maintaining equipment, valve stem movement, and similar requirements. Indicate movement and positioning of large equipment into the building during construction.

B. Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, 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. Mechanical equipment room layouts.
2. Specific equipment installations, including:
   a. Pumps and compressors.
   b. Tanks and heat exchangers.
   c. Water heaters and softeners.
3. Work in pipe spaces, chases, trenches, and tunnels.
4. Ceiling plenums which contain piping, ductwork, or equipment in congested arrangement.
5. Installations in mechanical riser shafts, at typical sections and crucial offsets and junctures.
6. Numbered valve location diagrams.
7. Manifold piping for multiple equipment units.

END OF SECTION

SECTION 220519 - METERS AND GAUGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of meters and gauges required by this Section is indicated on drawings and/or specified in other Division 22 sections. Types of meters and gauges specified in this Section include the following:

1. Glass Thermometers.
2. Direct Mount Dial Thermometers.
3. Dial Type Insertion Thermometers.
4. Thermometer Wells.
5. Pressure Gauges.
6. Pressure Gauge Cocks.
7. Gauge Connector Plugs.
8. Venturi - Type Flow Meters.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of meters and gauges, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Comply with ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, including installation instructions for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer’s figure number, scale range, location, and accessories for each meter and gauge.

PART 2 - PRODUCTS

2.1 THERMOMETERS

A. Glass Thermometers: Provide a die cast Cycolac plastic case finished in baked epoxy enamel, with glass front, spring secured, and nine inches long. The adjustable joint shall also be die cast aluminum, with 180° adjustment in vertical plan, 360° adjustment in horizontal plane, with locking device. Provide a clip mounted mercury filled tube and 1% scale range accuracy. Scale shall be satin faced, nonreflective aluminum, with permanently etched markings. Stem shall be copper-plated steel or brass, for separable socket. Ranges shall be as follows:

1. Hot Water: 30°F-240°F with 2°F scale divisions.

B. Direct Mount Dial Thermometers: Provide vapor tension, universal angle type with drawn steel or brass, glass lens, 4 ½" diameter. The adjustable joint shall be die cast aluminum, with 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device. The thermal bulb shall be copper with phosphor bronze bourdon pressure tube, one scale division accuracy. The scale shall be progressive, satin face, nonreflective aluminum with permanently etched markings. Movement shall be brass precision geared. Stem shall be copper plated steel, or brass, for separable socket, length to suit installation. Ranges shall be as follows:

1. Hot Water: 40°F-240°F.

C. Dial Type Insertion Thermometers: Provide bi-metal, stainless steel case and stem, 1 inch diameter dial, dust and leak proof, 1/8 inch diameter stem with normal length of five inches, accuracy equal to 0.5% or dial range. Ranges shall be as follows:

1. Hot Water: 0°F-220°F.

D. Acceptable manufacturers include Trerice (H.O.) Co., Weiss Instruments, Inc., and Weksler Instruments Corp.

2.2 THERMOMETER WELLS

A. Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2' extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

2.3 TEMPERATURE OR PRESSURE GAUGE CONNECTOR PLUGS

A. General: Provide temperature gauge connector plugs rated for 500 psi and 200°/f (93°C). Construct of brass and finish in nickel-plate, equip with ½" NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

B. An acceptable manufacturer is Peterson Equipment Co.

2.4 PRESSURE GAUGES

A. Provide pressure gauges for general use, 1% accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection. Cases shall be drawn steel or brass, with glass lens, 4 ½" diameter. Provide a brass connector with 1/4" male NPT. Provide a protective siphon when used for steam service. Scales shall be white coated aluminum with permanently etched markings. Accuracy shall be 1%. Ranges shall be as follows:

1. Case: Drawn steel or brass, glass lens, four and 4 ½" diameter.
2. Connector: Brass with 1/4" male NPT. Provide protective siphon when used for steam service.
3. Scale: White coated aluminum, with permanently etched markings.
4. Range: Conform to the following:
   a. Hot or Cold Water: 0 - 100 psi.

B. Acceptable manufacturers include Trerice (H.O.) Co., Weiss Instruments, Inc., Weksler Instruments Corp.

2.5 PRESSURE GAUGE COCKS

A. Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems. Construct gauge cock of brass with 1/4" female NPT on each end, and “T” handle brass plug.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which meters and gauges are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to the installer.

3.2 INSTALLATION

A. Install temperature gauges, pressure gauges, and flow meters in accessible location and positioned so as to be easily read by an observer standing on the floor.

B. Install gauge connector plugs in piping tees where indicated, located on pipe at most readable position. Secure cap.

C. Install pressure gauge cocks in piping tees with snubber.

3.3 ADJUSTING AND CLEANING

A. Adjust faces of meters and gauges to proper angle for best visibility.

B. Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows, repair any scratched or marred surfaces with manufacturer’s touch-up paint.

END OF SECTION

SECTION 220529 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of supports and anchors required by this Section is indicated on drawings and/or specified in other Division 22 sections. Types of supports and anchors specified in this Section include the following:

1. Horizontal-Piping Hangers and Supports.
2. Vertical-Piping Clamps.
3. Hanger-Rod Attachments.
4. Building Attachments.
5. Saddles and Shields.
6. Miscellaneous Materials.
7. Equipment Supports.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.

C. UL and FM Compliance: Provide products which are UL-listed and FM approved for sprinkler piping systems.

1.4 SUBMITTALS

A. The manufacturer shall determine the number, size, and type of anchor bolts, cable restraints, etc. for each piece and groups of pipes.

B. Details for steel frames to be used in connection with the isolations and seismic restraint of the items.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering hangers and supports which may be incorporated in work include B-Line Systems Inc., Carpenter and Patterson, Inc., Corner & Lada Co., Inc., Elcen Metal Products Co., Fee & Mason Mfg., Co. (Div. Figgie International), Anvil International, and Pipe Shields, Inc.

2.2 HANGERS, ATTACHMENTS AND SUPPORTS

A. Provide factory-fabricated anchors, hangers, attachments, and supports complying with MSS SP-58, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers, attachments, and supports for copper-piping systems.

B. Horizontal-Piping Hangers and Supports:

1. Adjustable Steel Clevis Hangers: MSS Type 1 (Anvil Fig. 260).
2. Steel Pipe Clamps: MSS Type 4 (Anvil Fig. 212).
3. Adjustable Swivel Pipe Rings: MSS Type 6 (Anvil Fig. 104).
4. Split Pipe Rings: MSS Type 11 (Anvil Fig. 108).
5. U-Bolts: MSS Type 24 (Anvil Fig. 137).
6. Clips: MSS Type 26 (Anvil Fig. 262).
7. Adjustable Pipe Saddle Supports: MSS Type 38 (Anvil Fig. 264), including steel pipe base support and cast-iron floor flange.
8. Single Pipe Rolls: MSS Type 41 (Anvil Fig. 171).
9. Adjustable Roller Hangers: MSS Type 43 (Anvil Fig. 174).

C. Vertical - Piping Clamps: Two-Bolt Riser Clamps: MSS Type 8 (Anvil Fig. 261).

D. Hanger - Rod Attachments: Steel Turnbuckles: MSS Type 13 (Anvil Fig. 230).

E. Building Attachments:

1. Concrete Inserts: MSS Type 18 (Anvil Fig. 285).
2. Top Beam C-Clamps: MSS Type 19 (Anvil Fig. 61).
3. Side Beam or Channel Clamps: MSS Type 20 (Anvil Fig. 225 or 226).
4. Center Beam Clamps: MSS Type 21 (Anvil Fig. 131).
5. C-Clamps: MSS Type 23 (Anvil Fig. 86).
6. Steel Brackets:
   a. Light Duty: MSS Type 31 (Anvil Fig. 194).
   b. Medium Duty: MSS Type 32 (Anvil Fig. 195).
7. Horizontal Travelers: MSS Type 58 (Anvil Fig. 170).

2.3 SADDLES AND SHIELDS

A. Provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated

piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Shields: MSS Type 40 (Anvil Fig. 167); of length recommended by manufacturer (minimum 12").

2.4 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

E. Equipment Supports: Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed. Correct inadequacies including proper placement of inserts, anchors and other building structural attachments. Installation of hangers, supports, anchors and associated work must be coordinated with all work by other disciplines to avoid conflicts.

3.2 INSTALLATION OF HANGERS, ATTACHMENTS AND SUPPORTS

A. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers. Install supports with maximum spacings complying with MSS SP-69. Do not use wire or perforated metal to support piping, and do not support piping from other piping. Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

B. Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment, and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

C. Insulated Piping:

1. Clamps: Attach clamps, including spacers, to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold water piping, install coated protective shields. For pipe eight inches and over, install wood insulation saddles.

D. Install building attachments within concrete or on structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional supports at concentrated loads and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

E. Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with suggested hanger spacing and rod sizes for straight horizontal runs according to MSS SP-69 as tabulated below:

	Hanger Spacing in Feet			
Pipe Size (Inches)	Std. Wt. Cast Iron Pipe Water	Copper Tube Water	PVC Water	Rod Size (Inches)
½	5	5	4	¼
¾	6	5	4	¼
1	7	6	4½	¼
1½	9	8	4½	⅜
2	10	8	5	⅜
2½	11	9	5	⅜
3	12	10	6	⅜
4	14	12	6½	½
6	17	14	7½	½
8	19	24	16	⅝

10	20	18	8½	¾
12	23	19		⅞
14	25			1
16	27			1
18	28			1¼
20	30			1¼

3.3 ADJUSTING AND CLEANING

A. Adjust hangers so as to distribute loads equally on attachments.

B. Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 220553 - PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of mechanical identification work required by this Section is indicated on drawings and/or specified in other Division 22 sections. Types of identification devices specified in this Section include painted identification materials, plastic pipe markers, valve tags, valve schedule frames, and plastic equipment markers.

B. Refer to Division 26 sections for identification requirements of electrical work; not work of this Section.

C. Painting specifications and color coding for pipes and equipment are also included in this Section.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Comply with ANSI A13.1 for lettering sizes, enamel paint and plastic tape colors, and pressure sensitive vinyl pipe markers.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8" x 11" bond paper. Tabulate valve number, piping system, system abbreviation location of valve and variations for identification. Mark valves which are intended for emergency shut-off and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering mechanical identification materials which may be incorporated in the work include Allen Systems, Inc., Brady (W.H.) Co. (Signmark Div.), Industrial Saftey Supply Co., Inc., and Seton Name Plate Corp.

2.2 IDENTIFICATION MATERIALS

A. Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Provide single selection for each product category.

B. Painted Identification Materials: Provide standard fiberboard stencils, with not less than 1¼" high letters for ductwork and not less than ¾" high letters for access door signs and similar operational instructions. Provide standard exterior type stenciling enamel, either brushing grade or pressurized spray-can form and grade, and standard identification enamel of colors indicated.

C. Plastic Pipe Markers: Provide manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers. Print each pipe marker with arrows to indicate flow direction. For pipes with external diameters less than 6" (including insulation), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by adhesive lap joint in pipe marker overlap. For pipes with external diameters of 6" and larger (including insulation) provide either full-band or strip-type pipe markers, but not narrower than three times letter height, laminated or bonded to pipe (or insulation), or taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than ¾" wide; full circle at both ends of pipe marker, tape lapped 3".

D. Plastic Tape: Provide manufacturer's standard color-coded pressure sensitive (self-adhesive) vinyl tape, not less than three mils thick. Provide 1" wide tape markers on pipes with outside diameters (including insulation) of less than 6", 2½" wide tape for larger pipes.

E. Valve Tags: Provide 19 gauge polished brass valve tags with stamp-engraved piping system abbreviation in ¼" high letters and valve numbers ½" high, and with 5/32" hole for fastener. Provide 1½" diameter tags and manufacturer's standard solid brass chain or solid brass S-hooks for attachment of tags to valves. Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to the concealed valve.

F. Valve Schedule Frames: For each page of valve schedule, provide removable glazed display frame. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.3 LETTERING AND GRAPHICS

A. Designations used in mechanical identification work should correspond with those shown on plans. If not otherwise indicated, provide designations which allow proper identification and operation/maintenance of mechanical systems and equipment.

2.4 COLOR CODING FOR PIPES AND EQUIPMENT

A. Color coding is to be in accordance with standard color code as developed by the Consulting Engineer. Colors to be selected by Consulting Engineer from Standard Colors of manufacturer. Color code painting shall be provided for all exposed conduits, through items and pipelines for the transport of gases, liquid and semiliquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and all operating accessories which are integral to the whole functional pipe and electrical conduit system. See Color Code Schedule attached at the end of this Section.

B. Pipelines which are not listed on the Color Code Schedule shall be assigned a color by the Consulting Engineer and shall be treated as an integral part of the Contract.

C. Color Code Schedule:

Description	**Color**
Cold Water Pipe	Blue or match existing color
Exterior Pipe Supports	Match exterior finish of building and coordinate with Owner for finish color.
Support Steel, Equipment tanks, etc.	Battleship gray
Valves	Green body, red handles
Housekeeping Pads/Inertia Bases	Green
Hot Water Piping	Brown

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install identification after completion of surfacing covering and painting, and prior to installation of acoustical ceilings and similar removable concealment.

B. Provide duct markers or stenciled signs on each access door in housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information. Where access doors are concealed, plasticized tags may be installed for identification in lieu of specified signs.

3.2 PIPING SYSTEM IDENTIFICATION

A. Install stenciled pipe markers including color-coded background band or rectangle, and contrasting lettering, for each system indicated to receive identification, and include arrows to show normal direction of flow.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior nonconcealed locations.

1. Near each valve and control device.

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch where there could be question of flow pattern.

3. Near locations where pipes pass through walls or floors/ ceilings, or enter nonaccessible enclosures.

4. At access doors, manholes and similar access points which permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

3.3 VALVE IDENTIFICATION

A. Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibbs, and shut-off valves at plumbing fixtures and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

B. Mount valve schedule frames and schedules in machine rooms where indicated or where directed by Architect/Engineer.

3.4 EQUIPMENT IDENTIFICATION

A. Paint the equipment identification abbreviation as shown on the plans for all major pieces of mechanical equipment such as water heaters, pumps, compressors, etc., installed under this contract.

3.5 ADJUSTING AND CLEANING

A. Adjusting: Relocate any identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.6 PAINTING

A. No paint containing lead will be allowed.

B. All paint materials and equipment used on the job shall be stored in a single space designated by the Architect and Owner. The storage area shall be kept neat and clean. Floors shall be adequately protected from paint spillage. All cloths and cotton waste which might constitute a fire hazard shall be placed in metal containers and destroyed at the end of each work day. All damage caused to surfaces within the storage area shall be repaired. A fire extinguisher shall be provided and fully charged at all times for this area.

C. Provide primers and other undercoat paint produced by same manufacturer as finish coats. Primers shall be compatible with finish paints.

D. All work shall be guaranteed by this Contractor against defects caused by use of inferior materials or workmanship for a period of 1 year from date of final acceptance of building.

E. All hangers and pipe support floor stands shall be painted. The system shall be painted up to but not including the flanges attached to the mechanical equipment nor the flexible conduit connected to electrical motors. Colors shall be as noted in the Color Code Schedule.

F. All systems which are an integral part of the equipment, that is originated from the equipment and returning to the same piece of equipment, shall be painted between and up to but not including the fixed flanges or connections on the equipment.

G. All metal surfaces to be painted shall be thoroughly cleaned of objectionable matter before priming or field coat are applied. Wire brushes shall not be used on galvanized and shop painted surfaces.

1. Unpainted Ferrous Metal: Surfaces shall be cleaned with wire brushes or by other proper and acceptable means. Grease and oil shall be removed with gasoline, benzine, or other similar volatile cleaners. The surface shall be free from moisture or frost.

2. Zinc-Coated (Galvanized) Surfaces: Grease and oil shall be removed with gasoline, benzine, or other similar volatile cleaner. Surfaces shall then be treated with an approved chemical compound such as phosphoric acid wash. The chemical compound shall be completely removed with clean, fresh water, and the surfaces thoroughly dried prior to priming.

3. Zinc-Chromate Shop Painted Ferrous Metal: Grease and oil shall be removed with gasoline, benzine, or other similar volatile cleaner.

H. Structural and miscellaneous metals are specified to be shipped to the job site with prime coat. Items shall be touched-up as necessary at the job site prior to erection.

1. Ferrous materials delivered to the job site without shop coats shall be thoroughly cleaned and primed in the field. Cleaning shall be in accordance with Steel Structures Painting Council Surface Preparations Specifications #2. After cleaning, all surfaces except galvanized shall be primed with zinc-chromate iron oxide primer, equal to Pittsburgh's formulation 17-6. Galvanized surfaces shall be prepared as previously specified and given a special galvanized primer.

I. After erection, all weld splatter shall be removed and additional cleaning done, as required, to ensure a proper paint bond. The prime shall be applied to all surfaces as soon as possible after cleaning.

J. Pipe and equipment insulation such as canvas jacket insulation to be painted shall be cleaned of all loose foreign and objectionable material prior to priming.

K. Wherever previously primed or painted surfaces have been destroyed or defaced, they shall be restored with materials of like kind. Gouges or scratches in factory-applied finishes shall be filled with suitable fillers and sanded smooth prior to priming and painting or for special finishes, refinished in accordance with manufacturer's recommendations.

L. The premises shall at all times be kept free from accumulation of waste material and rubbish by employees or work. At the completion of the painting remove all tools, scaffolding, surplus materials, and all rubbish from and about the buildings and leave work area "broom clean" unless more exactly specified.

M. Upon completion, remove all paint where it has been spilled, splashed, or splattered on floors, fixtures, equipment, furniture, and all other surfaces, leaving the work ready for inspection.

3.7 EXTRA STOCK

A. Furnish minimum of five percent extra stock of each plumbing identification material required, including additional numbered valve tags for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

B. This Contractor shall furnish the Owner with two full gallon cans of each finished color and complete manufacturer label and formula, and color chip with manufacturer's color name and/or code and location at which paint occurs.

END OF SECTION

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of mechanical insulation required by this Section is indicated on drawings and schedules, and by requirements of this Section. Types of mechanical insulation specified in this Section include the following:

1. Insulation of piping, tanks, fittings and other surfaces.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications: Firm with at least five years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of twenty-five or less, and smoke-developed index of fifty or less, in accordance with latest NFPA 90A.

D. Comply with the latest approved edition of the "Florida Energy Code".

E. Insulation materials: Insulation materials must be manufactured at facilities certified and registered with an approved registrar to conform to ISO 9000 quality standard.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation.

1.5 DELIVERY AND STORAGE OF MATERIALS

SCHEDULE 1 - Deliver all materials to the job site and protect the insulation against dirt, water, chemical, and mechanical damage before, during, and after installation. Do not install damaged or wet insulations; remove it from the job site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering products which may be incorporated in the work include Armstrong World Industries, Inc., Knauf Fiber Glass GmbH., Johns-Manville Products Corp., Owens-Corning Fiberglass Corp., Pittsburgh Corning Corp., and Rubatex Corp.

2.2 PIPING INSULATION MATERIALS

A. Fiberglass Piping Insulation: Preformed sectional fiberglass insulation and factory-applied vapor barrier, all service jacket with pressure sensitive self-sealing longitudinal laps and butt strips. Suitable for operating temperatures from 0℉ to +850℉ and similar to Johns-Manville's Micro-lok AP-T. Must be Type I, rigid, molded, non-combustible, and must meet ASTM C547.

B. Flexible unicellular piping insulation (Armaflex): Preformed split sectional closed-cell pipe insulation. Suitable for operating temperatures of -40℉ to +220℉. Thermal conductivity "K" factor of 0.27.

C. Jackets:

1. Type A: Smooth or embossed aluminum jacket, 0.016" minimum thickness secured with ½-inch aluminum bands, for all exterior installations.

2. Type B: Pre-sized reinforced glass cloth, smoothly adhered to insulation or cement surface with lagging adhesive; lap joints a minimum of three inches and adhere with lagging adhesive.

3. Type C: PVC plastic, Zeston 2000, one-piece molded-type fitting covers and Jekting material, gloss-white.

4. Type D: White or embossed, self-adhesive jacket: VentureClad 5-ply laminate for exterior installations.

D. Fittings: Provide fitting coverings of a similar material and thickness as adjacent pipe coverings. Cover all elbows, tees, valves, flanges and other fittings of piping system.

E. Accessories: All staples, bands, wires, adhesives, cements, sealers and protective finishes to be as recommended by insulation manufacturers.

2.3 EQUIPMENT INSULATION MATERIALS

A. Rigid Fiberglass Insulation: Board with factory applied all service jacket, suitable for operating temperatures of 0℉ to +450℉. Similar to Johns-Manville's 800 spin-glass.

B. Flexible Unicellular Equipment Insulation: Closed-cell insulation suitable for operating temperatures of -40℉ to +220℉. Exterior applications, apply VentureClad 1577CW – white, highly UV resistant.

C. Jacketing Material: Provide presized glass cloth jacketing material, not less than 7.8 ounces per square yard or VentureClad 1577CW-embossed 5-ply self-adhesive vapor barrier/weather proofing membrane.

D. Provide accessories (staples, bands, wire, etc.) and compounds (adhesives, cements, sealers, etc.) as recommended by insulation manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSULATION INSTALLATION, GENERAL

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices.

B. Install insulation materials with smooth and even surfaces. Do not use cut pieces or scraps abutting each other.

C. Clean and dry surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered. Maintain integrity of vapor-barrier, and protect to prevent puncture or other damage.

D. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

E. Protect outdoor insulation from weather or ultraviolet deterioration by installing outdoor protective finish or jacketing; VentureClad 1577CW – white, UV resistant.

3.3 PLUMBING PIPING SYSTEM INSULATION

A. Omit insulation on chrome-plated exposed piping, air chambers, unions, strainers, check valves, balance cocks, flow regulators, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and preinsulated equipment.

B. Insulate potable chilled water piping and roof drains and ten feet of connecting drain line with ½-inch flexible Unicellular; VentureClad 1577CW – white for exterior applications.

C. Insulate potable hot water piping and potable hot water recirculating piping with one of the following types and thicknesses of insulation for circulating mains and runouts. Jacket material shall be VentureClad 1577CW – white for exterior applications.

1. Fiberglass insulation thickness for temperature range:

Pipe Size	100°F - 160°F	161°F - 200°F
up to 1¼"	1"	1"
1½" to 2"	1"	1½"
2½" and up	1½"	2"

2. Flexible Unicellular: Non-circulating runouts, not to exceed ten feet in length for all temperature ranges above, ¾-inch thick insulation for pipe sizes up to one inch.

D. Install insulation on pipe systems subsequent to painting, testing, and acceptance of tests.

E. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

F. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply three inch wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with three inch wide vapor barrier tape or band. VentureClad butt strip tape, finish includes white and embossed (permeance 0.0000) or equal.

3.4 EQUIPMENT INSULATION

A. Insulate the following hot equipment with fiberglass insulation, 2" thick, except 3" thick for low pressure boilers and steam heat exchangers. Jacketing material shall be VentureClad 1577CW – white.

1. Boilers.
2. Hot water storage tanks.
3. Water heaters.
4. Heat exchangers.
5. Hot water pumps.

B. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship. Apply insulation using staggered joint method for both single and double layer construction. Apply each layer of insulation separately. Impale breeching and stack insulation over weld pins or secure with ½” steel bands on twelve inch centers.

C. Finish with ½" coat of finishing cement. Fill in with cement of sufficient thickness to remove surface irregularities. Cover insulated surfaces with all-service jacketing. Jacketing material shall be VentureClad 1577CW – white self adhesive jacket. Lap seams at least two inches. Apply over vapor barrier where applicable.

3.5 REPAIR, REPLACEMENT AND PROTECTION

A. Repair or replace damaged sections of existing mechanical insulation, including units with vapor barrier damage and moisture saturated units both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.

B. Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 221116 - WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies the water distribution piping system, including potable cold, hot, recirculated hot water piping, fittings, and specialties within the building to a point five feet outside the building.

B. Products installed but not furnished under this Section include water meters which will be provided by others, to the site, ready for installation.

1.3 DEFINITIONS

A. Water Distribution Piping: A pipe within the building or on the premises which conveys water from the water service pipe or meter to the points of usage.

B. Water Service Piping: The pipe from the water main or other source of potable water supply to the water distributing system of the building served.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data for water hammer arresters, valves, hydrants, backflow preventors and pressure-temperature relief valves.

1.5 QUALITY ASSURANCE

A. Comply with applicable portions of the local plumbing code and authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PIPE AND PIPING PRODUCTS

A. Pipe within building (except below slab), sizes 4" and smaller shall be copper tubing. Conform to ASTM B88, Type L, hard temper, copper tube, ANSI B16.22 streamlined pattern wrought-copper fittings, soldered joints using 95-5 tin-antimony solder.

B. Pipe inside and outside building, below ground, sizes 4" and smaller shall be copper tubing. Conform to ASTM B88, Type K, soft temper copper tube. All joints below ground are to be silver brazed.

. C. Pipe inside and outside building above and below ground sizes 6: ans smaller be Corzan® CPVC pipe and conform to meet or exceed the requirements of ASTM F441 in Schedule 80. Fittings shall meet or exceed the requirements of ASTM F437 (schedule 80 threaded), and ASTM F439 (schedule 80 socket).

D. Balance Cocks, Soldered Ends 2" and smaller: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern. Acceptable manufacturers include American Air Filter Co., Bell & Gossett ITT (Fluid Handling Div.), Hammond Valve Corp., Milwaukee Valve Co., Inc., Spirax Sarco., and Taco, Inc.

E. Hose Bibbs: Bronze body, renewable composition disc, tee handle, three-fourths inch (¾") NPT inlet, ¾" hose outlet, vacuum breaker. Acceptable manufacturers for hose bibbs and faucets include Hammond Valve Corp., Lee Brothers (Div. Phelps Dodge Brass Co.), Mansfield Plumbing Products, Nibco Inc., Prier Brass Mfg. Co., Tanner Mfg. Co., and Watts Regulator Co.

F. Provide proper size for relief valve, in accordance with ASME Boiler and Pressure Vessel Codes. Combined pressure-temperature relief valves shall be bronze body with test lever and thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210°F, and pressure relief at 150 psi; suit wall thickness. Acceptable manufacturers include Cash (A.W.) Valve Mfg. Corp., Conbraco Industries, Inc., Watts Regulator Co., and Zurn Industries, and Inc. (Wilkins-Regulator Div).

G. Hydrants: Acceptable manufacturers include Josam Mfg. Co., Smith (Jay R.) Mfg. Co., Tyler Pipe (Sub. Of Tyler Corp.), Woodford Mfg. Co., and Zurn Industries Inc. (Hydromechanics Div.).

H. Backflow Preventors: Acceptable manufacturers include Febco Sales, Inc. (Subs. of Charles M. Bailey Co., Inc.), Hersey Products, Inc., ITT Lawler (Fluid Handling Div.), and Watts Regulator Co.

I. Water Hammer Arrestors: Provide Plumbing and Draining Institute types A, B, C, D, E, and F. Josam Mfg. Co., Smith (Jay R.) Mfg. Co., Zurn Mfg. Co., and Precision Plumbing Prod.

2.2 HIGH PURITY WATER PIPING SPECIFICATIONS

A. PVDF Pipe: Pipe shall be manufactured to Schedule 80 iron pipe dimensions, from virgin, un-pigmented PVDF resin meeting ASTM D-3222 requirements. Pipe will be furnished in 10-foot lengths, cylindrical and straight, and will meet dimensional tolerances of ASTM D-2447 for dimensions.

B. PVDF Fittings: Fittings shall be manufactured to Schedule 80 wall thickness from virgin, un-pigmented PVDF ressin meeting ASTM D-3222 requirements. Fittings are to be joined by using the socket fusion method, conforming to ASTM D-2657 requirements. Fittings to be joined mechanically shall be complete with face seal, PVDF snap ring, and all parts necessary to

assemble a high quality joint that tests to 150 psi. All fittings shall be individually bagged and sealed.

C. PVDF Ball Valves: Ball valves shall be manufactured from virgin, un-pigmented PVDF resin to be fully compatible with the Orion PVDF High Purity System. All valves shall test to 150 psi at 79°F. Each valve shall be individually packaged and sealed.

D. PVDF Ball Check Valves: Ball check valves shall be manufactured from virgin, un-pigmented PVDF resin to be fully compatible with the Orion PVDF high Purity System. Each valve shall be individually packaged and sealed.

E. PVDF Needle Valves: Needle valves shall be manufactured from virgin, un-pigmented PVDF resin to be fully compatible with the Orion PVDF High Purity System. Each valve shall be individually packaged and sealed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all water distribution piping is installed in accordance with pertinent codes and regulations, the original design, and the referenced standards. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation. Coordinate pipe sleeve locations with other disciplines. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PIPING AND PIPING PRODUCTS

A. So far as practical, install piping as indicated. Solder copper tubing joints in accordance with the procedures specified in ANSI B9.1.

B. Extend water distribution piping to connect to water service piping as indicated for service entrance to building. Install shutoff valve at service entrance inside building complete with strainer, pressure gauge, and test tee with valve.

C. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation. Where sleeves penetrate rated partition walls, floors, etc., the integrity of the smoke/fire barrier must be maintained.

D. Valves:

1. Install sectional valves on each branch and riser, close to main, where branch or riser serves two or more plumbing fixtures or equipment connections, and elsewhere as indicated.

2. Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

3. For sectional shutoff valves 2" and smaller, use gate or ball valves; for sectional shutoff valves 2½" and larger, use gate or butterfly valves.

E. Install balance cocks in each hot water recirculating loop, discharge side of each pump, and elsewhere as indicated.

F. Install hose bibbs on exposed piping where indicated with vacuum breaker.

G. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

H. Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code.

I. Install water hammer arresters in locations recommended by manufacturers.

3.3 FIELD QUALITY CONTROL

A. Do not enclose, cover, or put into operation any new, extended, or replaced water distribution piping system until it has been inspected, tested, and approved by the authority having jurisdiction. Work which has been concealed prior to inspection, testing and approval must be uncovered. Notify the plumbing official having jurisdiction at least 24 hours prior to the time such inspection must be made. Prepare inspection reports, signed by the plumbing official. If the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection.

1. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

2. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

B. All new water distribution piping systems which have been altered, extended or repaired for leaks and defects must be tested. Perform tests in the presence of the plumbing official. Prepare reports for all tests and required corrective action. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

1. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for a period of four hours. Leaks and loss in test pressure constitute defects which must be repaired using new materials. Retest system until satisfactory results are obtained.

3.4 ADJUSTING AND CLEANING

A. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use. Prepare reports for all purging and disinfecting activities.

B. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure described in either AWWA C601, or AWWA D105, or as described below:

1. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.

2. Fill the system to be tested, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate and allow to stand for 24 hours.

3. Drain the system of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine; isolate and allow to stand for three hours.

4. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming from the system.

5. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

END OF SECTION

SECTION 221316 - DRAINAGE AND VENT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies building sanitary and storm drainage and vent piping systems, including drains and drainage specialties.

1.3 DEFINITIONS

A. Building Drain: That part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer.

B. Building Sewer: That part of the drainage system which extends from the end of the building drain and conveys its discharge to a public sewer, private sewer, individual sewage disposal system, or other point of disposal.

C. Drainage System: Includes all the piping within a public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.

D. Vent System: A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and back pressure.

1.4 SUBMITTALS

A. Product Data: Submit product data for drainage piping specialties, floor drains, and roof drains.

B. Coordination Drawings: Prepare and submit coordination drawings for Drainage and Vent Piping.

C. Quality Control Submittals: Submit reports specified in Part 3 of this Section.

1.5 QUALITY ASSURANCE

A. Comply with applicable portions of local plumbing code and the authorities having jurisdiction.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate the installation of all drains and associated materials, such as flashings, with other work such as roofing, concrete slabs and sanitary storm sewers to ensure proper interface with all project components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering products which may be incorporated in the work include Ancon Inc., Josam Mfg. Co., Smith (Jay R.) Mfg. Co., Tyler Pipe (Subs. of Tyler Corp.), and Zurn Industries Inc. (Hydromechanics Div.).

2.2 DRAINAGE AND VENT PIPE AND FITTINGS

A. Above Ground, All Pipe Sizes: Hubless cast-iron soil pipe. Conform to CISPI Standard 301, service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310 and stainless steel clamp and shield.

B. Underground Pipe Sizes 15" and Smaller: Cast-iron soil pipe. Conform to ASTM A74, for service weight, hub-and-spigot soil pipe and fittings, with neoprene compression gasket joints conforming to ASTM C564. Pipe and fittings shall have a heavy coating of coal tar varnish or asphaltum on both inside and outside surfaces.

C. Above Ground, Not In Plenum Returns, and Underground, All Pipe Sizes: Polyvinyl chloride (PVC) DWV, Schedule 40 pipe and socket fittings, conforming with ASTM D-2665. Pipe cement shall be PVC solvent cement conforming to ASTM D-2564.

2.3 DRAINAGE PIPING SPECIALTIES

A. Trap Primers: Bronze body valve with automatic vacuum breaker, with ½" connections matching piping system. Comply with ASSE 1018.

B. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

C. Floor Cleanouts: Heavy-duty rated cast-iron body and frame, with cleanout plug and adjustable round nickel bronze top, manufacturer's standard cast unit, exposed rim type, with recess to receive ⅛" thick resilient floor finish.

D. Cast-iron Top: Manufacturer’s standard cast unit, exposed flush type, with standard mill finish.

E. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including screws.

F. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide under-deck clamp and sleeve length as required.

G. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.

H. Vandal-proof Vent Caps: Cast-iron body full size of vent pipe, with caulked base connection for cast-iron pipes, threaded base for steel pipes.

I. Roof Drains: See plans for sizes and specifications. Provide static extensions as required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed. Do not proceed until unsatisfactory conditions have been corrected.

3.2 FOUNDATION PREPARATION FOR UNDERGROUND BUILDING DRAINS

A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.

B. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill at each pipe bell hole.

3.3 INSTALLATION, GENERAL

A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.

B. Cast-Iron Soil Pipe: Make lead and oakum caulked joints, compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

C. PVC Pipe: The pipe and socket must be cleaned, burrs removed, primed, and solvent applied to both. They must be assembled quickly and twisted one-quarter turn to spread the solvent.

D. Make changes in direction for drainage and vent piping using appropriate 45-degree wyes, half-wyes, or long sweep bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

E. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

F. Install building drain pitched down at minimum slope of ¼" per foot for piping 3" and smaller and ⅛" for piping 4" and larger unless shown otherwise.

G. Extend building drain to connect to sewer piping.

H. Install sleeve and mechanical sleeve seal through foundation wall for watertight installation.

I. Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:

1. as required by plumbing code;
2. at each change in direction of piping greater than 45 degrees;
3. at minimum intervals of 50' for piping 4" and smaller and 100' for larger piping;
4. at the base of each vertical soil or waste stack.

B. Cleanout Covers: Install floor and wall cleanout covers for concealed piping, types as indicated.

C. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

D. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer’s instructions.

3.5 INSTALLATION OF FLOOR DRAINS

A. Install floor drains in accordance with manufacturer's written instructions at low points of surface areas to be drained, or as indicated. Position drains so that they are accessible and easy to maintain. Trap all drains connected to the sanitary sewer.

B. Set drain elevation depressed below finished slab elevation as listed below to provide proper slope to drain:

DEPRESSION	RADIUS OF AREA DRAINED
½"	5'-0"
¾"	10'-0"
1"	15'-0"
1¼"	20'-0"
1½"	25'-0"

C. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

3.6 FIELD QUALITY CONTROL

A. Do not enclose, cover, or put into operation any new, extended, or replaced drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction. Work which has been concealed prior to inspection, testing, and approval must be uncovered. Notify the plumbing official having jurisdiction at least 24 hours prior to the time such inspection must be made. Prepare inspection reports, signed by the plumbing official.

1. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

2. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

3. If piping system fails to pass the test or inspection, make the required corrections, and arrange for reinspection.

B. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. Perform tests in the presence of the plumbing official. Prepare reports for all tests and required corrective action. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

1. Rough Plumbing: Test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
2. Finished Plumbing: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.

C. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

3.7 ADJUSTING AND CLEANING

A. Clean drain strainers, domes, traps and interior of piping. Remove dirt and debris as work progresses.

B. Protect drains to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies general installation requirements for plumbing fixtures and specific requirements for fittings, trim, and accessories. Refer to plumbing drawings and Plumbing Fixture Schedule for fixture requirements.

1.3 QUALITY ASSURANCE

A. Comply with applicable portions of the latest local plumbing code and the authorities having jurisdiction.

1.4 SUBMITTALS

A. Product Data: Submit product data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified; clearly indicate rated capacities of selected models of water coolers.

B. Shop Drawings: Submit rough-in drawings, detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with other trades as required for installation. Furnish templates as necessary.

C. Wiring Diagrams: Submit manufacturer's electrical requirements and wiring diagrams for power supply to units. Clearly differentiate between portions of wiring that are factory installed and field installed portions.

D. Color Charts: Submit manufacturer's standard color charts for cabinet finishes and fixture colors.

E. Maintenance Data: Include data in maintenance manual as specified in other sections.

F. Quality Control Submittals: Submit certification of compliance with specified ANSI, UL, and ASHRAE Standards and with performance verification requirements specified in this Section.

PART 2 - PRODUCTS

2.1 FITTINGS, TRIM, AND ACCESSORIES

A. Supplies and Stops for Lavatories and Sinks: Polished chrome-plated loose-keyed angle stop having ½" inlet and ⅜" O.D. by 12" long flexible tubing outlet, and wall flange and escutcheon. Insulate the trap and hot water supply for handicapped lavatories with insulation kit.

B. Supplies and Stops for Water Closets: Polished chrome-plated, loose-keyed angle stop having ½" inlet and ⅜" O.D. by 12" long flexible tubing outlet with collar, and wall flange and escutcheon.

C. Traps: Cast brass, 1¼" and 1½" adjustable "P" trap with cleanout and waste to wall. All connections at wall shall be slip joint type.

D. Tub Waste and Overflow Fittings: Concealed lever operated pop-up bath waste and overflow, chrome plated waste spud with universal type outlet connection suitable for one and 1½" I.P.S., or 1½" solder-joint outlet connection on waste tee.

E. Escutcheons: Chrome-plated cast brass with set screw.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards. Fasten plumbing fixtures securely to supports or building structure. Secure behind or within wall construction to provide rigid installation. Comply with the installation requirements of ANSI A117.1 and Public Law 90-480 with respect to plumbing fixtures for the physically handicapped.

B. Set shower receptor and mop basins in a leveling bed of cement grout.

C. Install a stop valve in an accessible location in the water connection to each fixture.

D. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.

E. Seal fixtures to walls and floors using silicone sealant as specified in other sections. Match sealant color to fixture color.

F. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt in a quantity of one device for each ten fixtures. Furnish faucet repair kits complete with all necessary washers, springs, pins, retainers, packings, O-rings, sleeves, and seats in a quantity of one kit for each forty faucets.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed unit for damage. Replace damaged fixtures. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.

B. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow and stream.

C. Replace washers of leaking or dripping faucets and stops.

3.4 PROTECTING AND CLEANING

A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials. Provide protective covering for installed fixtures, water coolers, and trim.

B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

END OF SECTION

SECTION 230150 - PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. Procedural requirements governing the Contractor's selection of products and product options are included in other sections.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions". The following are not considered substitutions:

1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.

2. Revisions to Contract Documents requested by the Owner or Architect.

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

4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if received within sixty days after commencement of the Work. Requests received more than sixty days after commencement of the Work may be considered or rejected at the discretion of the Architect/Engineer.

1. Submit three copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

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

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

   b. Samples, where applicable or requested.

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

   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.

   e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

   f. Cost information, including a proposal of the net change, in the Contract Sum.

   g. Assurance that the substitution is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

B. Action: Within one week of receipt of the request for substitution, the Architect/Engineer will request additional information or documentation necessary for evaluation of the request. Within two weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. Acceptance will be in the form of a Change Order. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use one of the products specified as approved.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Contractor's substitution request will be received and considered by the Architect/Engineer when one or more of the following conditions are satisfied, as determined by

the Architect/Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.

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

3. The request is timely, fully documented and properly submitted.

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

5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

6. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.

9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution can provide the required warranty.

10. Where a proposed substitution involves more than one Sub Contractor, each Contractor shall cooperate with the other Contractors involved to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.

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

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 230200 - SHOP DRAWINGS AND SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF REQUIREMENTS

A. This Section specifies procedural requirements for non-administrative submittals including shop drawings product data, samples, and other miscellaneous submittals.

B. Shop drawings are technical drawings and data that have been specially prepared for this project. Information required on shop drawings includes dimensions, identification of specific products and materials which are included in the work, compliance with specified standard and notations of coordination requirements with other work. Provide special notation of dimensions that have been established by field measurement. Indicate deviations from the contract documents on the shop drawings.

C. Product data includes standard printed information on manufactured products that has not been specially-prepared for this project. General information required specifically as product data includes manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies, and the application of their labels and seals special notation of dimensions which have been verified by way of field measurement, and special coordination requirements for interfacing the material, product or system with other work.

D. Samples are physical examples of work. Documentation required specifically for sample submittals includes a generic description of the sample, the sample source or the product name or manufacturer, compliance with governing regulations and recognized standards. In addition, indicate limitations in terms of availability, sizes, delivery time, and similar limiting characteristics.

E. Miscellaneous submittals are work-related, nonadministrative submittals that do not fit in the three previous categories.

1.3 SUBMITTAL PROCEDURES

A. Submit all Division 23 Shop Drawings, product data samples, and related documents in one package. Submittal should be as complete as possible and include the following:

1. Enclose submittal in 3-ring or similar loose leaf booklet.
2. Include title page and table of contents.
3. Include list of subcontractors' qualifications and suppliers.

4. Provide tabs in front of major submittal sections relating back to table of contents.

B. No individual submittal sections will be considered and will be returned marked "No Action", with the following exceptions:

1. Items with long "Lead Time" may be submitted early if all such items are packaged together.

2. Sheet metal, piping and control drawings may be submitted after initial submittal due to preparation time required.

C. Prepare and transmit the submittal to the Architect/Engineer sufficiently in advance of the scheduled performance of related work and other applicable activities. Advise the Architect/Engineer if processing time is critical to the progress of the work.

1. Allow two weeks minimum for the Architect/Engineer's initial processing of each submittal. The Architect/Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.

2. Allow one week for processing each resubmittal.

3. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.

D. Mark each submittal with a permanent label for identification. Provide the following information on the label for proper processing and recording of action taken.

1. Project name.
2. Date.
3. Name and address of Architect/Engineer, Contractor, subcontractor and supplier.
4. Name of manufacturer.
5. Number and title of appropriate specification section.
6. Drawing number and detail references, as appropriate.
7. Similar definitive information as necessary.
8. Provide a space on the label for the Contractor's review and approval markings, and a space for the Architect/Engineer's "Action" marking.

E. Transmit each submittal from the Contractor to the Architect/Engineer, and to other destinations as indicated, by use of a transmittal form. Submittals received from sources other than the Contractor will be returned to the sender marked "No Action".

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

A. Shop Drawings: Provide six prints plus two additional prints where they are required for maintenance manuals. Two prints will be retained; the remainder will be returned. One of the prints returned will be marked-up and maintained by the Contractor as a "Record Document". Provide coordination drawings where required for the integration of the work. Show sequencing and relationship of separate units of work which are located in areas with restricted space. Submit newly prepared information, drawn to accurate scale on sheets not less than 8 inches by 11 inches; except for actual pattern or template type drawings, the maximum sheet size shall not exceed 36

inches by 48 inches. Indicate the name of the firm that prepared each shop drawing and provide appropriate project identification in the title block.

B. Product Data: Submit six copies. Do not proceed with installation of materials, products and systems until a copy of product data applicable to the installation is in the possession of the installer. Do not permit the use of unmarked copies of product data in connection with the performance of the work.

C. Samples: Submit three sets of samples for the Architect/Engineer's visual review; one set will be returned with comments. Maintain the reviewed submittal set of samples, as returned by the Architect/Engineer, at the project site, available for quality control comparisons throughout the course of performing the work.

D. Miscellaneous Submittals:

1. Inspection and Test Reports: Classify each inspection and test report as being either "shop drawings" or "product data" depending on whether the report is specially prepared for the project, or a standard publication of workmanship control testing at the point of production. Process inspection and test reports accordingly.

2. Warranties: Refer to other sections for specific general requirements on warranties, product bonds, workmanship bonds and maintenance agreements. In addition to copies desired for the Contractor's use, furnish two executed copies of such warranties, bonds or agreements. Provide two additional copies where required for maintenance manuals.

3. Standards: Where submittal of a copy of standards is indicated, and except where copies of standards are specified as an integral part of a "Product Data" submittal, submit a single copy of standards for the Architect/Engineer's use.

4. Closeout Submittals: Refer to other sections of these specifications for specific submittal requirements of project closeout information, materials, tools, and similar items.

a. Record Documents: Furnish set of original documents as maintained on the project site. Along with original marked-up record drawings, provide two copies of marked-up drawings which may be reduced to not less than half size.

b. Operation And Maintenance Data: Include description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts. Also include manufacturer's printed operating procedures, maintenance procedures, and servicing instructions, lubrication charts and schedules.

c. Materials and Tools: Refer to individual sections of these specifications for required quantities of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

1.5 ARCHITECT/ENGINEER'S ACTION

A. Except for submittals for the record and similar purposes, where action and return on submittals is required or requested, the Architect/Engineer will review each submittal, mark with appropriate "Action Taken", and where possible return within two weeks of receipt. The Architect/Engineer will stamp each submittal to be returned with a uniform, self-explanatory action stamp, appropriately marked to indicate one of the following:

1. Final Unrestricted Release: Where the submittals are marked "No Exception Taken", the work covered by the submittal may proceed provided it complies with the requirements of the contract documents; acceptance of the work will depend upon that compliance.

2. Final-But-Restricted Release: When the submittals are marked "Exception Taken as Noted", the work covered by the submittal may proceed provided it complies with both the Architect's/Engineer's notations or corrections on the submittal and with the requirements of the contract documents; acceptance of the work will depend on that compliance.

3. Returned for Resubmittal: When the submittal is marked either "Revise and Resubmit" or "Not Accepted Resubmit", do not proceed with the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise the submittal or prepare a new submittal in accordance with the Architect's/Engineer's notations stating the reasons for returning the submittal; resubmit the submittal without delay. Repeat if necessary to obtain a different action marking. Do not permit submittals with this marking to be used at the project site, or elsewhere where work is in progress.

4. Other Action: Where the submittal is returned, marked with the Architect/Engineer's explanation, for special processing or other Contractor activity, or is primarily for information or record purposes, the submittal will be marked "For Information Only".

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION

SECTION 230500 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division 23. It expands and supplements the requirements specified in sections of Division 1.

1.3 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. Extend all grease fittings to an accessible location.

1.4 MECHANICAL INSTALLATIONS

A. Coordinate mechanical equipment and materials installation with other building components. Verify all dimensions by field measurements. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

B. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

C. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible. Coordinate the installation of mechanical materials and equipment above ceilings with suspension system, light fixtures, and other installations.

D. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

1.5 DRAWINGS AND SPECIFICATIONS

A. Separate divisional drawings and specifications shall not relieve the Contractor from full responsibility to complete all work which may be indicated on any of the drawings or in any division of the specification.

B. The specifications and drawings are complementary and are to be taken together for a complete interpretation of the work.

C. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Therefore, no interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for a complete installation are excluded.

D. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

E. Examine the architectural, structural, electrical and mechanical drawings and specifications prior to submitting bid. Architectural and structural drawings take precedence over mechanical drawings with reference to building construction, location of plumbing fixtures, and any other similar fixed items.

F. The Architect shall be notified of any discrepancies, omissions, conflicts or interferences which occur between drawings and specifications. If such notification is received in adequate time additional data or changes will be issued by addendum to all bidders.

1.6 CUTTING AND PATCHING

A. Do not endanger or damage installed Work through procedures and processes of cutting and patching. Do not cut structural members without prior written approval of the structural Engineer or Architect.

B. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

C. Perform cutting, fitting, and patching of mechanical equipment and materials required to: uncover Work to provide for installation of ill-timed Work; remove and replace defective Work; remove samples of installed Work as specified for testing; install equipment and materials in existing structures; upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

D. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.

E. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Locate identify, and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to change over.

1.7 MECHANICAL SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary), Division 1 and Division 23 Section: SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES for submittal definitions, requirements, and procedures. Submittal of shop drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.

1.8 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders, Division 1 and Division 23 Section “PRODUCTS AND SUBSTITUTION” for requirements in selecting products and requesting substitutions.

1.9 PRODUCT LISTING

A. Prepare listing of major mechanical equipment and materials for the project. Submit this listing as a part of the submittal requirement specified.

1.10 PRODUCTS

A. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated. Provide products which are compatible within systems and other connected items.

1.11 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications: adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

1.13 RECORD DOCUMENTS

A. Refer to the Division 1 Section: PROJECT CLOSEOUT or PROJECT RECORD DOCUMENTS for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark drawings to indicate revisions to piping and ductwork, size and location both exterior and interior: including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair: actual equipment locations, dimensioned for column lines: actual inverts and locations of underground piping: concealed equipment, dimensioned to column lines: mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.): Change Orders: concealed control system devices.

C. Mark specifications to indicate approved substitutions: Change Orders; actual equipment and materials used.

D. Reproducible record drawings shall be on disk.

1.14 OPERATION AND MAINTENANCE DATA

A. In addition to the information required by Division 1 for Maintenance Data, include the following information:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions: regulation, control, stopping, shut-down, and emergency instructions: and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting: disassembly, repair, and reassembly: aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

1.15 WARRANTIES

A. Refer to the Division 1 Section: SPECIFIC WARRANTIES for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division 23, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond: duration of warranty or bond: and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.16 CLEANING

A. Refer to the Division 1 Section: PROJECT CLOSEOUT or FINAL CLEANING for general requirements for final cleaning.

B. Refer to Division 23 Section: TESTING, ADJUSTING, AND BALANCING for requirements for cleaning filters, strainers, and mechanical systems prior to final acceptance.

1.17 MECHANICAL COORDINATION DRAWINGS

A. Prepare and submit a set of coordination drawings showing major elements, components, and systems of mechanical equipment and materials in relationship with other building components. Prepare drawings to an accurate scale of ¼"=1'-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing and maintaining insulation, servicing and maintaining equipment, valve stem movement, and similar requirements. Indicate movement and positioning of large equipment into the building during construction.

B. Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, 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. Mechanical equipment room layouts.

2. Specific equipment installations, including:

   a. Pumps and compressors.
   b. Tanks and heat exchangers.
   c. Air handling units.

3. Work in pipe spaces, chases, trenches, and tunnels.

4. Ceiling plenums which contain piping, ductwork, or equipment in congested arrangement.

5. Installations in mechanical riser shafts, at typical sections and crucial offsets and junctures.

6. Numbered valve location diagrams.

7. Manifold piping for multiple equipment units.

END OF SECTION

SECTION 230529 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of supports and anchors required by this Section is indicated on drawings and/or specified in other Division 23 sections. Types of supports and anchors specified in this Section include the following:

1. Horizontal-Piping Hangers and Supports.
2. Vertical-Piping Clamps.
3. Hanger-Rod Attachments.
4. Building Attachments.
5. Saddles and Shields.
6. Miscellaneous Materials.
7. Equipment Supports.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.

C. UL and FM Compliance: Provide products which are UL-listed and FM approved for sprinkler piping systems.

1.4 SUBMITTALS

A. The manufacturer shall determine the number, size, and type of anchor bolts, cable restraints, etc. for each piece and groups of pipes.

B. Details for steel frames to be used in connection with the isolations and seismic restraint of the items.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering hangers and supports which may be incorporated in work include Cooper B-Line Systems Inc., Fee & Mason Mfg., Co., Anvil International, and Pipe Shields, Inc.

2.2 HANGERS, ATTACHMENTS AND SUPPORTS

A. Provide factory-fabricated anchors, hangers, attachments, and supports complying with MSS SP-58, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers, attachments, and supports for copper-piping systems.

B. Horizontal-Piping Hangers and Supports:

1. Adjustable Steel Clevis Hangers: MSS Type 1 (Anvil Fig. 260).
2. Steel Pipe Clamps: MSS Type 4 (Anvil Fig. 212).
3. Adjustable Swivel Pipe Rings: MSS Type 6 (Anvil Fig. 104).
4. Split Pipe Rings: MSS Type 11 (Anvil Fig. 108).
5. U-Bolts: MSS Type 24 (Anvil Fig. 137).
6. Clips: MSS Type 26 (Anvil Fig. 262).
7. Adjustable Pipe Saddle Supports: MSS Type 38 (Anvil Fig. 264), including steel pipe base support and cast-iron floor flange.
8. Single Pipe Rolls: MSS Type 41 (Anvil Fig. 171).
9. Adjustable Roller Hangers: MSS Type 43 (Anvil Fig. 181).

C. Vertical - Piping Clamps: Two-Bolt Riser Clamps: MSS Type 8 (Anvil Fig. 261).

D. Hanger - Rod Attachments: Steel Turnbuckles: MSS Type 13 (Anvil Fig. 230).

E. Building Attachments:

1. Concrete Inserts: MSS Type 18 (Anvil Fig. 285).
2. Top Beam C-Clamps: MSS Type 19 (Anvil Fig. 93).
3. Side Beam or Channel Clamps: MSS Type 20 (Anvil Fig. 225 or 226).
4. Center Beam Clamps: MSS Type 21 (Anvil Fig. 133).
5. C-Clamps: MSS Type 23 (Anvil Fig. 86).
6. Steel Brackets:
   a. Light Duty: MSS Type 31 (Anvil Fig. 194).
   b. Medium Duty: MSS Type 32 (Anvil Fig. 195).
7. Horizontal Travelers: MSS Type 58 (Anvil Fig. 170).

2.3 SADDLES AND SHIELDS

A. Provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Shields: MSS Type 40 (Anvil Fig. 167); of length recommended by manufacturer (minimum 12").

2.4 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

E. Equipment Supports: Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed. Correct inadequacies including proper placement of inserts, anchors and other building structural attachments. Installation of hangers, supports, anchors and associated work must be coordinated with all work by other disciplines to avoid conflicts.

3.2 INSTALLATION OF HANGERS, ATTACHMENTS AND SUPPORTS

A. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers. Install supports with maximum spacings complying with MSS SP-69. Do not use wire or perforated metal to support piping, and do not support piping from other piping. Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

B. Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment, and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

C. Insulated Piping:

1. Clamps: Insulation on pispes must run continuously. Provide insulation shields, 12" long as required.

2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold water piping, install coated protective shields. For pipe eight inches and over, install wood insulation saddles.

D. Install building attachments within concrete or on structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional supports at concentrated loads and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

E. Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with suggested hanger spacing and rod sizes for straight horizontal runs according to MSS SP-69 as tabulated below:

	Hanger Spacing in Feet				
Pipe Size	Std. Wt. Steel Pipe		Copper Tube	PVC	Rod Size
(Inches)	Water	Steam	Water	Water	(Inches)
½	5	6	5	4	¼
¾	6	7	5	4	¼
1	7	9	6	4½	¼
1½	9	12	8	4½	⅜
2	10	13	8	5	⅜
2½	11	14	9	5	⅜
3	12	15	10	6	⅜
4	14	17	12	6½	½
6	17	19	14	7½	½
8	19	21	24	16	⅝
10	20	26	18	8½	¾
12	23	30	19		⅞
14	25	32			1
16	27	35			1
18	28	37			1¼
20	30	39			1¼

3.3 ADJUSTING AND CLEANING

A. Adjust hangers so as to distribute loads equally on attachments.

B. Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 230553 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of mechanical identification work required by this Section is indicated on drawings and/or specified in other Division 23 sections. Types of identification devices specified in this Section include painted identification materials, plastic pipe markers, valve tags, valve schedule frames, and plastic equipment markers.

B. Refer to Division 26 sections for identification requirements of electrical work; not work of this Section.

C. Painting specifications and color coding for pipes and equipment are also included in this Section.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Comply with ANSI A13.1 for lettering sizes, enamel paint and plastic tape colors, and pressure sensitive vinyl pipe markers.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8" x 11" bond paper. Tabulate valve number, piping system, system abbreviation location of valve and variations for identification. Mark valves which are intended for emergency shut-off and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering mechanical identification materials which may be incorporated in the work include Allen Systems, Inc., Brady (W.H.) Co. (Signmark Div.), Industrial Saftey Supply Co., Inc., and Seton Name Plate Corp.

2.2 MECHANICAL IDENTIFICATION MATERIALS

A. Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Provide single selection for each product category.

B. Painted Identification Materials: Provide standard fiberboard stencils, with not less than 1¼" high letters for ductwork and not less than ¾" high letters for access door signs and similar operational instructions. Provide standard exterior type stenciling enamel, either brushing grade or pressurized spray-can form and grade, and standard identification enamel of colors indicated.

C. Plastic Pipe Markers: Provide manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers. Print each pipe marker with arrows to indicate flow direction. For pipes with external diameters less than 6" (including insulation), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by adhesive lap joint in pipe marker overlap. For pipes with external diameters of 6" and larger (including insulation) provide either full-band or strip-type pipe markers, but not narrower than three times letter height, laminated or bonded to pipe (or insulation), or taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than ¾" wide; full circle at both ends of pipe marker, tape lapped 3".

D. Plastic Tape: Provide manufacturer's standard color-coded pressure sensitive (self-adhesive) vinyl tape, not less than three mils thick. Provide 1" wide tape markers on pipes with outside diameters (including insulation) of less than 6", 2½" wide tape for larger pipes.

E. Valve Tags: Provide 19 gauge polished brass valve tags with stamp-engraved piping system abbreviation in ¼" high letters and valve numbers ½" high, and with 5/32" hole for fastener. Provide 1½" diameter tags and manufacturer's standard solid brass chain or solid brass S-hooks for attachment of tags to valves. Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to the concealed valve.

F. Valve Schedule Frames: For each page of valve schedule, provide removable glazed display frame. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.3 LETTERING AND GRAPHICS

A. Designations used in mechanical identification work should correspond with those shown on plans. If not otherwise indicated, provide designations which allow proper identification and operation/maintenance of mechanical systems and equipment.

2.4 COLOR CODING FOR PIPES AND EQUIPMENT

A. Color coding is to be in accordance with standard color code as developed by the Consulting Engineer. Colors to be selected by Consulting Engineer from Standard Colors of manufacturer. Color code painting shall be provided for all exposed conduits, through items and pipelines for the transport of gases, liquid and semiliquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and all operating accessories which are integral to the whole functional pipe and electrical conduit system. See Color Code Schedule attached at the end of this Section.

B. Pipelines which are not listed on the Color Code Schedule shall be assigned a color by the Consulting Engineer and shall be treated as an integral part of the Contract.

C. Color Code Schedule:

Description	**Color**
Chilled Water Pipe	Blue or match existing color
Exterior Pipe Supports	Match exterior finish of building and coordinate with Owner for finish color.
Support Steel, Equipment tanks, etc.	Battleship gray
Valves	Green body, red handles
Housekeeping Pads/Inertia Bases	Green
Heating Hot Water	Orange

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install identification after completion of surfacing covering and painting, and prior to installation of acoustical ceilings and similar removable concealment.

B. Provide duct markers or stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information. Where access doors are concealed, plasticized tags may be installed for identification in lieu of specified signs.

3.2 PIPING SYSTEM IDENTIFICATION

A. Install stenciled pipe markers including color-coded background band or rectangle, and contrasting lettering, for each system indicated to receive identification, and include arrows to show normal direction of flow.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior nonconcealed locations.

1. Near each valve and control device.

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch where there could be question of flow pattern.

3. Near locations where pipes pass through walls or floors/ ceilings, or enter nonaccessible enclosures.

4. At access doors, manholes and similar access points which permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

3.3 VALVE IDENTIFICATION

A. Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibbs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

B. To identify such valves zone "Control Valves" and inspector test valves for fire protection system located above finished ceiling, identification shall be placed on access panel, next to access panel, or on to a nonmovable part of the ceiling system such as a tee-bar grid of a lay-in type ceiling.

C. Mount valve schedule frames and schedules in machine rooms where indicated or where directed by Architect/Engineer.

3.4 EQUIPMENT IDENTIFICATION

A. Paint the equipment identification abbreviation as shown on the plans for all major pieces of mechanical equipment such as air handlers, chillers, pumps, exhaust fans, etc., installed under this contract.

3.5 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.6 PAINTING

A. No paint containing lead will be allowed.

B. All paint materials and equipment used on the job shall be stored in a single space designated by the Architect and Owner. The storage area shall be kept neat and clean. Floors shall be adequately protected from paint spillage. All cloths and cotton waste which might constitute a fire hazard shall be placed in metal containers and destroyed at the end of each work day. All damage caused to surfaces within the storage area shall be repaired. A fire extinguisher shall be provided and fully charged at all times for this area.

C. Provide primers and other undercoat paint produced by same manufacturer as finish coats. Primers shall be compatible with finish paints.

D. All work shall be guaranteed by this Contractor against defects caused by use of inferior materials or workmanship for a period of 1 year from date of final acceptance of building.

E. All hangers and pipe support floor stands shall be painted. The system shall be painted up to but not including the flanges attached to the mechanical equipment nor the flexible conduit connected to electrical motors. Colors shall be as noted in the Color Code Schedule.

F. All systems which are an integral part of the equipment, that is originated from the equipment and returning to the same piece of equipment, shall be painted between and up to but not including the fixed flanges or connections on the equipment.

G. All metal surfaces to be painted shall be thoroughly cleaned of objectionable matter before priming or field coat are applied. Wire brushes shall not be used on galvanized and shop painted surfaces.

1. Unpainted Ferrous Metal: Surfaces shall be cleaned with wire brushes or by other proper and acceptable means. Grease and oil shall be removed with gasoline, benzine, or other similar volatile cleaners. The surface shall be free from moisture or frost.

2. Zinc-Coated (Galvanized) Surfaces: Grease and oil shall be removed with gasoline, benzine, or other similar volatile cleaner. Surfaces shall then be treated with an approved chemical compound such as phosphoric acid wash. The chemical compound shall be completely removed with clean, fresh water, and the surfaces thoroughly dried prior to priming.

3. Zinc-Chromate Shop Painted Ferrous Metal: Grease and oil shall be removed with gasoline, benzine, or other similar volatile cleaner.

H. Structural and miscellaneous metals are specified to be shipped to the job site with prime coat. Items shall be touched-up as necessary at the job site prior to erection.

1. Ferrous materials delivered to the job site without shop coats shall be thoroughly cleaned and primed in the field. Cleaning shall be in accordance with Steel Structures Painting Council Surface Preparations Specifications #2. After cleaning, all surfaces except galvanized shall be primed with zinc-chromate iron oxide primer, equal to Pittsburgh's formulation 17-6. Galvanized surfaces shall be prepared as previously specified and given a special galvanized primer.

I. After erection, all weld splatter shall be removed and additional cleaning done, as required, to ensure a proper paint bond. The prime shall be applied to all surfaces as soon as possible after cleaning.

J. Pipe and equipment insulation such as canvas jacket insulation to be painted shall be cleaned of all loose foreign and objectionable material prior to priming.

K. Wherever previously primed or painted surfaces have been destroyed or defaced, they shall be restored with materials of like kind. Gouges or scratches in factory-applied finishes shall be filled with suitable fillers and sanded smooth prior to priming and painting or for special finishes, refinished in accordance with manufacturer's recommendations.

L. The premises shall at all times be kept free from accumulation of waste material and rubbish by employees or work. At the completion of the painting remove all tools, scaffolding, surplus materials, and all rubbish from and about the buildings and leave work area "broom clean" unless more exactly specified.

M. Upon completion, remove all paint where it has been spilled, splashed, or splattered on floors, fixtures, equipment, furniture, and all other surfaces, leaving the work ready for inspection.

3.7 EXTRA STOCK

A. Furnish minimum of five percent extra stock of each mechanical identification material required, including additional numbered valve tags for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

B. This Contractor shall furnish the Owner with two full gallon cans of each finished color and complete manufacturer label and formula, and color chip with manufacturer's color name and/or code and location at which paint occurs.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections:

1. Other Division 23 sections specify balancing devices and their installation, and materials and installations of mechanical systems.

1.2 SUMMARY

A. This Section specifies the requirements and procedures to be utilized for new installations and as indicated for mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. Test, adjust, and balance the following mechanical systems:

1. Supply air systems.
2. Return air systems.
3. Exhaust air systems.
4. Verify temperature control system operation.

C. This Section does not include:

1. Testing boilers and pressure vessels for compliance with safety codes.

2. Specifications for materials for patching mechanical systems.

3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

4. Requirements and procedures for piping and ductwork systems leakage tests.

1.3 DEFINITIONS

A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. The balance of air distribution.

2. Adjustment of total system to provide design quantities.
3. Electrical measurement.
4. Verification of performance of all equipment and automatic controls.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

H. Main: Duct or pipe containing the system's major or entire fluid flow.

I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.

J. Branch main: Duct or pipe serving two or more terminals.

K. Branch: Duct or pipe serving a single terminal.

1.4 SUBMITTALS

A. Engineer and Technicians Data: Submit proof that the Test and Balance Engineer assigned to supervise the procedures and the technicians proposed to perform the procedures meet the qualifications specified below.

B. Procedures and Agenda:

1. Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

2. Pre-Construction Plan Check: Contractor shall review the Plans and/or visit the site prior to the start of construction of the project (new or existing systems). Notify the installing contractor and Architect/Engineer in writing of any modifications or changes to the system(s), and how they should be made to allow the most effective total system balance.

C. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below.

D. Draft Reports: Within one week of completion of testing, adjusting, and balancing procedures, submit draft report directly to the Engineer on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit two (2) complete sets of draft reports. Only 1 complete set of draft reports will be returned.

1. Immediately notify the Architect/Engineer in writing of any system(s) that do not provide the design quantities as scheduled and specified.

2. Coordinate with installing contractor, those items or systems that require corrective action to meet design performance, in a timely manner. Retest after corrections have been accomplished.

E. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit four (4) complete sets of final reports.

F. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

1. General Information and Summary.
2. Air Systems.
3. Temperature Control Systems.

G. Report Contents: Provide the following minimum information, forms and data:

1. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name, address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

2. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

H. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.5 QUALITY ASSURANCE

A. Agency Qualifications:

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

2. The independent testing, adjusting, and balancing agency certified by National Environmental Balancing Bureau (NEBB) or Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified as a Test and Balance Engineer.

B. Codes and Standards:

1. AABC: "National Standards for Total System Balance".

2. ASHRAE: "ASHRAE Handbook," 1987 Systems Volume, Chapter 57, Testing, Adjusting, and Balancing.

C. Compliance with the latest approved edition of the "Florida Energy Code for Building Construction".

1.6 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps:

1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.

2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.

3. Compare design to installed equipment and field installations.

4. Walk the system from the central equipment to terminal units to determine variations of installation from design.

5. Check filters for cleanliness.

6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.

7. Prepare report test sheets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a cross-check.

8. Determine best locations in main and branch ductwork for most accurate duct traverses.

9. Place outlet dampers in the full open position.

10. Prepare schematic diagrams of system "as-built" ductwork layouts to facilitate reporting.

11. Lubricate all motors and bearings.

12. Check fan belt tension.

13. Check fan rotation.

3.2 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

G. Take all reading with the eye at the level of the indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

3.3 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation and ductwork for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.4 RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR

A. The mechanical contractor shall complete the installation and start all HVAC systems to ensure they are working properly, and shall perform all other items as described hereinafter to assist the balancing agency in performing the testing and balancing of the HVAC systems.

B. Air Distribution Systems:

1. Verify installation for conformity to design.

2. Ensure that all supply, return, and exhaust ducts are installed in such a manner that maximum allowable leakage rates as required by specifications are not exceeded.

3. Ensure that all volume, splitter, extractor, and fire dampers are properly located and functional. Dampers serving requirements of minimum and maximum outside, return, relief, and exhaust air shall provide tight closure and full opening, with a smooth and free operation.

4. Verify that all supply, return, exhaust, and transfer grilles; registers; diffusers; and high-pressure terminal units are installed and operational.

5. Ensure that air-handling systems, units, and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., are blanked and/or sealed to eliminate excessive bypass or leakage of air.

6. Ensure that all fans (supply, return, relief, and exhaust) are operating and free of vibration. All fans and drives shall be checked for proper fan rotation and belt tension. Overload protection shall be of proper size and rating. A record of motor current and voltage shall be made to verify that the motors do not exceed nameplate rating.

7. Make any necessary changes to the sheaves, belts, and dampers, as required by the balancing agency, at no additional cost to the Owner.

8. Install clean filters.

3.5 RESPONSIBILITIES OF THE TEMPERATURE CONTROL CONTRACTOR

A. The temperature-control contractor shall complete the installation of the temperature control system, and operate and test all controls systems to ensure they are functioning properly as designed. The temperature control contractor shall assist the balancing agency in testing and balancing the HVAC systems, as described hereinafter.

1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, and fire and freeze stats.

2. Verify that all controlling instruments are calibrated and set for design operating conditions.

3. Calibrate room thermostats after installation, and before the thermostat control verification tests are performed. The balancing agency shall prove the accuracy of final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.

4. The temperature-control contractor shall allow sufficient time in the project to provide assistance and instruction to the balancing agency in the proper use and setting of control components such as but not limited to, computers, static pressure controllers, or any other device that may need set points changed so that the testing and balancing work can be performed.

3.6 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

END OF SECTION

SECTION 230700 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of mechanical insulation required by this Section is indicated on drawings and schedules, and by requirements of this Section. Types of mechanical insulation specified in this Section include the following:

1. Insulation of piping, tanks, fittings and other surfaces.

2. Insulation of ductwork, air devices and all equipment pertaining to the air distribution system.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications: Firm with at least five years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of twenty-five or less, and smoke-developed index of fifty or less, in accordance with NFPA 90A.

D. Comply with the latest approved edition of the "Florida Energy Code for Building Construction".

E. Insulation materials: Insulation materials must be manufactured at facilities certified and registered with an approved registrar to conform to ISO 9000 quality standard.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation.

1.5 DELIVERY AND STORAGE OF MATERIALS

SCHEDULE 1 - Deliver all materials to the job site and protect the insulation against dirt, water, chemical, and mechanical damage before, during, and after installation. Do not install damaged or wet insulations; remove it from the job site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers offering products which may be incorporated in the work include Armstrong World Industries, Inc., Knauf Fiber Glass GmbH., Johns-Manville Products Corp., Owens-Corning Fiberglass Corp., Pittsburgh Corning Corp., and Rubatex Corp.

2.2 PIPING INSULATION MATERIALS

A. Fiberglass Piping Insulation: Preformed sectional fiberglass insulation and factory-applied vapor barrier, all service jacket with pressure sensitive self-sealing longitudinal laps and butt strips. Suitable for operating temperatures from 0ºF to +850ºF and similar to Johns-Manville's Micro-lok AP-T. Must be Type I, rigid, molded, non-combustible, and must meet ASTM C547.

B. Cellular Glass Piping Insulation: Preformed split sectional pipe insulation of rigid foamed cellular glass for piping and flat block formed to fit for equipment. Apply with all joints tightly butted and bettered with joint sealer. Secure in place with tape, twelve inches on center, secured with at least two points per section. Cover outdoor insulation with one-eight inch layer of white fire-retardant vapor-barrier mastic; apply layer of white open weave glass fabric (10" x 20" mesh) with all joints overlapped two inches, and cover with second one-eight inch layer of same mastic or VentureClad 1577CW-embossed 5-ply self-adhesive vapor barrier/weather proofing membrane with a permeance of 0.0000 when tested per ASTM-E-96; exceeds both UL-723 and ASTM-E84 flame spread and smoke develop. Indoor insulation may be covered with factory-applied white fire-retardant foil-scrim-kraft all purpose jacket or VentureClad 1577CW-embossed 5-ply self-adhesive vapor barrier/weather proofing membrane with a permeance of 0.0000 when tested per ASTM-E-96; exceeds both UL-723 and ASTM-E84 flame spread and smoke develop.

C. Flexible unicellular piping insulation (Armaflex): Preformed split sectional closed-cell pipe insulation. Suitable for operating temperatures of -40ºF to +220ºF. Thermal conductivity "K" factor of 0.27.

D. Jackets:

1. Type A: Smooth or embossed aluminum jacket, 0.016" minimum thickness secured with ½-inch aluminum bands, for all exterior installations.

2. Type B: Pre-sized reinforced glass cloth, smoothly adhered to insulation or cement surface with lagging adhesive; lap joints a minimum of three inches and adhere with lagging adhesive.

3. Type C: PVC plastic, Zeston 2000, one-piece molded-type fitting covers and Jekting material, gloss-white.

4. Type D: White or embossed, self-adhesive jacket: VentureClad 5-ply laminate for exterior installations.

E. Fittings: Provide fitting coverings of a similar material and thickness as adjacent pipe coverings. Cover all elbows, tees, valves, flanges and other fittings of piping system.

F. Accessories: All staples, bands, wires, adhesives, cements, sealers and protective finishes to be as recommended by insulation manufacturers.

2.3 DUCTWORK INSULATION MATERIALS

A. Rigid Fiberglass Insulation: Foil-backed, 3 pound per cubic foot density, operating range of 0℉ to +450℉ and meeting ASTM C612, Type IA and IB, rigid. Similar to Johns-Manville's 814 spin-glass.

B. Flexible Fiberglass Ductwork Insulation: Foil-backed, ¾ pound per cubic foot density blanket, 2.3 inches thick with an installed R-value of 6.5 and meeting ASTM C1136, Type II.

C. Rigid duct lining: 1½ pound per cubic foot density, one inch minimum thickness, containing an EPA registered anti-microbial coating, having a NRC=0.70 and meeting ASTM C1071.

D. Lap, Seam and Pin Head Sealing: Presized reinforced glass mesh adhered to insulation or ductwork with fire retardant vapor barrier mastic, or dead soft foil tape.

E. Provide accessories (staples, bands, wires, etc.) and compounds (cements, adhesives, coatings, etc.) as recommended by insulation manufacturer.

2.4 EQUIPMENT INSULATION MATERIALS

A. Rigid Fiberglass Insulation: Board with factory applied all service jacket, suitable for operating temperatures of 0℉ to +450℉. Similar to Johns-Manville's 800 spin-glass.

B. Cellular Glass Insulation: Preformed flat block cut for equipment with factory applied all service jacket, or Pittcote 4045 with PC79 fabric or VentureClad 1577CW-embossed 5-ply self-adhesive vapor barrier/weather proofing membrane.

C. Flexible Unicellular Equipment Insulation: Closed-cell insulation suitable for operating temperatures of -40℉ to +220℉. Exterior applications, apply VentureClad 1577CW – white, highly UV resistant.

D. High Temperature Insulation: Calcium-silicate insulation, suitable for up to 1200°F service, K factor of 0.49 at 600°F, and density of 14 ½ pounds per cubic foot. Apply VentureClad 1577CW-white, on interior/exterior hot lines.

E. Jacketing Material: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard or VentureClad 1577CW-embossed 5-ply self-adhesive vapor barrier/weather proofing membrane.

F. Provide accessories (staples, bands, wire, etc.) and compounds (adhesives, cements, sealers, etc.) as recommended by insulation manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSULATION INSTALLATION, GENERAL

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices.

B. Install insulation materials with smooth and even surfaces. Do not use cut pieces or scraps abutting each other.

C. Clean and dry surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered. Maintain integrity of vapor-barrier, and protect to prevent puncture or other damage.

D. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

E. Protect outdoor insulation from weather or ultraviolet deterioration by installing outdoor protective finish or jacketing; VentureClad 1577CW – white, UV resistant.

3.3 HVAC PIPING SYSTEM INSULATION

A. Omit insulation on hot piping within radiation enclosures or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan; on heating piping beyond control valve, located within heated space; and on unions.

B. Insulate refrigerant suction lines between evaporators and compressors, and refrigerant hot gas piping with flexible unicellular insulation: ¾” thick for pipe sizes up to 2"; 1" thick for pipe sizes 2½” and larger. Jacket for exterior application shall be VentureClad 1577-CW – white.

C. Insulate condensate drain piping inside of the building with flexible unicellular insulation ½" thick for all pipe sizes. Jacket for exterior application shall be VentureClad 1577-CW – white.

D. Insulate HVAC chilled water supply and return piping with cellular glass insulation, 1½" thick for pipe sizes up to and including 5"; 2½" thick for pipe 6" and larger. Jacketing material shall be VentureClad 1577-CW – embossed high performance self-adhesive vapor barrier/weather proofing membrane.

E. Insulate HVAC hot water supply and return piping, and steam and condensate piping, with fiberglass insulation of one of the following thickness. Runout piping shall not exceed ten feet in length to an individual terminal unit.

INSULATION THICKNESS FOR TEMPERATURE RANGE

Pipe Size	120°F-200°F	201°F-250°F	251°F-305°F	306°F-450°F
Up to 1"	1"	1½"	2"	2½"
1¼" to 2"	1"	1½"	2½"	2½"
2½" to 4"	1½"	2"	2½"	3"
5" to 6"	1½"	2"	3"	3½"
8" and larger	1½"	2"	3"	3½"
Individual runouts: up to 2", not exceeding 12' in length	½"	1"	1½"	1½"

F. Insulate ice storage-brine piping systems with cellular glass insulation, 1½" thick for pipe sizes up to and including 5"; 2½" thick for pipe 6" and larger. Runout piping shall not exceed ten feet in length to an individual terminal unit.

G. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units except where specific form or type is indicated.

H. Butt pipe insulation against pipe insulation inserts. For hot pipes, apply 3" wide vapor barrier tape (VentureClad butt strip tape) or band the butt joints. For cold piping apply a wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

3.4 DUCTWORK SYSTEM INSULATION

A. Do not insulate fibrous glass ductwork, or ductwork where internal insulation or sound absorbing linings have been installed unless otherwise indicated. Do not insulate return ductwork located in return air ceiling plenums.

B. Insulate outdoor air intake ductwork between air entrance and fan inlet or HVAC unit inlet; HVAC supply ductwork between fan discharge, or HVAC unit discharge, and room terminal outlet, including neck and plenum of supply diffusers; HVAC return ductwork between room terminal inlet and return fan inlet or HVAC unit inlet; and HVAC plenums and unit housings not

preinsulated at factory or lined; with one of the following types and thicknesses of external insulation.

1. Rigid Fiberglass: 1½" thick

2. Flexible Fiberglass: 2" thick, ¾ pounds per cubic foot density, application limited to concealed locations.

C. Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

3.5 EQUIPMENT INSULATION

A. Omit insulation on factory insulated breechings and stacks, double wall breechings, and boilers and other equipment preinsulated at factory.

B. Insulate refrigeration equipment, including chillers and chilled water pumps, chemical pot feeders, and air separators with cellular glass, 2" thick for surfaces above 35F, including chilled water pumps and seals. Jacketing material shall be VentureClad 1577CW – embossed.

C. Insulate the following hot equipment with fiberglass insulation, 2" thick, except 3" thick for low pressure boilers and steam heat exchangers. Jacketing material shall be VentureClad 1577CW – white.

1. Boilers.
2. Hot water storage tanks.
3. Water heaters.
4. Heat exchangers.
5. Condensate receivers.
6. Hot water pumps.
7. Condensate pumps.

D. Insulate breechings between heating equipment outlet and stack chimney connection and stacks from bottom to top with high temperature insulation, 2" thick.

E. Do not apply insulation to equipment, breechings, or stacks while hot. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide removable insulation sections to cover parts or equipment which must be opened periodically for maintenance.

F. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship. Apply insulation using staggered joint method for both single and double layer construction. Apply each layer of insulation separately. Impale breeching and stack insulation over weld pins or secure with ½" steel bands on twelve inch centers.

G. Finish with ½" coat of finishing cement. Fill in with cement of sufficient thickness to remove surface irregularities. Cover insulated surfaces with all-service jacketing. Jacketing material shall be VentureClad 1577CW – white self adhesive jacket. Lap seams at least two inches. Apply over vapor barrier where applicable.

3.6 REPAIR, REPLACEMENT AND PROTECTION

A. Repair or replace damaged sections of existing mechanical insulation, including units with vapor barrier damage and moisture saturated units both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.

B. Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating and air conditioning systems in pressure classes from minus 2 inches to plus 10 inches water gauge.

1.3 DEFINITIONS

A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:

1. Seams: A seam is defined as the joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.

2. Joints: Joints include girth joints; branch and subbranch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system.

B. Changes or alterations to the layout or configuration of the duct system must be specifically approved in writing. Accompany requests for layout modifications with calculations showing that the proposed layout will provide the original design results without increasing the system total pressure.

1.5 SUBMITTALS

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

B. Product data including details of construction relative to materials, dimensions of individual components, profiles, and finishes for duct liner, sealing materials, and fire-stopping materials.

C. Submittals for Seismic Restraints:

1. The seismic and vibration control manufacturer shall determine the number, size, and type of anchor bolts, cable restraints, etc. for each section of ductwork.

2. Complete engineering calculations and drawings for all vibration and seismic requirements for all piping, except calculations are not required where restraints conform to SMACNA “Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Systems”.

3. Details for steel frames to be used in connection with the isolation and seismic restraint of the items.

E. Record Drawings: Include duct systems routing, fittings details, and installed accessories and devices.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 90A-2002, "Standard for the Installation of Air Conditioning and Ventilating Systems".

B. Comply with NFPA 96-1998, "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations”.

C. Comply with the latest approved edition of the "Florida Energy Code for Building Construction".

D. Comply with the latest approved edition of the SMACNA “Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Systems”.

E. Comply with UL 723 and UL 181B for duct sealants for metal ductwork.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Sheet Metal, General: Provide sheet metal in thicknesses indicated, packaged and marked as specified in ASTM A 700.

B. Galvanized Sheet Steel: Lock-forming quality, ASTM A 653, Coating Designation G 90. Provide mill-phosphatized finish for duct surfaces exposed to view.

C. PVC-coated Galvanized Steel: Shall be UL-181 Class 1 listing, lock-forming quality, galvanized sheet steel with ASTM A 527, Coating Designation for exposed surfaces of ducts and fittings (exterior of ducts and fittings for underground applications, and the interior of ducts and fittings

for fume-handling applications) and 2-mil PVC coating on the reverse side of the ducts and fittings.

D. Carbon Steel Sheets: ASTM A 366, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.

E. Stainless Steel: ASTM A 480, Type 316, sheet form, with No. 4 finish on exposed surface for ducts exposed to view; Ype 304, sheet form, with No. 1 finish for concealed ducts.

F. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish where ducts are exposed to view, and mill finish for concealed ducts.

G. Copper Sheet: Where indicated, provide copper sheet complying with ASTM B 370; H00 temper, except where 060 temper is required for unusual forming.

H. Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts. For aluminum and stainless steel ducts, provide reinforcing of compatible materials.

I. Tie Rods: Galvanized steel, ¼" minimum diameter for 36" length or less; ⅜" minimum diameter for lengths longer than 36".

2.2 DUCT LINER

A. General: Comply with NFPA Standard 90A-1989 and TIMA Standard AHC-101.

B. Materials: ASTM C 1071, Type I, with coated surface exposed to airstream to prevent erosion of glass fibers. Thickness shall be 1", with 1½ pound per cubic foot density, and "K-Factor" equal to 0.24 or better, at a mean temperature of 75°F. Liner shall have a flame-spread rating of not more than 25 and a smoke-developed rating of not higher than 50, when tested in accordance with ASTM C 411. Comply with ASTM C 916 for liner adhesive. Minimum noise reduction coefficient (NRC) for 1" liner shall be 0.70.

C. The air stream surface shall have 100% coverage of an acrylic polymer coating formulated with an immobilized EPA registered preservative proven resistant to microbial growth as determined by ASTM G21 and G22.

D. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct. Provide fasteners that do not damage the liner when applied as recommended by the manufacturer; that do not cause leakage in the duct; and will indefinitely sustain a 50-pound tensile dead load test perpendicular to the duct wall.

1. Fastener Pin Length: As required for thickness of insulation, and without projecting more than ⅛-inch into the airstream.

2. Adhesive For Attachment of Mechanical Fasteners: Comply with the "Fire Hazard Classification" of duct liner system.

2.3 FLEXIBLE DUCTS

A. Either spiral-wound spring steel with flame-proof vinyl sheathing, or corrugated aluminum; complying with UL 181. Provide one inch (1") thick continuous flexible fiberglass sheath with vinyl vapor barrier jacket.

2.4 SEALING MATERIALS

A. Joint and Seam Sealants, General: Seal all joints and seams. The term sealant used here is not limited to materials of adhesive nature, but also includes tapes and combinations of open weave fabric strips and mastics.

B. Joint and Seam Sealant: One-part, nonsag, solvent-release curing, polymerized butyl sealant complying with FS TT-S-001657 and UL 723, Type I; formulated with a minimum of 75 percent solids.

C. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.5 FIRE-STOPPING

A. Fire-resistant Sealant: Provide one-part, elastomeric sealant formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
2. "Pensil 851"; General Electric Co.
3. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
4. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
5. "RTV 7403"; General Electric Co.
6. "Fyre Putty"; Standard Oil Engineered Materials Co.
7. Fire Temp”; Johns Manville.

2.6 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder-actuated concrete fasteners, unless approved in writing by the structural engineer.

B. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod. Straps and rod sizes shall conform with Table 4-1 in SMACNA HVAC Duct Construction Standards, 1985 Edition, for sheet width and gauge and steel rod diameters. Hangers installed in corrosive atmospheres shall be electro-galvanized all-thread rod or hot-dipped-galvanized rods with threads painted after installation.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36.

1. Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.

2. For stainless steel ducts, provide stainless steel support materials.

3. For aluminum ducts, provide aluminum support materials, except where materials are electrolytically separated from ductwork.

4. For copper ducts, provide copper, bronze or brass support materials.

2.7 RECTANGULAR DUCT FABRICATION

A. General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA "HVAC Duct Construction Standards", Tables 1-3 through 1-19, including their associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

B. Static Pressure Classifications: Except where otherwise indicated, construct duct systems to the following pressure classifications:

1. Supply Ducts: 3 inches water gauge.
2. Return Ducts: 2 inches water gauge, negative pressure.
3. Exhaust Ducts: 2 inches water gauge, negative pressure.

C. Cross-breaking or Cross Beading: Cross-break or bead duct sides that are 19 inches and larger and are 20-gauge or less, with more than 10 square feet of unbraced panel area, as indicated in SMACNA "HVAC Duct Construction Standard", Figure 1-4, unless they are lined or are externally insulated.

2.8 RECTANGULAR DUCT FITTINGS

A. Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Metal Duct Construction Standard", 1985 Edition, Figures 2-1 through 2-10.

2.9 SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with 100 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness is prohibited. Apply a coat of adhesive to liner facing in direction of airflow not receiving metal nosing. Butt transverse joints without gaps and coat joint with adhesive. Fold and compress liner in corners of rectangular ducts or cut and fit to assure butted edge overlapping. Coat all exposed raw edges with superseal coating.

B. Avoid longitudinal joints in rectangular ducts wherever possible.

C. Secure liner with mechanical fasteners 4" from corners and at intervals not exceeding 12 inches transversely around perimeter; at 3" from transverse joints and at intervals not exceeding 18 inches longitudinally.

D. Secure transversely oriented liner edges facing the airstream with metal nosings that are either channel or "Z" profile or are integrally formed from the duct wall at the following locations:

1. Fan discharge.
2. Intervals of lined duct preceding unlined duct.

E. Terminate liner with duct build-outs installed in ducts to attach dampers, turning vane assemblies, and other devices. Fabricated build-outs (metal hat sections) or other build-out means are optional; when used, secure build-outs to the duct wall with bolts, screws, rivets, or welds. Terminate liner at fire dampers at connection to fire damper sleeve through fire separation.

2.10 ROUND AND FLAT OVAL DUCT FABRICATION

A. General: "Basic Round Diameter" as used in this article is the diameter of the size of round duct that has a circumference equal to the perimeter of a given sized of flat oval duct. Except where interrupted by fittings, provide round and flat oval ducts in lengths not less than 12 feet.

B. Round Ducts: Fabricate round supply ducts with spiral lock-seam or longitudinal seam construction. Comply with SMACNA "HVAC Duct Construction Standards", Table 3-2 for galvanized steel gauges.

C. Flat Oval Ducts: Fabricate flat oval supply ducts with standard spiral lock-seams (without intermediate ribs) or with butt-welded longitudinal seams in gauges listed in SMACNA "HVAC Duct Construction Standards", Table 3-4.

D. Double-wall (Insulated) Ducts: Fabricate double-wall insulated ducts with an outer shell, insulation, and an inner liner as specified below. Dimensions indicated on internally insulated ducts are nominal inside dimensions.

1. Thermal Conductivity: 0.27 Btu/square foot/degree F./inch thickness at 75ºF mean temperature.

2. Outer Shell: Base outer shell gauge on actual outer shell dimensions. Provide outer shell lengths 2" longer than inner shell and insulation, and in gauges specified for single-wall duct.

3. Insulation: Unless otherwise indicated, provide 1" thick fiberglass insulation. Provide insulation ends where internally insulated duct connects to single-wall duct or noninsulated components. The insulation end shall terminate the insulation and reduce the outer shell diameter to the inner liner diameter.

4. Solid Inner Liner: Construct round and flat oval inner liners with solid sheet metal of the gauges listed below. For flat oval ducts, the diameter indicated in the table below is the "basic round diameter".
   a. 3 to 8 inches: 28-gauge with standard spiral construction.
   b. 9 to 42 inches: 28-gauge with single-rib spiral construction.
   c. 44 to 60 inches: 26-gauge with single-rib spiral construction.
   d. 62 to 88 inches: 22-gauge with standard spiral construction.

5. Maintain concentricity of liner to outer shell by mechanical means. Protect insulation from discoloration by mechanical means.

2.11 ROUND AND FLAT OVAL SUPPLY AND EXHAUST FITTINGS FABRICATION

A. Laterals and 90-degree Conical Tees: Fabricate to conform to SMACNA "HVAC Duct Construction Standards", 1985 Edition, Figures 3-4 and 3-5 and with metal thicknesses specified for longitudinal seam straight duct.

B. Diverging-flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from the body onto branch tap entrance.

C. Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate the bend radius of die-formed, gored, and pleated elbows 1.5 times the elbow diameter. Unless elbow construction type is indicated, provide elbows meeting the following requirements:

1. Mitered Elbows: Fabricate mitered elbows with welded construction in gauges specified below.
   a. Mitered Elbows Radius and Number of Pieces: Unless otherwise indicated, construct elbow to comply with SMACNA "HVAC Duct Construction Standards", Table 3-1.
   b. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from minus 2 inches to plus 2 inches:
      1) 3 to 26 inches: 24-gauge.
      2) 27 to 36 inches: 22-gauge.
      3) 37 to 50 inches: 20-gauge.
      4) 52 to 60 inches: 18-gauge.
      5) 62 to 84 inches: 16-gauge.
   c. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from 2 inches to 10 inches:

1) 3 to 14 inches: 24-gauge.
2) 15 to 26 inches: 22-gauge.
3) 27 to 50 inches: 20-gauge.
4) 52 to 60 inches: 18-gauge.
5) 62 to 84 inches: 16-gauge.

d. Flat Oval Mitered Elbows: Solid welded and with the same metal thickness as longitudinal seam flat oval duct.

e. 90-degree, 2-piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material handling classes A and B; and only where space restrictions do not permit the use of 1.5 bend radius elbows. Fabricate with single-thickness turning vanes.

2. Round Elbows - 8 Inches and Smaller: Die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend angle configurations or ½" diameter (e.g. 3½- and 4½-inch) elbows with gored construction.

3. Round Elbows - 9 Through 14 Inches: Gored or pleated elbows for 30, 45, 60, and 90 degrees, except where space restrictions require a mitered elbow. Fabricate nonstandard bend angle configurations or ½" diameter (e.g. 9½ and 10½ inch) elbows with gored construction.

4. Round Elbows - Larger Than 14 Inches and All Flat Oval Elbows: Gored elbows, except where space restrictions require a mitered elbow.

5. Die-formed Elbows for Sizes Through 8 Inches and All Pressures: 20-gauge with 2-piece welded construction.

6. Round Gored Elbows Gauges: Same as for nonelbow fittings specified above.

7. Flat Oval Elbows Gauges: Same as longitudinal seam flat oval duct.

8. Pleated Elbows Sizes Through 14 Inches and Pressures Through 10 Inches: 26-gauge.

D. Double-wall (Insulated) Fittings: Fabricate double-wall insulated fittings with an outer shell, insulation, and an inner liner as specified below. Dimensions indicated on internally insulated ducts are nominal dimensions.

1. Thermal Conductivity: 0.27 Btu/square foot/degree F/inch thickness at 75ºF mean temperature.

2. Outer Shell: Base outer shell gauge on actual outer shell dimensions. Provide outer shell lengths 2" longer than inner shell and insulation. Gauges for outer shell shall be same as for uninsulated fittings specified above.

3. Insulation: Unless otherwise indicated, provide 1" thick fiberglass insulation. Provide insulation ends where internally insulated duct connects to single-wall duct or noninsulated components. The insulation end shall terminate the insulation and reduce the outer shell diameter to the nominal single-wall size.

4. Solid Inner Liner: Construct round and flat oval inner liners with solid sheet metal of the gauges listed below. For flat oval ducts, the diameter indicated in the table below is the "basic round diameter."
   a. 3 to 34 inches: 24-gauge.
   b. 35 to 58 inches: 22-gauge.
   c. 60 to 88 inches: 20-gauge.

5. Maintain concentricity of liner to outer shell by mechanical means. Protect insulation from discoloration by mechanical means.

E. PVC-coated Elbows and Fittings: Fabricate elbows and fittings as follows:

1. Round Elbows 4 to 8 Inches: Two-piece, die stamped, with longitudinal seams spot welded, bonded, and painted with PVC aerosol spray.

2. Round Elbows 9 to 26 Inches: Standing seam construction.

3. Round Elbows 28 to 60 Inches: Standard gore construction, riveted and bonded.

4. Other Fittings: Riveted and bonded joints.

5. Couplings: Slip-joint construction with a minimum of a 2-inch insertion length.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

A. Install ducts with the fewest possible joints. Use fabricated fittings for all changes in directions, changes in size and shape, and connections. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.

B. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct usable space of block access for servicing building and its equipment. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Provide clearance of 1 inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any. Install insulated ducts with 1-inch clearance outside of insulation. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

C. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures. Do not route ducts above electrical panel boards.

D. Nonfire-rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1½ inches.

3.2 INSTALLATION OF FLEXIBLE DUCTS

A. For any duct run using flexible ductwork, do not exceed 8'-0" extended length. Install in accordance with Section III of SMACNA's, "HVAC Duct Construction Standards, Metal and Flexible".

3.3 PVC-COATED DUCT INSTALLATION

A. Install PVC-coated duct and fittings in accordance with the manufacturer's instructions.

B. Seal all joints and seams. Apply sealer to male end connectors before insertion, and afterwards to cover the entire joint and sheet metal screws.

C. Secure couplings with sheet metal screws. Install screws at an interval of 12 inches, with a minimum of 3 screws in each coupling.

D. Repair damage to PVC coating with a PVC aerosol spray.

3.4 HANGING AND SUPPORTING

A. Install metal ducts with support systems indicated in SMACNA "HVAC Duct Construction Standards", tables 4-1 through 4-3 and Figures 4-1 through 4-8.

B. Support horizontal ducts within 2' of each elbow and within 4' of each branch intersection.

C. Support vertical ducts at a maximum interval of 16' and at each floor.

D. Upper attachments to structures shall have an allowable load not exceeding ¼ of the failure (proof test) load but are not limited to the specific methods indicated.

E. Install concrete insert prior to placing concrete.

F. Restraint of rigidly-mounted ductwork shall conform to SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Systems," SMACNA latest edition. Calculations need not be submitted for restraint systems conforming to these guidelines.

3.5 CONNECTIONS

A. Equipment Connections: Connect equipment with flexible connectors in accordance with Division 23 Section "Duct Accessories".

B. Branch Connections: Comply with SMACNA "HVAC Duct Construction Standards", Figures 2-7 and 2-8.

C. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards", Figures 2-16 through 2-18.

D. Terminal Units Connections: Comply with SMACNA "HVAC Duct Construction Standards", Figure 2-19.

3.6 FIELD QUALITY CONTROL

A. Maximum Allowable Leakage: As described in ASHRAE 1989 Handbook, "Fundamentals" Volume, Chapter 32, Table 6 and Figure 10. Comply with requirements for leakage classification 3 for round and flat oval ducts, leakage classification 12 for rectangular ducts in pressure classifications less than and equal to 2" water gauge (both positive and negative pressures), and leakage classification 6 for pressure classifications greater than 2" water gauge and less than and equal to 10" water gauge.

B. Reseal leaking joints as required and apply sealants to achieve specified maximum allowable leakage.

3.7 ADJUSTING AND CLEANING

A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

D. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION

SECTION 233300 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this Section. Types of ductwork accessories required for project include the following:

1. Dampers:
   a. Balancing dampers.
   b. Control dampers.
   c. Automatic backdraft dampers.
2. Fire and smoke dampers.
3. Turning vanes.
4. Duct hardware.
5. Duct access doors.
6. Flexible connections.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than three years.

B. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

C. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.

D. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers".

E. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

F. Comply with the latest approved edition of the "Florida Energy Code for Building Construction".

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.

PART 2 - PRODUCTS

2.1 DAMPERS

A. Low Pressure Manual Dampers: Provide dampers of single blade type or multi-blade type, constructed in accordance with SMACNA "HVAC Duct Construction Standards".

B. Control Dampers: Provide dampers with parallel blades for 2-position control, or opposed blades for modulating control. Construct blades of 16-gauge steel, provide heavy-duty molded self-lubricating nylon bearings, ½" diameter steel axles spaced on 9" centers. Construct frame of 2" by ½" by ⅛" steel channel for face areas 25 square feet and under; 4" by 1¼" by 16-gauge channel for face areas over 25 square feet. Provide galvanized steel finish with aluminum touch-up.

C. Backdraft Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at 0.1" static pressure. Construct blades of 16-gauge aluminum, provide ½" diameter ball bearings, ½" diameter steel axles spaced on 9" centers. Construct frame of 2" by ½" by ⅛" steel channel for face areas 25 square feet and under; 4" by one and 1¼" by 16-gauge channel for face areas over 25 square feet. Provide galvanized steel finish on frame with aluminum touch-up.

D. Acceptable manufacturers include Air Balance, Inc.; Airguide Corp.; Arrow Louver and Damper; Greenheck; Louvers & Dampers, Inc.; Nailor; Penn Ventilator Co.; and Ruskin Mfg. Co.

2.2 FIRE AND SMOKE DAMPERS

A. Fire Dampers: Construct casings of 20-gauge galvanized steel. Provide fusible link rated at 160°F to 165°F unless otherwise indicated. Dampers shall be meet UL 555 qualifications. Provide damper with positive lock in closed position, and with curtain type damper blade assembly, with curtain 100% out of airstream and 24-gauge galvanized steel blades.

B. Fire/Smoke Dampers: Construct casings of 20-gauge galvanized steel. Provide fusible link rated at 160°F to 165°F unless otherwise indicated. Provide additional frangible link containing explosive charge, connected in series with fusible link. Provide stainless steel spring loaded leakage seals in sides of casing, and 36" long wire leads for connecting smoke link to smoke detector, and low profile multi-formed 16-gauge galvanized steel blades.

C. Ceiling fire dampers: Only all steel constructed air devices to be installed with this type of damper. Construct frame of 20-gauge galvanized steel. Provide fusible link rated at 160°F to 165°F unless otherwise indicated. Provide damper with positive lock in the closed position, and with single or butterfly damper blade assembly with UL Classified insulating mineral board and 22 gauge galvanized steel blades. Provide minimum ¼" thick ceramic insulating blanket as required by air device, and manufacturer's tested assembly. Ceiling damper based on Ruskin model CFD

and CFDR with UL test assembly and sizes based on air device served. Damper may be used as a volume damper for air devices with an approved UL tested assembly.

D. Motor-Driven Fire/Smoke Dampers: Construct casing of 16-gauge galvanized steel, fusible link 160°F to 165°F multi-blade type. Damper manufacturer shall have tested, and listed with UL a complete range of damper sizes covering all combination fire/smoke dampers required by this specification. Electric operator shall be factory installed. Damper and operator shall be supplied as a single entity which must meet UL 555S qualifications. Damper shall be equal to Ruskin model FSD36 Class II.

1. Damper electric operator shall be equal to Ruskin series MP2781 for duct sizes up to three square feet and series MA 418 for ducts above three square feet to 24 square feet.
2. Each combination fire /smoke damper shall have pressure drops in the open position of less than 0.1 inch w.g. with average duct velocities of 2500 fpm.

E. Acceptable manufacturers include Ruskin Mfg. Co., Air Balance, Inc.; Nailor, Greenheck; and Prefco Products, Inc.

2.3 TURNING VANES

A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards" or provide manufactured turning vanes constructed of 1" wide curved blades set at ¾" o.c., supported with bars perpendicular to blades set at 2" o.c., and set into side strips suitable for mounting in ductwork.

B. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of airfoil shaped aluminum extrusions with perforated faces and fiberglass fill.

C. Acceptable manufacturers include Aero Dyne Co., Airsan Corp., Anemostat Products, Barb-Aire Co., Duro Dyne Corp., Environmental Elements Corp., Hart & Cooley Mfg. Co., and Register & Grille Mfg. Co., Inc.

2.4 DUCT HARDWARE

A. Provide duct hardware manufactured by one manufacturer for all items on project.

B. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

C. Acceptable manufacturers include Elgen Manufacturing, Ventfabrics, Inc., and Young Regulator Co.

2.5 DUCT ACCESS DOORS

A. Construct access doors of the same or greater gauge as ductwork served, provide 1" thick insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for

externally insulated duct. Provide one side hinged, other side with one handle-type cam latch for all doors. If space is limited for a hinged door swing, then provide a two handle-type cam latch door. Installation of door shall be accessible, and the size opening shall be large enough to permit maintenance and resetting of device the door serves.

B. Acceptable manufacturers include Air Balance Inc., Louver & Dampers, Inc., and Ruskin Mfg. Co.

2.6 FLEXIBLE CONNECTIONS

A. Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

B. Acceptable manufacturers include American/Elgen Co., Duro Dyne Corp., Flexaust Co., and Ventfabrics, Inc.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

B. Install turning vanes in square or rectangular 90º elbows in supply air systems, and elsewhere as indicated.

C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter. Provide access doors at all duct mounted smoke detectors, fire dampers, smoke/fire dampers and other locations where routine maintenance will be required.

D. Combination Fire/Smoke Dampers:

1. Each combination fire/smoke damper shall be installed in accordance with the conditions of their listing and the manufacturer's installation instructions.

2. Provide wall sleeves. Thickness of sleeves shall not be less than the conditions of rating under UL 555S, standard for fire dampers and ceiling dampers. Provide an expansion gap between the fire rated wall opening and the fire/smoke damper sleeve. The gap shall be sized at ⅛" per linear foot in both dimensions.

3. Smoke seal retaining angles by providing a bead of acoustic sealant or UL rated caulking on the edge of retaining angle at the wall.

E. Install 2 ft long orange plastic strips at all volume dampers to aid in easy identification of locations. These strips are to remain after construction.

3.3 FIELD QUALITY CONTROL

A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak-proof performance.

3.4 ADJUSTING AND CLEANING

A. Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.

B. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.5 EXTRA STOCK:

A. Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range.

END OF SECTION

SECTION 233713 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than five years.

B. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.

C. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A-"Standard for the Installation of Air Conditioning and Ventilating Systems".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:

1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.

2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES, REGISTERS AND LOUVERS

A. Ceiling Diffusers: Rectangular louvered face, aluminum construction, baked white enamel finish, fixed, throw pattern and rectangular or round neck as shown on plan. All units shall be provided with lever operated opposed blade damper in throat (Price VCS3). Provide 2'x 2' lay-in panel for T-bar ceilings. Provide beveled drop face (Price Border 6) for drywall or plaster ceilings. Price AMD or approved equal.

B. Ceiling diffusers: Rectangular perforated face, aluminum construction, baked white enamel finish, adjustable pattern and throw with round neck. Provide 2' x 2' lay-in type for T-bar ceilings. Provide 1" border (Price Border 1) for drywall or plaster ceilings Price APDC or

approved equal.

C. Return or exhaust grilles and registers: Rectangular louvered face, 35° or 45° fixed blades on ½-inch centers, all aluminum construction, white baked enamel finish. Blades shall be horizontal in wall-mounted applications and run the short dimension in ceiling applications. Provide opposed blade dampers in registers (Price D). Delete screw holes for lay-in ceiling applications and provide 2' X 2' lay-in panel. Provide gasket around frame for drywall or plaster installation. Price model 630 or approved equal.

D. Supply grilles or registers: Rectangular louvered face, double deflection, ¾-inch blade spacing, all adjustable, aluminum construction, white baked enamel finish. Front blades shall run the short direction. Price model 620 or approved equal.

E. For fire-rated ceilings, provide diffusers of steel construction to match standard diffusers. Provide radiation blanket and fire damper with air volume adjustment option.

1. Louvered face diffusers shall be Price model SMD with Ruskin CFD with adjustment option or approved equal.

2. Perforated face diffusers shall be Price model PDC with Ruskin CFD damper with air volume adjustment or approved equal. Mount damper in strict accordance with manufacturer's recommendation.

F. Approved manufacturers of grilles and diffusers: Price, Titus, Krueger, Nailor, Metal-Aire, or Carnes, subject to compliance with specification.

G. Louvers: 6-inch deep, drainable, fixed 35° blade, mill-finished extruded aluminum, minimum 0.081 inch thick blades, high free area with ¾" x ½" aluminum bird screen. Unit shall have a water penetration rate of 0.05 ounces per square foot of free area or less at 1000 fpm. Air pressure drop shall be less than 0.1 inch w.g. at 800 fpm. Provide flanged frame where required and anodized finish or insect screen where shown on plan. Louver must have current Miami-Dade County, Florida notice of acceptance number. Ruskin ELF637DXD or approved equal by Arrow, Carnes, Louvers & Dampers, Inc., or Vent Products.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

3.3 SPARE PARTS

A. Furnish to Owner, with receipt, three operating keys for each type of air outlet and inlet.

END OF SECTION

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DIVISION 26 - ELECTRICAL

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SECTION 26 01 00 – BASIC ELECTRICAL REQUIREMENTS

1.1 RELATED DOCUMENTS:

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

B.

26 01 00	Basic Electrical Requirements
26 05 19	Low-Voltage Electrical Power Conductors and Cables
26 05 20	Electrical Connections for Equipment
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26 24 16	Panelboards
26 27 26	Wiring Devices
26 51 00	Lighting
28 31 11	Fire Alarm System

1.2 CODES:

A. The work shall be in conformance with the following:

NFPA 70	National Electric Code	2020
NFPA 72		2019
Florida Fire Prevention Code (8th Edition)		2023
Florida Building Code (8th Edition)		2023

B. The installation shall also comply with all applicable rules and regulations of local and state laws and ordinances. Include in the work, without extra cost, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations. Inform the architect of any work or materials which conflict with any of the applicable codes, standards, laws, and regulations before submitting their bid.

1.3 ROUGH-IN:

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 23 for rough-in requirements.

1.4 ELECTRICAL INSTALLATIONS:

A. Existing services shall not be interrupted without prior consent of the owner's authorized representative and may be interrupted only at, and for, the specific time designated by the owner's authorized representative.

B. Make a thorough examination of the site and the contract documents. No claim for extra compensation will be recognized if difficulties are encountered which an examination of site conditions and contract documents prior to executing contract would have revealed.

C. Coordinate electrical equipment and materials installation with other building components.

D. Verify all dimensions by field measurements.

E. Arrange for chases, slots, and openings in other building components to allow for electrical installations.

F. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

G. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.

H. Install electrical equipment to facilitate 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.

I. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.

J. Temporary electrical service and construction lighting shall be provided under this section. Provide for all electrical service for construction period, making all connections and removal of same at job conclusion. Furnish and install temporary lighting for construction period. At job completion, all temporary lamps shall be removed and replaced with new lamps.

1.5 CUTTING AND PATCHING:

A. Do not endanger or damage installed work through procedures and processes of cutting and patching.

B. Arrange for repairs required to restore other work because of damage caused as a result of electrical installations.

C. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

D. Perform cutting, fitting, and patching of electrical equipment and materials 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 equipment and materials in existing structures.

6. Upon written instructions from the architect/engineer, uncover and restore work to provide for architect/engineer observation of concealed work.

E. Cut, remove and legally dispose of, selected electrical equipment, components, and materials as indicated; including, but not limited to, removal of electrical items indicated to be removed and items made obsolete by the new work.

F. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

G. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

H. Locate, identify, and protect electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the owner prior to the changeover.

1.6 ELECTRICAL SUBMITTALS:

A. Refer to the Conditions of the Contract (General and Supplementary) and Division 1 Section 01 33 00: SUBMITTAL PROCEDURES for submittal definitions, requirements, and procedures.

B. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the contractor. Data submitted from subcontractors and material suppliers directly to the architect/engineer will not be processed.

1.7 PRODUCT OPTIONS AND SUBSTITUTIONS:

A. Refer to the Instructions to Bidders and the Division 1 Section "PRODUCT REQUIREMENTS" for requirements in selecting products and requesting substitutions.

1.8 PRODUCT LISTING:

A. Prepare listing of major electrical equipment and materials for the project.

B. Submit this listing as a part of the submittal requirement specified in the Division 1 Section: PRODUCT REQUIREMENTS.

C. When two or more items of the same material or equipment are required, they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.

D. Provide products which are compatible within systems and other connected items.

E. No substitution will be considered unless written request has been submitted to the architect at least ten (10) days prior to the date for receipt of bids.

F. If the architect approves any proposed substitutions, such approval will be set forth in an addendum.

1.9 DELIVERY, STORAGE, AND HANDLING:

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installation.

1.10 RECORD DOCUMENTS:

A. Refer to the Division 1 Section 01 77 00: CLOSEOUT PROCEDURES for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark drawings to indicate revisions to conduit size and location, both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; change orders; concealed control system devices.

C. Mark Specifications to indicate approved substitutions; change orders; actual equipment and materials used.

D. Provide record documents in PDF format.

1.11 WARRANTIES:

A. Refer to the Division 1 Section: PRODUCT REQUIREMENTS for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Divisions 26, 27, and 28 into a separated set of vinyl- covered, three-ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment; date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.12 CLEANING:

A. Refer to the Division 1 Section: CLOSEOUT PROCEDURES for general requirements for final cleaning.

B. Clean all light fixtures, lamps, and lenses prior to final acceptance. Replace all inoperative lamps.

END OF SECTION 26 01 00

SECTION 26 05 19 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26, Division 27, and Division 28 section making reference to wires and cables specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical wire and cable work is indicated by drawings and schedules.

B. Types of electrical wire, cable, and connectors specified in this Section include the following:

Copper conductors.
Fixture wires.
Split-bolt connectors.
Wirenut connectors.

C. Applications of electrical wire, cable, and connectors required for project are as follows:

1. For power distribution circuits.

2. For lighting circuits

3. For appliance and equipment circuits.

4. For motor-branch circuits.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience with projects utilizing electrical wiring and cabling work similar to that required for this project.

C. NEC Compliance: Comply with NEC requirements as applicable to construction, installation, and color coding of electrical wires and cables.

D. IEEE Compliance: Comply with applicable requirements of IEEE Stds. 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std. 241, "IEEE

Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.

E. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8 and D-753. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).

F. The following systems of color coding shall be strictly adhered to:

grounded leads	Green
grounded neutral leads	White
120/208 volt, ungrounded phase wires	Black, Red and Blue
277/480 volt, ungrounded phase conductors	Yellow, Orange, Brown

G. The Contractor shall verify the the code followed in the existing facility and advise the Engineer of any deviations from the color code listed above prior to installing conductors. The color code assigned to each phase wire shall be consistently followed throughout.

H. The color code listed above shall be posted at each panel location per NEC 210.5.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA specified type wire and cable reels.

B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

C. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 - PRODUCTS

2.1 BUILDING WIRES:

A. Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated.

B. Conductor insulation shall be dual type THHN/THWN 75°C (167°F) for dry, damp, and wet locations. Conductor insulation with single type marking THHN 90°C (194°F) may be used for dry locations only.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRES AND CABLES:

A. General: Install electrical cables, wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation" and in accordance with recognized industry practices.

B. Unless otherwise noted, all branch circuit conductors shall be No. 12 AWG. Branch circuits over 75 feet in length shall be No. 10 AWG unless noted otherwise.

C. Install UL Type THWN or THHN wiring in conduit, for feeders and branch circuits.

D. Pull conductors simultaneously where more than one is being installed in same raceway.

E. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.

F. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceway.

G. Keep conductor splices to minimum.

H. Install splices and tapes which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced. Use splice and tap connectors which are compatible with conductor material.

3.2 FIELD QUALITY CONTROL:

A. Prior to energization of circuitry, check installed feeder wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled. A list of feeders tested shall be submitted to the engineer indicating the insulation resistance level for each cable.

B. Prior to energization, test wires and cables for electrical continuity and for short-circuits.

C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 26 05 19

SECTION 26 05 20 – ELECTRICAL CONNECTIONS FOR EQUIPMENT

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 section making reference to electrical connections for equipment specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.

B. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Division 21, Division 22, Division 23, and other Division 26 sections, and are work of this Section.

C. Motor starters and controllers not furnished as integral part of equipment are specified in applicable Division 26 sections and are work of this Section.

D. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 26 sections, and are work of this Section.

E. Electrical identification for wire/cable conductors is specified in Division 26 section, "IDENTIFICATION FOR ELECTRICAL SYSTEMS", and is work of this Section.

F. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division 26 sections, and are work of this Section.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties; whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firms with at least three (3) years of successful installation experience with projects utilizing electrical connections for equipment similar to that required for this project.

C. NEC Compliance: Comply with applicable requirements of NEC as to type products used and installation of electrical power connections (terminals and splices) for junction boxes, motor starters, and disconnect switches.

D. UL Compliance: Comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL listed and labeled.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS:

A. General: For each electrical connection indicated, provide complete assembly of materials; including, but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, cable ties, solderless wirenuts, and other items and accessories as needed to complete splices and terminations of types indicated.

B. Metal Conduit, Tubing and Fittings, General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Division 26 Basic Electrical Materials and Methods section "Raceways", and in accordance with the following listing of metal conduit, tubing and fittings:

Galvanized rigid steel conduit.
Rigid metal conduit fittings.
Electrical metallic tubing.
EMT fittings.
Flexible metal conduit.
Flexible metal conduit fittings.
Liquid-tight flexible metal conduit.
Liquid-tight flexible metal conduit fittings.

C. Wires, Cables, and Connectors:

1. General: Provide wires, cables, and connectors complying with Division 26 basic electrical materials and methods section "LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES".

2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match (including sizes and ratings) wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).

D. Connectors and Terminals: Provide electrical connectors and terminals which mate and match (including sizes and ratings) with equipment terminals, and are recommended by equipment manufacturer for intended applications.

PART 3 - EXECUTION

3.1 OBSERVATION:

A. Observe area and conditions under which electrical connections for equipment are to be installed and notify contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.2 INSTALLATION OF ELECTRICAL CONNECTIONS:

A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions, with recognized industry practices, and complying with applicable requirements of UL and NEC to ensure that products fulfill requirements.

B. Coordinate with other work, including wires/cables, raceway, and equipment installation as necessary to properly interface installation of electrical connections for equipment with other work.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Maintain existing electrical service and feeders to occupied areas and operational facilities unless otherwise indicated, or when authorized otherwise in writing by owner or architect/engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.

E. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.

F. Prepare cables and wires by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

G. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing, and maintenance.

H. Provide flexible conduit for motor connections and other electrical equipment connections where subject to movement and vibration.

I. Provide liquid-tight flexible conduit for connection of motors and other electrical equipment where subject to movement and vibration; and also where connections are subjected to one or more of the following conditions:

1. Exterior location.
2. Moist or humid atmosphere where condensate can be expected to accumulate.
3. Corrosive atmosphere.
4. Water spray.
5. Dripping oil, grease, or water.

3.3 FIELD QUALITY CONTROL:

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION 26 05 20

SECTION 26 05 26 – GROUNDS AND BONDING FOR ELECTRICAL SYSTEMS

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Materials and Methods section, and is part of each Division 26, Division 27, and Division 28 making reference to grounding specified herein.

1.2 SUMMARY:

A. The extent of electrical grounding and bonding work is indicated by drawings and schedules, and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.

B. The type of electrical grounding and bonding work specified in this Section includes the following:

Solidly grounded.

C. Applications of electrical grounding and bonding work in this Section includes the following:

Electrical power systems.
Grounding electrodes.
Separately derived systems.
Raceways.
Service equipment.
Enclosures.
Equipment.
Lighting standards.

D. Refer to other Division 26 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work; not work of this section.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.

1.4 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of grounding and bonding products, of types and ratings required, and ancillary grounding materials; including stranded cable, copper braid and bus, grounding electrodes and plate electrodes,

and bonding jumpers; whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience on projects with electrical grounding work similar to that required for project.

C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits, and equipment.

2. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment", and 869, "Electrical Service Equipment", pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL listed and labeled for their intended usage.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING:

A. Materials and Components, General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is installer's option. Where materials or components are not indicated, provide products which comply with NEC and UL, requirements, and with established industry standards for those applications indicated.

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.

C. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs, and clamps as recommended by bonding plate, connector, terminal, and clamp manufacturers for indicated applications.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which electrical grounding and bonding connections are to be made, and notify contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.2 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS:

A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions; applicable portions of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices, to ensure that products comply with requirements.

B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

C. Ground each separately-derived system neutral to separate grounding electrode.

D. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

E. All raceways with No. 10 or 12 AWG phase conductors for receptacles, lighting fixtures, and similar circuits shall be provided with a parity-sized green equipment ground conductor. Ground conductor shall be installed in entire raceway system, including wall switches and flexible conduit to light fixtures. Equipment ground conductor sizes for circuits with phase conductors larger than No. 12 AWG are indicated on drawings. Ground conductors shall be connected to ground buss in panelboards.

F. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing. Conductors looped under screw or bolt heads will not be permitted.

G. Connect grounding electrode conductors to one inch (1") diameter or greater metallic cold water pipe, using a suitably sized ground clamp. Provide connections to flanged piping at street side of flange.

H. Install clamp-on connectors on clean metal contact surfaces to ensure electrical conductivity and circuit integrity.

I. Provide a grounding bushing and a continuous copper bonding jumper from the bushing to the equipment ground bus in all feeders. The bonding jumper shall be the same size as the equipment ground conductor.

3.3 FIELD QUALITY CONTROL:

A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over twenty-five (25) ohms, take appropriate action to reduce resistance to twenty-five (25) ohms or less by driving additional ground rods; then retest to demonstrate compliance.

END OF SECTION 26 05 26

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is a part of each Division 26, Division 27, and Division 28 section making reference to electrical supporting devices specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of supports, anchors, sleeves, and seals is indicated by drawings and schedules and/or specified in other Division 26 sections.

B. Types of supports, anchors, sleeves, and seals specified in this Section include the following:

Clevis hangers.
One-hole conduit straps.
Two-hole conduit straps.
Round steel rods.
Expansion anchors.
Toggle bolts.
Wall and floor seals.
Korn Clamps.

C. Supports, anchors, sleeves, and seals furnished as part of factory fabricated equipment are specified as part of that equipment assembly in other Division 26 sections.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience with projects utilizing electrical supporting device work similar to that required for this project.

C. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation", pertaining to anchors, fasteners, hangers, supports, and equipment mounting.

D. UL Compliance: Provide electrical components which are UL listed and labeled.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's data on supporting devices, including catalog cuts, specifications, and installation instructions for each type of support, anchor, sleeve, and seal.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES:

A. General: Provide supporting devices which comply with manufacturer's standard materials, design and construction, in accordance with published product information and as required for complete installation and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is installer's option.

B. Supports: Provide supporting devices of types, sizes, and materials indicated and having the following construction features:

1. Clevis Hangers: For supporting metal conduit; galvanized steel, with ½" diameter hole for round steel rod, approximately 54 pounds per 100 units.

2. Reducing Couplings: Steel rod reducing coupling, ½" by $^{5}/_{8}$", approximately 16 pounds per hundred 100 units.

3. One-Hole Conduit Straps: For supporting metal conduit; galvanized steel, approximately 7 pounds per 100 units.

4. Two-Hole Conduit Straps: For supporting metal conduit; galvanized steel.

5. Hexagon Nuts: For ½" rod size, galvanized steel, approximately 4 pounds per 100 units.

6. Round Steel Rod: ½" diameter, approximately 67 pounds per 100'.

7. Offset Conduit Clamps: For supporting 2" rigid metal conduit; galvanized steel, approximately 200 pounds per 100 units.

C. Anchors: Provide anchors of types, sizes, and materials indicated with the following construction features:

1. Expansion Anchors: ½", approximately thirty-eight 38 pounds per hundred 100 units.

2. Toggle Bolts: Springhead, $^{3}/_{16}$" by 4"; approximately five (5) pounds per hundred 100 units.

D. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated, with the following construction features:

1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated, suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves,

malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws. Seals shall be fire-rated where required.

E. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment; 12-gauge hot-dip galvanized steel of types and sizes indicated. Construct with $^{3}/_{16}$" diameter holes, 8" O.C. on top surface, and with the following fittings which mate and match with U-channel:

Fixture hangers.
Channel hangers.
End caps.
Beam clamps.
Wiring studs.
Thinwall conduit clamps.
Rigid conduit clamps.
Conduit hangers.

2.2 FABRICATED SUPPORTING DEVICES:

A. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Steel Pipe: Fabricate from schedule 40 galvanized steel pipe. Remove burrs.

B. Sleeve Seals: Provide sleeves for piping which penetrate foundation walls below grade or exterior walls. Caulk between sleeve and pipe with nontoxic, UL classified caulking material to ensure watertight seal. Seals shall be fire-rated where required.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES:

A. Install hangers, anchors, sleeves, and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacings indicated and in compliance with NEC requirements.

END OF SECTION 26 05 29

SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this Section.

B. This Section is a Division 26 Basic Electrical Materials and Methods section and is part of each Division 26, Division 27, and Division 28 section making reference to electrical raceways specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of raceway, electrical box, and associated fitting work is indicated by drawings and schedules.

B. Types of raceways specified in this section include the following:

Electrical metallic tubing (EMT).
Liquid-tight flexible metal conduit.
Rigid metal conduit.
Flexible metal conduit.
Wireways.

C. Types of electrical boxes and fittings specified in this section include the following:

Outlet boxes.
Junction boxes.
Pull boxes.
Floor boxes.
Poke-throughs.

1.3 QUALITY ASSURANCE:

A. Raceway Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Electrical Box and Fitting Manufacturers: Firms regularly engaged in the manufacture of electrical boxes and fittings of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

C. Installer's Qualifications: Firms with at least three (3) years of successful installation experience on projects with electrical raceway work similar to that required for this project.

D. Codes and Standards:

1. UL Compliance and Labeling

a. Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL listed and labeled.

b. Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL listed and labeled.

2. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING:

A. General: Provide metal conduit, tubing, and fittings of types, grades, sizes, and weights (wall thicknesses) for each service indicated.

B. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.

C. Rigid Steel Conduit: Provide rigid steel, hot dipped galvanized, threaded type.

D. Flexible Metal Conduit: UL 1 formed from continuous length of spirally-wound, interlocked, zinc-coated strip steel.

E. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit. Construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside. Coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).

F. Rigid Metal Conduit Fittings: Cast malleable iron, galvanized or cadmium plated.

1. Use Type 1 fittings for rain-tight connections.

2. Use Type 2 fittings for concrete tight connections.

G. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless, hinged clamp type.

1. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

2. 45° or 90° Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

H. Liquid-Tight Flexible Metal Conduit Fittings: Provide cadmium plated, malleable iron fittings with compression-type, steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.

I. Electrical Metallic Tubing (EMT): UL 797.

J. EMT Fittings: Couplings and connectors for conduit sizes 2" and smaller shall be steel hex-nut, expansion-gland type, zinc or cadmium plated. Set screw type fittings may be used for conduit sizes 2½" and larger.

2.2 WIREWAYS:

A. General: Provide electrical wireways of types, grades, sizes, and number of channels for each type of service as indicated. Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other components and accessories as required for complete system.

B. Lay-in Wireways: Construct lay-in wireways with hinged covers in accordance with UL 870 and with components UL-listed, including lengths, connectors, and fittings. Select units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wireways with knockouts.

1. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached so that removal is not necessary to utilize the lay-in feature.

2. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.

C. Rain-tight Wireway: Construct rain-tight lay-in wireways with hinged covers, in accordance with UL 870 and with components UL listed, including lengths, connectors, and fittings. Design units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wireway units with knockouts only in bottom of troughs.

D. Rain-tight Troughs: Construct in accordance with UL 870, with components UL-listed.

1. Construction: 16-gauge galvanized sheet metal parts for 4"x4" to 6"x6" sections, and 14-gauge parts for 8"x8" and larger sections. Provide knockouts only in bottom of troughs, with suitable adapters to facilitate attaching to other NEMA 3R enclosures. Do not use gasketing that can rip or tear during installation, or would compromise rain-tight capability of the trough. Do not use cover screws that will protrude into the trough area and damage wire insulation.

2. Finish: Provide 14-gauge and 16-gauge galvanized sheet metal parts with corrosion-resistant phosphate primer and baked enamel finish. Plate hardware to prevent corrosion.

2.3 FABRICATED MATERIALS:

A. Outlet Boxes: Provide galvanized coated flat-rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes (including box depths as indicated), suitable for installation at respective locations. Construct outlet boxes with mounting holes and with cable and conduit-size knockout openings in bottom and sides.

1. Outlet Box Accessories: Provide outlet box accessories as required for each installation; including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations.

2. Ceiling boxes shall be 4" square (or octagonal, $1^1/_8$") deep for exposed work or furred ceiling work and 3" deep for concrete work. Plaster rings and/or fixture studs shall be provided where required.

B. Device Boxes: Provide galvanized coated flat-rolled sheet-steel, non-gangable device boxes, of shapes, cubic inch capacities, and sizes (including box depths as indicated), suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps and for equipment type grounding.

1. Device Box Accessories: Provide device box accessories as required for each installation; including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations.

2. Flush mounted wall outlets shall be 4" square boxes or gang boxes, not less than 1½" deep. Boxes shall be provided with extension rings and/or covers with sufficient depth to bring the covers flush with the finished wall.

3. Boxes for flush mounting in concrete block work with one or two devices shall have covers with square corners on the raised portion of the cover. The covers shall have a sufficient amount of depth to be flush with the face of the block. Covers shall be Steel City 52-C series. Boxes for more than two devices shall be Steel City "GW" gang boxes. The bottom side of the covers or boxes shall be installed at the masonry course nearest to the dimension specified or noted.

4. Outlet boxes for exposed wall mounting and outdoor installation shall be cast metal type "FS" or "FD" boxes with suitable cast aluminum covers. Weatherproof receptacle covers shall have spring hinged lids.

C. Rain-Tight Outlet Boxes: Provide corrosion-resistant, cast-metal, rain-tight outlet wiring boxes; of types, shapes and sizes (including depth of boxes), with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring-hinged watertight caps

suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.

D. Junction and Pull Boxes: Provide galvanized, code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

PART 3 - EXECUTION

3.1 OBSERVATION:

A. Examine areas and conditions under which raceways are to be installed and substrate which will support raceways. Notify contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 INSTALLATION OF RACEWAYS:

A. General: Raceways run below grade, under floors on grade, or in concrete shall be rigid steel conduit. All other raceways may be thin wall conduit.

B Conduit run above accessible ceilings shall be supported from the structure and shall not be supported from, or attached to, ceiling suspension system. Double locknuts shall be used on all rigid conduit terminations except threaded hubs. All conduit shall be made up tight and no running threads will be permitted. "Erickson" couplings shall be used where necessary. All metallic conduit runs below grade or under floors on grade shall be given one (1) coat of Rust-Oleum 'Gray Primer' and one (1) heavy coat of Rust-Oleum 'Flat Black' acrylic paint or a heavy coat of an approved non-bitumastic asphaltic type compound.

C. Sizes of raceways shall be not less than NEC requirements and shall not in any case be less than indicated on the drawings. Larger size raceways and/or pull boxes shall be installed if there is excessive length of unbroken run or excessive number of bends. Combining of circuits other than those indicated on the drawings will not be permitted.

D. Coordinate with other work, including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.

1. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.

2. Use roughing-in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.

3. Provide nylon pull cord in empty conduits where indicated. Test all empty conduits with ball mandrel. Clear any conduit which rejects ball mandrel. Pay

costs involved for restoration of conduit and surrounding surfaces to original condition.

4. Use liquid-tight flexible conduit where subjected to one or more of the following conditions:

   a. Exterior location.
   b. Moist or humid atmosphere where condensate can be expected to accumulate.
   c. Corrosive atmosphere.
   d. Subjected to water spray or dripping oil, water, or grease.

E. Cut conduits straight, ream properly, and cut threads for heavy wall conduit deep and clean.

F. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.

G. Fasten conduit terminations in sheet metal enclosures by two (2) locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.

H. Conduits are not to cross pipe shafts or ventilating duct openings.

I. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes, or other sources of heat. Do not install horizontal raceway runs below water and steam piping.

J. Support riser conduit at each floor level with clamp hangers.

K. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.

L. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

M. Concealed Conduits:

1. Metallic raceways installed underground or in floors below grade, or outside are to have conduit threads painted with corrosion-inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure water tightness.

2. For floors-on-grade, install conduits under concrete slabs.

3. Install underground conduits a minimum of 24" below finished grade.

N. Conduits in Concrete Slabs:

1. Place conduits between bottom reinforcing steel and top reinforcing steel. Place conduits either parallel or at 90 degrees to main reinforcing steel.

2. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.

3. Conduits crossing in slab must be reviewed for proper cover by engineer.

4. Embedded conduit diameter is not to exceed one-third (1/3) of slab thickness.

O. Install conduits as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.

P. Exposed Conduits:

1. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.

2. Install exposed conduit work as not to interfere with ceiling inserts, lights, or ventilation ducts or outlets.

3. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed 8'-0".

4. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.

5. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings, and in crawl spaces.

Q. Conduit Fittings:

1. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.
2. Bushings for terminating conduits smaller than 1" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.

3. Install insulated type bushings for terminating conduits 1" and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.

4. Bushing of standard or insulated type to have screw type grounding terminal.

5. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs to be specifically designed for their particular application.

3.3 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

C. Provide weather-tight outlets for interior and exterior locations exposed to weather or moisture.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring. All existing and new junction boxes within the project area shall be made accessible. Relocate existing junction boxes as required to comply with the NEC.

F. Metallic and approved nonmetallic electrical outlet boxes may be installed in vertical fire resistive assemblies classified as 2-hour or less without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 square inches. Boxes located opposite sides of walls or partitions shall be separated by a horizontal distance of 24".

G. In openings larger than 16 square inches, the wall shall be built around openings so as not to interfere with the integrity of the wall rating.

H. All clearances between such boxes and the gypsum board shall be completely filled with joint compound or other approved material.

I. Position recessed outlet boxes accurately to allow for surface finish thickness.

J. Set floor boxes level and flush with finish flooring material.

K. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

L. Subsequent to installation of boxes, protect boxes from construction debris and damage.

3.4 FIELD QUALITY CONTROL:

A. General: Mechanically assemble metal enclosures and raceways for conductors to form continuous electrical conductor, and connect to electrical boxes, fittings and cabinets as to provide effective electrical continuity and rigid mechanical assembly.

B. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion-inhibiting compound before assembling.

C. Install expansion fittings in all raceways wherever structural expansion joints are crossed.

D. Make changes in direction of raceway run with proper fittings supplied by raceway manufacturer. No field bends of raceway sections will be permitted.

E. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported.

F. Use boxes as supplied by raceway manufacturer wherever junction, pull, or devices boxes are required. Standard electrical "handy" boxes, etc. shall not be permitted for use with surface raceway installations.

G. Raceway penetrations of fire-rated walls and/or floors shall be sealed to maintain integrity of construction. All products, materials, and methods of installation shall be UL approved and meet NFPA requirements.

H. Fire rating of construction assemblies are specified under architectural section of the contract documents.

I. Unless otherwise noted on drawings, notified by architect and/or authorities having jurisdiction, the following materials may be used.

1. Rock wool: Minimum four pound per cubic foot density; flame spread 15, smoke developed 0, fuel contribution 0 by ASTM 384; minimum melting point 2000°F.

2. Concrete and masonry are also approved firestop materials by NFPA 90A.

3. UL approved products such as Nelson Type CLK Silicon Sealant. Manufacturers recommendations shall be strictly followed.

J. Submit complete data on fire-stopping materials and construction methods for review by architect before proceeding with work.

END OF SECTION 26 05 33

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26, Division 27, and Division 28 section making reference to electrical identification specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical identification work is indicated by drawings and schedules.

B. Types of electrical identification work specified in this Section include the following:

Equipment/system identification signs.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIALS:

A. Engraved Plastic-Laminate Signs:

1. General: Provide engraving stock melamine plastic laminate in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated; black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

2. Signs shall be black face with white core plies (letter color).

a. Thickness: 1/16", except as otherwise indicated.

b. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot, or should not, penetrate substrate.

2.2 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations, and other designations used in electrical identification work with corresponding designations shown, specified, or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION:

A. General Installation Requirements:

1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions and requirements of NEC.

2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.

3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Equipment/System Identification:

1. General: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/ control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:

a. Panelboards, electrical cabinets and enclosures.
b. Access panels/doors to electrical facilities.
c. Transformers.
d. Call system master station.
e. Disconnect switches, motor starters, contactors, including current origination.

2. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not, or cannot, penetrate substrate.

END OF SECTION 26 05 53

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is a part of each Division 26, Division 27, and Division 28 section making reference to panelboards specified herein.

1.2 SUMMARY:

A. Extent of panelboard work, is to re-use existing breakers and add breakers into existing panelboards, as indicated by drawings and schedules and as specified herein.

B. Refer to other Division 26 Sections for wires/cables, electrical boxes and fittings, and raceway work required in conjunction with installation of panelboards and enclosures.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's data on panelboards and enclosures. Shop drawings shall indicate arrangement of busses, branch circuits, enclosures, dimensions, etc.

1.4 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of panelboards and enclosures, of types, sizes, and ratings required; whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: A firm with a least three (3) years of successful installation experience on projects utilizing panelboards similar to those required for this project.

C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Article 384 as applicable to the installation and construction of electrical panelboards and enclosures.

2. UL Compliance: Comply with applicable requirements of UL 67, "Electric Panelboards", and UL codes 50, 869, and 1053 pertaining to panelboards, accessories and enclosures. Provide panelboard units which are UL listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electrical panelboard products which may be incorporated in the work include, but are limited to, the following:

1. Square D
2. Siemens
3. Eaton
4. ABB

Square D products are listed as the basis of design. Equivalent equipment from the manufacturers listed above. Contractor shall confirm the submitted equipment fits in the allocated space and code required clearances are maintained.

2.2 PANELBOARDS:

A. General: Except as otherwise indicated, provide panelboards, enclosures, and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials; with the design and construction in accordance with published product information. Equipped with proper number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL, and established industry standards for those applications indicated.

B. Power Distribution Panelboards: Provide dead-front, safety-type power distribution panelboards as indicated; with panelboard switching and protective devices in quantities, ratings, types, and with arrangement shown; with anti-turn, solderless pressure type main lug connectors approved for use with copper conductors. Select unit with feeders connecting at top of panel. Equip with copper bus bars with not less than 98 percent conductivity, and with full-sized neutral bus. Provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Provide bolt-on, molded-case circuit breaker types for each circuit, with toggle handles that indicate when tripped. Provide panelboards with are uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards which mate and match properly with panelboards.

1. Power panelboards shall be Square D type 'I Line'. Voltage shall be as indicated.

C. Lighting and Appliance Panelboards: Provide dead-front safety type lighting and appliance panelboards as indicated; with switching and protective devices in quantities, ratings, types and arrangements shown; with anti-burn solderless pressure type lug connectors approved for use with copper conductors. Construct unit for connecting feeders at top of panel. Equipped with copper bus bars, full-sized neutral bar, with bolt-in type heavy-duty, quick-make, quick-break, circuit-breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required, and provide bare uninsulated grounding bars suitable for bolting to enclosures.

Select enclosures fabricated by same manufacturer as panelboards which mate and match properly with panelboards.

1. Panelboards shall be Square D type 'NQ' or 'NF'. Panelboard boxes shall be five and three-fourths inches (5 ¾") deep. Voltage shall be as indicated.

D. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated; code-gauge, minimum 16-gauge thickness. Cabinets shall be furnished without knock-outs and all holes for raceways shall be drilled and punched on the job. Panelboard enclosures shall be five and three-fourths inches (5 ¾") deep. Provide fronts with adjustable trim clamps and doors with flush locks and keys; all panelboard enclosures keyed alike, with concealed piano door hinges and door swings as indicated. Provide baked gray enamel finish over a rust inhibitor coating. Design enclosures for recessed mounting. Provide enclosures which are fabricated by same manufacturer as panelboards which mate and match properly with panelboards to be enclosed.

E. All panelboards shall be connected distributed phase with circuit numbering as indicated on the drawings. Panelboards shall be numbered with odd numbers on the left side of the panel and even numbers on the right side of the panel. Panelboards shall have a circuit directory card mounted in a frame with plastic cover, mounted on the inside of the door, and directory cards shall be completed with a typewriter to indicated areas and/or devices served by each circuit. All new and existing panelboards being used for this project shall have new typed directories.

F. Panelboards shall be installed complete with connectors and associated hardware for all circuit breakers and circuit breaker spaces listed in the panelboard schedule.

G. When connecting equipment to existing panelboards, the new and existing circuit breakers shall be identified. A new circuit directory card shall be provided.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which panelboards and enclosures are to be installed and notify contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.2 GROUNDING:

A. Provide equipment grounding connections for panelboard enclosures as indicated.

B. Prior to energization, check panelboards for electrical continuity of circuits and for short-circuits.

3.4 ADJUSTING AND CLEANING:

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finishes.

END OF SECTION 26 24 16

SECTION 26 27 26 – WIRING DEVICES

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26, Division 27, and Division 28 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.

B. Types of electrical wiring devices in this section include the following:

Receptacles.
Ground-fault circuit interrupters.
Switches.
Wallplates.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience on projects utilizing wiring devices similar to those required for this project.

C. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.

D. UL Compliance: Provide wiring devices which are UL listed and labeled.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's data on electrical wiring devices.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, manufacturers providing wiring devices which may be incorporated in the work include; but are not limited to, the following (for each type and rating of wiring device):

Arrow-Hart, Cooper Industries
Bryant Electric, Inc.
Eagle Electric Manufacturing Co., Inc.
Harvey Hubbell Inc.
Pass and Seymour Inc.
Leviton Manufacturing Co. Inc.

2.2 FABRICATED WIRING DEVICES:

A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds. Pub/No. WD 1. Provide ivory color devices except as otherwise indicated.

B. Receptacles:

1. All receptacles shall be the grounding type with ground connection made through an extra pole which shall be permanently connected to the green grounding conductor.

2. Duplex receptacles for 20 ampere, 120 volt service shall be two-pole, three-wire receptacles, rated 20 amperes at 125 volts. Receptacles shall be Specification Grade.

3. Single receptacles for 20 amps, 120 volts service shall be two-pole, three-wire rated 20 amperes at 125 volts. Receptacles shall be Specification Grade.

4. Ground-fault interrupters duplex receptacles for 20 ampere, 120 volt service shall be two-pole, three-wire receptacles, rated 20 amperes at 125 volts. Receptacles shall be Specification Grade.

C. Switches:

1. Snap: Provide toggle switches, rated 20 amperes at 120/277 volts, quiet type, and shall be UL approved without derating for tungsten lamp loads or inductive loads. All switches shall have a grounding terminal which shall be connected to the green grounding conductor. The following catalog numbers are Legrand Pass & Seymour.

Type	Catalog No.
Single Pole	PS20AC1
Three Way	PS20AC3
Four Way	PS20AC4

2. Single pole switches with pilot light handle shall be Legrand Pass & Seymour Catalog No. PS20AC1-CPL7.

2.3 WIRING DEVICE ACCESSORIES:

A. Wallplates: Provide wallplates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached.

B. Cover plates for flush mounted wall boxes shall be .035 inch thick, type 302 stainless steel with satin finish and suitable for the device covered and/or purpose intended. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES:

A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.

B. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.

C. Install wiring devices after wiring work is completed.

D. Install wallplates after painting work is completed.

3.2 PROTECTION OF WALLPLATES AND RECEPTACLES:

A. Upon installation of wallplates and receptacles, advise contractor regarding proper and cautious use of convenience outlets. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.3 GROUNDING:

A. Provide equipment grounding connections for all wiring devices, unless otherwise indicated.

3.4 TESTING:

A. Prior to energizing circuitry, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 26 27 26

SECTION 26 51 00 – LIGHTING

1.1 RELATED DOCUMENTS:

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

B. This is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26, Division 27, and Division 28 referring to lighting fixtures specified herein.

1.2 SUMMARY:

A. Extent, location, and details of lighting work are indicated on drawings and in schedules.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's product data and installation instructions on each type building lighting fixture, and component.

B. Shop Drawings: Submit fixture shop drawings in booklet form, with separate sheet for each fixture assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet. Submit details indicating compatibility with ceiling grid system

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of lighting fixtures of sizes, types, and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer Qualifications: Firms with at least three (3) years of successful installation experience on projects with lighting fixture work similar to that required for this project.

C. Codes and Standards:

1. UL Compliance: Comply with UL standards pertaining to lighting fixtures. Provide lighting fixtures and components which are UL listed and labeled.

2. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.5 STORAGE, AND HANDLING:

A. Store lighting fixtures inside well-ventilated area, protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat and blocked off ground.

B. Handle lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.6 SEQUENCING AND SCHEDULING:

A. Coordinate with other work, including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of lighting fixtures with other work.

B. Sequence lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

PART 2 - PRODUCTS

2.1 LED FIXTURES

A. Except as otherwise indicated; provide LED luminaires, of types and sizes indicated on fixture schedules.

B. Include the following features unless otherwise indicated:

1. Each Luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).

2. Each luminaire shall be rated for a minimum operational life of 50,000 hours utilizing a minimum ambient temperature of (25°C).

3. Light Emitting Diodes tested under LM-80 Standards for a minimum of 12,000 hours.

4. Color Rendering Index (CRI) of 82 at a minimum.

5. Color temperature 4,000 K, unless otherwise indicated.

6. Rated lumen maintenance at 70% lumen output for 50,000 hours, unless otherwise indicated.

7. Fixture efficacy of 60 Lumens/Watt, minimum.

8. 5 year luminaire warranty, minimum.

9. Photometry must comply with IESNA LM-79.

10. The individual LEDs shall be constructed such that a catastrophic loss of the failure of one LED will not result in the loss of the entire luminaire.

11. Luminaire shall be constructed such that LED modules may be replaced or repaired without the replacement of the whole fixture.

C. Technical Requirements

1. Luminaire shall have a minimum efficacy of 60 lumens per watt. The luminaire shall not consume power in the off state.

2. Operation Voltage: The luminaire shall operate from a 50 HZ to 60 HZ AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.

3. Power Factor: The luminaire shall have a power factor of 0.9 or greater.

4. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 15 percent.

5. Operational Performance: The LED circuitry shall prevent visible flicker to the unaided eye over the voltage range specified above.

D. Thermal Management

1. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.

2. The LED manufacturer’s maximum thermal pad temperature for the expected life shall not be exceeded.

3. Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.

4. The luminaire shall have a minimum heat sink surface such that LED manufacturer’s maximum junction temperature is not exceeded at maximum rated ambient temperature.

F. DRIVERS FOR LED FIXTURES:

Electronic Driver for LED Fixtures: Comply with UL 1310 Class 2 requirements for dry and damp locations. Include the following features unless otherwise indicated:

1. Rated for 50,000 hours of life, unless otherwise noted.

2. Sound Rating: Class A.

3. Total Harmonic Distortion Rating: 15 percent or less.

4. Current Crest Factor: 1.5 or less.

5. 0-10V Dimming Standard (Step Dimming does not qualify)

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures. Notify contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 INSTALLATION OF LIGHTING FIXTURES:

A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by architect/engineer.

C. Install flush-mounted fixtures properly to eliminate light leakage between fixture frame and finished surface.

D. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

E. Fasten fixtures securely to indicated structural supports and ensure that pendant fixtures are plumb and level.

F. Recessed incandescent or high intensity discharge fixtures shall be centered in the ceiling tile, structural pan, or other visually controlling feature, unless otherwise noted on drawings. Verify architectural drawings for applicable notes and details.

G. Lay-in fixtures shall be independently supported with two supports on opposite corners and have T-bar clips installed.

H. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacture's published torque tightening values for equipment connectors.

I. Support surface mounted fixtures greater than two feet (2') in length at a point in addition to the outlet box fixture stud.

3.3 ADJUSTING AND CLEANING:

A. Clean lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses. Fixtures shall be lamped with new lamps at the time of final inspection.

B. Protect installed fixtures from damage during remainder of construction period.

3.4 GROUNDING:

A. Provide equipment grounding connections for lighting fixtures as indicated.

3.5 DEMONSTRATION:

A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance. Otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 26 51 00

SECTION 28 31 11 - FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 Section making reference to fire alarm systems specified herein.

1.2 DESCRIPTION OF WORK:

The existing Fire Alarm system shall be reworked and the existing devices shall be modified and relocated as indicated on the contract documents. Provide new devices as required per the contract documents. All new devices shall be compatible with the existing Edwards fire alarm system. The electrical contractor shall provide the conduit, back boxes, and system devices as noted.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. NEC Compliance: Comply with applicable requirements of NEC standards pertaining to fire alarm systems.

2. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to fire alarm systems, and provide products and components which are UL listed and labeled.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of fire alarm system equipment. Include standard or typical riser and wiring diagrams and operation and maintenance instructions for inclusion in maintenance manuals.

B. Maintenance Data: Submit maintenance data and parts lists for each type of fire alarm equipment installed, including furnished specialties and accessories. Include this data, product data, and shop drawings in maintenance manual in accordance with requirements of Division 1.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Handle fire alarm equipment carefully to prevent damage, breaking, and scoring. Do not install damaged equipment or components; replace with new.

B. Store fire alarm equipment in clean, dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: The Subject to compliance with requirements, manufacturers offering fire alarm systems which may be incorporated in the work include, but are not limited to, the following:

1. Siemens.

2.2 Scope of Work:

A. The Contractor, during remodeling, shall relocate/provide devices as shown on drawings to match existing. Reconnect to existing circuit in respective fire zone.

2.3 SYSTEM OPERATION

A. Upon activation of any alarm initiating device (manual station, flow switch, heat detector, or smoke detector) the following shall occur:

1. Energize all alarm signaling devices.

2. Sound all audible alarms and flash visual signals throughout the facility.

3. Alert the local fire department directly by way of the proprietary system.

4. Cause the alarm location to be displayed on the annunciator section of the control panel and at each remote annunciator.

5. Close all doors held open by automatic release devices throughout the facility.

6. Fan shut down relays shall be de-energized and shall interrupt control power to air handling units and associated exhaust fans. Isolation room fans shall not shut down.

2.4 SYSTEM COMPONENTS

A. Strobe units shall match existing and shall be compatible with existing Siemens fire alarm system.

B. Wiring

1. All fire alarm system wiring must be new.

2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits and signaling line circuits, and 14 AWG (1.63 mm) for notification appliance circuits.

3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).

5. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

6. All analog voice speaker and analog telephone circuits shall use twisted/shielded pair to eliminate cross talk.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which fire alarm systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 INSTALLATION OF BASIC WIRING SYSTEM MATERIALS:

A. Install wiring, raceways, and electrical boxes and fittings in accordance with Division 16 Basic Electrical Materials and Methods sections, "Raceways", "Wires and Cables", and "Electrical Boxes and Fittings" for wiring of non-power-limited circuits.

B. The manufacturer shall furnish complete wiring diagrams and installation and operation instruction for the system. The required interconnecting wiring may vary with different equipment manufacturers; therefore, the wiring indicated on the drawings is intended only a guide, and necessary adjustments in number of conductors and raceway sizes shall be made to suit the particular system being furnished at no extra cost.

C. All wiring shall be in conduit color coded in accordance with the facility standard color code and manufacturer's recommendations and shall be terminated with spade type lugs. Termination at the control unit shall be identified as to zone and use. All wiring shall test free from opens and grounds prior to final connections.

D. Install wires and cables without splices. Make connections at terminal strips in cabinets or at equipment terminals. Make soldered splices in electronic circuits in control cabinets.

E. Wiring control equipment incorporating standby power: The control equipment shall be provided with operating power from a fused 2 wire, 120 volt, single phase, 60 hertz source. This power shall be converted to 24 volts DC for system operation. Transformers must be mounted with the cabinet. In the event of failure of the operating supply, the system shall transfer automatically to a standby battery. The battery shall be of the nickel cadmium type, with sufficient capacity to operate the system under normal supervision for up to 24 hours.

F. Wiring of control equipment not incorporating standby power. The system shall operate from 2 phase and a neutral of a 208 volt, 3 phase, 4 wire service. The main operating power shall be taken from one side to neutral; the trouble signal circuit shall be taken from the other side to neutral.

G. Conductors color coding:

ITEM	COLOR
Fire Alarm Station, Smoke Detector Alarm, Heat Detector	Violet & Pink
Alarm Signal Devices	Yellow & Blue
Recall Signal	Yellow & Blue
Flashing Lights	Orange
Door Holders	White
Air Handler Shutdown Relays	Purple
Smoke Detector Power	Black & Red
Smoke Detector Supervisory	Brown
Fire Alarm Panel Power	Black & White

3.3 FIELD QUALITY CONTROL:

A. Where work consists of additions or extensions to existing system, prior to starting work, establish that system is in proper working order. If condition exists which prevents normal operation of specified additions and extensions, bring this fact to the architect/engineer's attention prior to doing work affecting existing system. Where work is done without such notification, it is assumed that connections have been made to a working system, and performance requirements and guarantee will apply to entire system.

B. System Test and Approval: Prior to final acceptance of systems, manufacturer of system shall, in presence of contractor, owner's representative and architect's/engineer's representative, test each sensing or detection and alarm device.

C. Submit copy of test results in duplicate after signed by owner's representative to architect/engineer.

3.4 TESTING:

A. All new and existing detectors within the project fire alarm zones shall be tested per NFPA 72. A detector sensitivity test report shall be completed prior to AHCA final inspection. A sample test report is included at the end of this Section.

B. To assure that each smoke detector is operative and produces the intended response, it shall be caused to initiate an alarm at its installed location with smoke or other aerosol acceptable to the manufacturer that demonstrates that smoke can enter the chamber and initiate an alarm.

C. The detector sensitivity shall not be tested or measured using any spray device that administers an unmeasured concentration of aerosol into the detector. To assure that each smoke detector is within its listed and marked sensitivity range, it shall be tested using either:
   1. A calibrated test method, or

2. The manufacturer's calibrated sensitivity test instrument, or
3. Listed control equipment arranged for the purpose, or
4. Other calibrated sensitivity test method acceptable to the authority having jurisdiction.

D. Smoke Detectors are to be sensitivity tested at start of project and devices should be replaced as indicated by test. Detectors found to have a sensitivity outside the approved range shall be replaced. As an exception, detectors listed as field adjustable may be either adjusted within an approved range or replaced.

E. After demonstration tests for Fire Marshal and for AHCA, system report is to be completed and submitted to the Project Superintendent.

END OF SECTION 28 31 11