C1 & C2 HANGAR IMPROVEMENTS

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SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of this Section Includes:
 - 1. Demolition and removal of selected portions of interior of building floor slab.

1.2 DEFINITIONS

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

1.3 MATERIALS OWNERSHIP

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

1.4 COORDINATION

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

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review and finalize selective demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

- 4. Review areas where existing construction is to remain and requires protection.
- 5. Review and finalize protection requirements.
- 6. Review procedures for dust control.

1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, and for dust control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Temporary interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - a. Any furniture, equipment of furnishings that would hinder the work.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. On-site sale of removed items or materials is not permitted.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

3.2 PREPARATION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 3. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."
- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.

3.3 UTILITY SERVICES AND BUILDING SYSTEMS

- A. Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.
 - 2. Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 3. Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.
 - a. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 2. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 3. Maintain fire watch during and for at least 12 hours after flame-cutting operations.
 - 4. Maintain adequate ventilation when using cutting torches.
 - 5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.

2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete:
- B. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- C. Resilient Floor Coverings: Remove floor coverings and adhesive in accordance with recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPAapproved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.

3.7 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 02 41 19

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

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1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Curing compounds.
 - 6. Floor and slab treatments.
 - 7. Bonding agents.
 - 8. Adhesives.
 - 9. Vapor retarders.
 - 10. Semi-rigid joint filler.
 - 11. Repair materials.
- B. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
- D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- E. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

- 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- 3. Resident Engineer: The Resident Engineer is a person hired by the owner to perform the following: The Resident Engineer will sample the concrete for each day's placement with will be accepted on the basis of the compressive strength. If more than 100 cubic yards of the mix is placed in a given day, additional tests at a frequency of one (1) per 100 cubic yards shall be taken for compressive strength, slump, and air. Testing shall comply with Illinois Department of Transportation, Aeronautics Policy Memorandum (PM) 961A, Item 610, Structural Portland Cement Concrete: Job Mix Formula Approval & Production testing. The Contactor shall provide adequate facilities for the initial curing of cylinders.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1 and as follows.
 - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 2. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
 - 3. Do not use frozen materials or materials containing ice or snow.
 - 4. Do not place concrete in contact with surfaces less than 35 deg F (1.7 deg C), other than reinforcing steel.

- 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:
 - 1. Maintain concrete temperature at time of discharge to not exceed 95 deg F (35 deg C).
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

- 2.1 CONCRETE, GENERAL
 - A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301 (ACI 301M).
- 2.2 CONCRETE MATERIALS
 - A. Source Limitations:
 - 1. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
 - 2. Obtain aggregate from single source.
 - 3. Obtain each type of admixture from single source from single manufacturer.
 - B. Cementitious Materials:
 - 1. Portland Cement: ASTM C150/C150M, Type I/II.
 - 2. Fly Ash: ASTM C618, Class C or F.
 - 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
 - 4. Silica Fume: ASTM C1240 amorphous silica.
 - C. Normal-Weight Aggregates: ASTM C33/C33M, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Alkali-Silica Reaction: Comply with one of the following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.

- b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
- c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301 (ACI 301M).
- 2. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
- 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C260/C260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 2. Retarding Admixture: ASTM C494/C494M, Type B.
 - 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- F. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

D. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

2.4 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Wire: ASTM A 1064/A 1064M.
- C. Deformed-Steel Wire: ASTM A 1064/A 1064M.
- D. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.5 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.

2.6 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I gray.
 - 2. Fly Ash: ASTM C 618, Class F or C.
- C. Normal-Weight Aggregates: ASTM C 33 coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Water: ASTM C 94/C 94M and potable.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 15 mils (0.38 mm) thick.

2.8 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlappolyethylene sheet.
- C. Water: Potable.
- D. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - a. <u>ChemMasters, Inc</u>.
 - b. <u>Dayton Superior</u>.
 - c. <u>Euclid Chemical Company (The); an RPM company</u>.
 - d. <u>Master Builders Solutions</u>.
 - e. <u>Metalcrete Industries</u>.
 - f. <u>W.R. Meadows, Inc</u>.

- g. Or approved substitute.
- E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation; Construction Systems.
 - b. ChemMasters, Inc.
 - c. Dayton Superior.
 - d. Edoco by Dayton Superior.
 - e. Euclid Chemical Company (The); an RPM company.
 - f. L&M Construction Chemicals, Inc.
 - g. Metalcrete Industries.
 - h. W. R. Meadows, Inc.
 - i. Or approved substitute.
 - 2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

- 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
- 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
- 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- C. Epoxy Crack Injection Adhesive (Repair): ASTM C881, Type 1, Grade 1, solvent free.
 - 1. Products:
 - a. Sika Corporation: Sikadur 35 Hi-Mod LV
 - b. Dayton superior Corporation: Sure-Inject (J-56)
 - c. Euclid Chemical Company: EUCO #352 LV
 - d. BASF Construction Chemicals: Concresive Standard LVI
- 2.11 CONCRETE MIXTURES, GENERAL
 - A. Mix designs must be verified to meet the parameters noted and accepted by the IDOT-Aeronautics Mixtures Engineer before use.
 - B. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
 - C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.

- 2. Ground Granulated Blast-Furnace Slag: 50 percent.
- 3. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
- F. Footings and Foundation Walls: Proportion normal-weight concrete mixture as follows:
 - 1. See footing and foundation requirements on sheet S2.0.
- G. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - 1. See slab requirements in the drawings on sheet S2.0.
- 2.12 FABRICATING REINFORCEMENT
 - A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- 2.13 CONCRETE MIXING
 - A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Chamfer exterior corners and edges of permanently exposed concrete.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- 3.5 JOINTS
 - A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).

- 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and opentextured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

- G. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:
 - 1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces to be covered with a coating or covering material applied directly to concrete
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until

surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

- 1. Apply a trowel finish to surfaces to be covered with resilient flooring.
- 2. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).

3.9 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.10 CONCRETE PROTECTING AND CURING

- General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moistureretaining cover for curing concrete, placed in widest practicable width, with sides

and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

- a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
- b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
- c. Cure concrete surfaces to receive floor coverings with either a moistureretaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
- 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
- 4. of coating and repair damage during curing period.

3.11 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth

to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill formtie voids with patching mortar or cone plugs secured in place with bonding agent.

- 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
- 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

- 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
 - Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
 - 5. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

- 7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratorycured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
- 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
- 10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- 12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
- 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 03 30 00

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

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. Interior non-load-bearing wall framing.
 - 2. Soffit framing.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Cold-formed steel framing materials.
 - 2. Exterior non-load-bearing wall framing.
 - 3. Interior non-load-bearing wall framing.
 - 4. Double deflection track.
 - 5. Soffit framing.
 - 6. Post-installed anchors.
 - 7. Power-actuated anchors.
 - 8. Sill sealer gasket.
- B. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

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1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and tracks.
- D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
- E. Research Reports:
 - 1. For nonstandard cold-formed steel framing post-installed anchors and poweractuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
 - 2. For sill sealer gasket, showing compliance with ICC-ES AC380.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. AllSteel & Gypsum Products, Inc.
 - 2. ClarkDietrich.
 - 3. Craco Manufacturing, Inc.
 - 4. Custom Stud.
 - 5. Jaimes Industries.
 - 6. MRI Steel Framing, LLC.
 - 7. Steel Construction Systems.
 - 8. United Metal Products, Inc.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 - 1. Grade: ST33H (ST230H)
 - 2. Coating: G60 (Z180).
- B. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: 33 (230).
 - 2. Coating: G60 (Z180).

2.3 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 20-gauge 0.0329 inch (0.84 mm).
 - 2. Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 20-gauge 0.0329 inch (0.84 mm).
 - 2. Flange Width: 1-1/4 inches (32 mm).

- C. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 20-gauge 0.0329 inch (0.84 mm).
 - b. Flange Width: 1 inch (25 mm) plus the design gap of 1-1/2" (38 mm).
 - 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 18-gauge, 0.0428 inch (1.09 mm)
 - b. Flange Width: 3-1/2" inch (89 mm).

2.4 SOFFIT FRAMING

- A. Interior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 20 gauge, 0.0329 inch (0.84 mm).
 - 2. Flange Width: 1-5/8 inches, minimum.

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Joist hangers and end closures.
 - 10. Hole-reinforcing plates.
 - 11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
- B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.
 - 1. Uses: Securing cold-formed steel framing to structure.
 - 2. Type: Torque-controlled adhesive anchor or adhesive anchor.
 - 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
- C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

- A. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- C. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- D. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.8 FABRICATION

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

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. 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.

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 (1.6 mm).
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

- H. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framingassembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches (406 mm)
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install double deep-leg deflection tracks and anchor outer track to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 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 (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 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.

3.7 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 05 40 00

SECTION 06 10 00 - ROUGH CARPENTRY

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. Wood blocking and nailers.
 - 2. Plywood backing panels.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) size or greater but less than 5 inches nominal (114 mm actual) size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. Timber: Lumber of 5 inches nominal (114 mm actual) size or greater in least dimension.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply
with requirements. Indicate type of preservative used and net amount of preservative retained.

- 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
- 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
- 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.
 - 2. Power-driven fasteners.
 - 3. Post-installed anchors.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less; 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2. for interior construction not in contact with ground, Use Category UC3b.for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:

- 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
- 2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
- 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
- 4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
- 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
- B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any of the following species:
 - 1. Hem-fir (north); NLGA.
 - 2. Mixed southern pine or southern pine; SPIB.
 - 3. Spruce-pine-fir; NLGA.
 - 4. Hem-fir; WCLIB or WWPA.
 - 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine or southern pine; No.3 grade; SPIB.
 - 2. Hem-fir or hem-fir (north); Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.
 - 3. Spruce-pine-fir (south) or spruce-pine-fir; Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
 - 4. Eastern softwoods; No.3 Common grade; NeLMA.
 - 5. Northern species; No.3 Common grade; NLGA.
 - 6. Western woods; Standard or No. 3 Common grade; WCLIB or WWPA.

- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

2.5 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressurepreservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or A4).

2.6 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).
- B. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- C. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- D. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- E. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

- F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.
- G. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

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

3.3 PROTECTION

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

END OF SECTION 06 10 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND 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 SUMMARY

- A. Section includes:
 - 1. Interior standard steel doors and frames.
- B. Related Requirements:
 - 1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

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

1.4 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 hardware, electrified door hardware, and access control and security systems.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fireresistance ratings, temperature-rise ratings, and finishes.

- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 7. Details of anchorages, joints, field splices, and connections.
 - 8. Details of accessories.
 - 9. Details of moldings, removable stops, and glazing.
- C. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.
- D. Samples for Verification:
 - 1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 127 mm).
 - 2. Fabrication: Prepare Samples approximately 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.
- E. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For door inspector.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.

- B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly and thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.
- C. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.
- D. Field quality control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
- 1.8 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented 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 doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. Republic Doors and Frames.
 - 4. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.
- C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.38 deg Btu/F x h x sq. ft. (2.16 W/K x sq. m) when tested according to ASTM C518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - Face: Uncoated steel sheet, minimum thickness of 16 Gauge 0.053 inch (1.3 mm).
 - d. Edge Construction: Model 1, Full Flush.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges].
 - f. Core: Manufacturer's standard.
 - g. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.
 - 2. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 16 Gauge, 0.053 inch (1.3 mm).

- b. Construction: Full profile welded.
- 3. Exposed Finish: Prime.

2.4 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
 - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

- 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.
- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

2.6 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. 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.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surfacemounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.7 STEEL FINISHES

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

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with NAAMM-HMMA 840.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 - 2. Fire-Rated Openings: Install frames according to NFPA 80.
 - 3. Floor Anchors: Secure with post-installed expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 4. Solidly pack mineral-fiber insulation inside frames.
 - 5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
 - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

- 1. Non-Fire-Rated Steel Doors: Comply with NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
- 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- 3. Smoke-Control Doors: Install doors according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 REPAIR

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

END OF SECTION 08 11 13

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hinges.
 - 2. Continuous, gear-type hinges.
 - 3. Bored locks.
 - 4. Surface closers.
 - 5. Wall- and floor-mounted stops.
 - 6. Door gasketing.
 - 7. Thresholds.
 - 8. Metal protective trim units.
- B. Related Requirements:
 - 1. Section 08 11 13 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.

1.2 COORDINATION

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

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Hinges.
 - 2. Continuous, gear-type hinges.
 - 3. Bored locks.
 - 4. Surface closers.
 - 5. Wall- and floor-mounted stops.
 - 6. Door gasketing.

- 7. Thresholds.
- 8. Metal protective trim units.
- 9. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Product Data Submittals: For each product.
- C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.
 - 1. Tag Samples with full product description to coordinate Samples with door hardware schedule.
- D. Samples for Initial Selection: For each type of exposed finish.
- E. 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 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. Fastenings and other installation information.
 - e. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - f. Mounting locations for door hardware.
 - g. List of related door devices specified in other Sections for each door and frame.
- F. 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 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Architectural Hardware Consultant].
- B. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lockup 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.

1.8 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.

PART 2 - PRODUCTS

- 2.1 SOURCE LIMITATIONS
 - A. Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated.

2.2 PERFORMANCE REQUIREMENTS

- A. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- B. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design" and the "2018 Illinois Accessibility Code".
 - 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 (22.2 N).
 - 2. Comply with the following maximum opening-force requirements:

- a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
- 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

2.3 HINGES

- A. Hinges: ANSI/BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Allegion plc.
 - b. Hager Companies.
 - c. Lawrence Hardware Inc.
 - d. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
 - e. STANLEY; dormakaba USA, Inc.

2.4 CONTINUOUS HINGES

- A. Continuous, Gear-Type Hinges: ANSI/BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings. Minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
 - 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. Allegion plc.
 - b. Hager Companies.
 - c. Lawrence Hardware Inc.
 - d. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
 - e. Pemko; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
 - f. STANLEY; dormakaba USA, Inc.

2.5 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
- C. Lock Backset: 2-3/4 inches (70 mm) unless otherwise indicated.
- D. Lock Trim:
 - 1. Description: equal to Schlage "Rhodes"
 - 2. Levers: Cast.
 - 3. Escutcheons (Roses): Wrought.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
- F. Bored Locks: ANSI/BHMA A156.2, Grade 1, Series 4000.
 - 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. Allegion plc.
 - b. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
 - c. Lawrence Hardware Inc.
 - d. SARGENT Manufacturing Company; ASSA ABLOY.
 - e. STANLEY; dormakaba USA, Inc.
 - f. Yale Security Inc; ASSA ABLOY.

2.6 KEYING

- A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, appendix. Provide one extra key blank for each lock.
 - 1. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
 - b. Re-key Owner's existing master key system into new keying system.
- B. Keys: Nickel silver.

2.7 SURFACE CLOSERS

- A. Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Allegion plc.
 - b. Hager Companies.
 - c. Norton Door Controls; ASSA ABLOY.
 - d. dormakaba USA Inc.

2.8 MECHANICAL STOPS

- A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16.
 - 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. Allegion plc.
 - b. Hager Companies.
 - c. Hiawatha, Inc; a division of the Activar Construction Products Group.
 - d. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

2.9 DOOR GASKETING

- A. Door Gasketing: ANSI/BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Hager Companies.
 - b. National Guard Products, Inc.
 - c. Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

- d. Reese Enterprises, Inc.
- B. Maximum Air Leakage: When tested in accordance with ASTM E283/E283M with tested pressure differential of 0.3 inch wg (75 Pa), as follows:

2.10 THRESHOLDS

- A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.
 - 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. Hager Companies.
 - b. National Guard Products, Inc.
 - c. Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
 - d. Reese Enterprises, Inc.

2.11 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: ANSI/BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
 - 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. Allegion plc.
 - b. Hager Companies.
 - c. Hiawatha, Inc; a division of the Activar Construction Products Group.
 - d. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

2.12 FABRICATION

A. 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 ANSI/BHMA A156.18.

B. 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; however, aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

2.13 FINISHES

- A. Provide finishes complying with ANSI/BHMA A156.18.
 - 1. Provide a "brushed chrome" finish for all hardware unless otherwise noted. (US26D of US32D (stainless steel)).
 - 2. Provide "Dark Bronze" for continuous geared hinges.
 - 3. Thresholds to be milled finished aluminum.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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.
- 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 in accordance with 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 (760 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."
- E. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - 1. Do not notch perimeter gasketing to install other surface-applied hardware.

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 six months after date of Substantial Completion, Installer's Architectural Hardware Consultant is to 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 is to include 12 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 are to 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. See the Door Schedule in the Drawings.

END OF SECTION 08 71 00

SECTION 09 29 00 - GYPSUM BOARD

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. Interior gypsum board.
- B. Related Requirements:
 - 1. Section 05 40 00 "Cold-Formed Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Gypsum board, Type X.
 - 2. Interior trim.
 - 3. Joint treatment materials.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.4 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.

1.5 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.

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.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
 - 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 Corporation.
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company.
 - d. USG Corporation.
 - 2. Thickness: 5/8 inch (15.9 mm).
 - 3. Long Edges: Tapered and featured (beveled) for prefilling.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
 - 1. Material: Plastic.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - 3. 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. Plastic Components, Inc.
 - b. Trim-Tex, Inc.
 - c. Clark Dietrich VinylCorp
- B. Reveal Joints Fry Reglet, Model DRMF (basis of design)
 - 1. Material: Aluminum, extruded alloy 6063 T5
 - 2. Shape: F
 - 3. Finish: Clear anodized
- 2.5 JOINT TREATMENT MATERIALS
 - A. General: Comply with ASTM C475/C475M.
 - B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

- a. Use setting-type compound for installing paper-faced metal trim accessories.
- 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
- 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
- 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

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 (1.5 mm) 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. (0.7 sq. m) 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- (6.4- to 9.5-mm-) 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- (6.4- to 12.7-mm-) 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.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.

- 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
- 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use where indicated.
 - 4. U-Bead: Use at exposed panel edges.

3.5 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.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

3.6 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 09 29 00

SECTION 09 65 13 - 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 SUMMARY

- A. Section Includes:
 - 1. Vinyl base.
 - 2. Vinyl molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.
- E. Product Schedule: For resilient base and accessory products.
- F. protective covering for storage and identified with labels describing contents.

1.4 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 (10 deg C) or more than 90 deg F (32 deg C).

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), 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 (13 deg C) or more than 95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

- 2.1 VINYL BASE
 - A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Burke Mercer Flooring Products; a division of Burke Industries Inc.
 - 3. Flexco.
 - 4. Johnsonite; a Tarkett company.
 - 5. Roppe Corporation, USA.
 - 6. VPI Corporation.
 - B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).
 - 1. Group: II (layered).
 - 2. Style and Location:
 - a. Style B, Cove.
 - C. Minimum Thickness: 0.125 inch (3.2 mm).
 - D. Height: 4 inches (102 mm).
 - E. Lengths: Coils in manufacturer's standard length.

- F. Outside Corners: Preformed.
- G. Inside Corners: Preformed.
- H. Colors and Patterns: As selected by the Architect from manufacturer's standard colors

2.2 INSTALLATION MATERIALS

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

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. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH
scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

- 4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. 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 RESILIENT BASE INSTALLATION
 - A. Comply with manufacturer's written instructions for installing resilient base.
 - B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
 - C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
 - D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - E. Do not stretch resilient base during installation.
 - F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
 - G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 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.

END OF SECTION 09 65 13

SECTION 09 81 16 – ACOUSTIC BLANKET INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Provide glass fiber acoustical blanket insulation for interior partitions.
- B. Related Sections:
 - 1. Section 09 29 00 "Gypsum Board".

1.2 REFERENCES

- A. Materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:
 - 1. American Society for Testing of Materials (ASTM):
 - a. ASTM C423 Test Method for Sound Absorption Coefficient by the Reverberation Room Method.
 - b. ASTM C518 Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter.
 - c. ASTM C665 Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - d. ASTM E36 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
 - e. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.
 - f. ASTM E119 Test Methods for Fire Tests of Building Construction and Materials.

1.3 SUBMITTALS

A. Product Data: Submit product characteristics, performance criteria, and limitations, including installation instructions, for each type of product indicated.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original packaging.

- B. Store and protect products in accordance with manufacturer's instructions. Store in a dry indoors location. Protect insulation materials from moisture and soiling.
- C. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
- D. Do not install insulation that has been damaged or wet. Remove it from jobsite.
 - 1. An exception may be allowed in cases where the contractor is able to demonstrate that wet insulation when fully dried out (either before installation or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Owens Corning Insulating Systems, LLC, Toledo, OH 43659; www.owenscorning.com. (basis of design)
 - 2. Knauf Insulation
 - 3. Johns Manville
 - 4. Guardian

2.2 ACOUSTIC BLANKET INSULATION (SOUND ATTENUATION BATTS), FIRE-RATED

A. Type: Unfaced glass fiber acoustical insulation, complying with ASTM C665, Type I.

Thickness	Width	Length
3.5-inch (89mm)	16-inch (406mm) – 24-inch (609mm)	96-inch (2438mm)

B. Surface Burning Characteristics: ASTM E84.

- 1. Maximum flame spread: 10
- 2. Maximum smoke developed: 10
- C. Combustion Characteristics: Passes ASTM E136.

- D. Fire Resistance Ratings: Part of ASTM E119 fire tested wall assemblies.
- E. Sound Transmission Class: ASTM C423, STC 50
- F. Dimensional Stability: Linear Shrinkage less than 0.1%

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which the work of this Section is to be performed. Notify the Architect in writing of any unsatisfactory conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Verify mechanical and electrical services within the partition have been tested and inspected.

3.2 INSTALLATION

- A. Comply with manufacturer's installation instructions.
- B. Friction-fit blanket insulation in place, until the interior finish is applied. Install batts to fill entire stud cavity, with no gaps, voids, or areas of compression. If stud cavity is less than 8 feet in height, cut lengths to friction fit against floor and ceiling tracks. Walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes, and other irregularities.
 - 1. Install 3.5-inch (89 mm) batts in 3.625-inch (92 mm) stud walls
 - 2. Unless otherwise noted install batts to top of stud wall.
- C. Where walls are not finished on both sides or where insulation does not fill the cavity depth, install supplementary support to hold product in place.
- D. Where insulation must extend higher than 8 feet, provide temporary support to hold product in place, until finish material is applied.

3.3 PROTECTION

A. Protect installed insulation as recommended by manufacturer.

END OF SECTION 09 81 16

SECTION 09 91 23 - 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. Water-based finish coatings.
 - 3. Solvent-based finish coatings.
- B. Related Requirements:
 - 1. Section 05 50 00 "Metal Fabrications" for shop priming steel.
 - 2. Section 08 11 13 "Hollow Metal Doors" and Frames for shop priming hollow metal.

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.
- B. Samples: For each type of topcoat product.
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

E. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint Products: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 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 (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Benjamin Moore & Co.
 - 2. PPG Paints; PPG Industries, Inc.
 - 3. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
 - 4. Sherwin-Williams Company (The). Basis for this specification.
- B. Source Limitations: Obtain each paint product from single source from single manufacturer.

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

2.3 PRIMERS

A. Alkali-Resistant, Water-Based Primer: Water-based primer formulated for use on alkaline surfaces, such as plaster, vertical concrete, and masonry.

- B. Interior Latex Primer for Wood: Waterborne-emulsion primer formulated for resistance to extractive bleeding, mold, and microbials; for hiding stains; and for use on interior wood subject to extractive bleeding.
- C. Interior Latex Primer Sealer: Water-based latex sealer used on new interior plaster, concrete, and gypsum wallboard surfaces.
- D. 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.
- E. Alkyd Quick-Dry Primer for Metal: Corrosion-resistant, solvent-based, modified-alkyd primer; lead and chromate free; formulated for quick-drying capabilities and for use on cleaned, interior steel surfaces.

2.4 WATER-BASED FINISH COATS

- A. Interior, Latex, Institutional Low Odor/VOC, Semigloss: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.
 - 1. Gloss Level: Manufacturer's standard semigloss finish

2.5 SOLVENT-BASED FINISH COATS

- A. Interior, Alkyd, Semigloss: 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. Gloss Level: Manufacturer's standard semigloss finish

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

- C. 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. 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.
- E. 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.
 - 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.
- E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

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

and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 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.

3.6 INTERIOR PAINTING SCHEDULE

- A. Gypsum Board Substrates:
 - 1. Primer: Sherwin Williams ProMar 200 Primer
 - 2. Second and Third Coats: Sherwin Williams ProMar 200 B31W02651 HP Zero VOC Acrylic Semi-Gloss
- B. Hollow Metal Doors & Frames:
 - 1. Touch-up shop primer: Sherwin Williams Kem Bond HS Universal Gray B50AZ0008
 - 2. First and Second Coats: Sherwin Williams SOLO 100% Acrylic Interior/Exterior Latex A76W51

END OF SECTION 09 91 23

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY 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 SUMMARY

- A. Section Includes:
 - 1. Grab bars
 - 2. Mirrors

1.3 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Include electrical characteristics.
- B. Samples: Full size, for each exposed product and for each finish specified.
 - 1. Retain subparagraph below if applicable.
 - 2. Approved full-size Samples will be returned and may be used in the Work.

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- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 OWNER-FURNISHED MATERIALS
 - A. Owner-Furnished Materials:
 - 1. Soap dispensers
 - 2. Toilet paper dispensers
 - 3. Paper towel dispensers
 - 4. Custodial Accessories

2.2 WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
 - 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:

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- a. Bradley Corporation
- b. Bobrick
- c. American Specialties
- B. Grab Bar
 - 1. Mounting: Flanges with concealed fasteners.
 - 2. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 - 3. Outside Diameter: 1-1/2 inches (38 mm).
 - 4. Configuration and Length:
 - a. Toilets: 1 36-inch (914 mm) along water wall & 1- 42-inch (1,067 mm) alongside wall.
- C. Mirror Unit:
 - 1. Frame: Stainless steel angle, 0.05 inch (1.3 mm) thick.
 - a. Corners: Welded, ground smooth matching finish
 - 2. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
 - 3. Mirror: 0.25 inch (6 mm) tempered glass
 - 4. Size: As indicated on Drawings
 - 5. Exposed Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.3 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

- D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.4 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 10 28 00

SECTION 22 05 23 - GENERAL DUTY VALVES FOR PLUMBING

1.0 GENERAL

- 1.1 WORK INCLUDES
 - A. Contractor:
 - 1. Provide valves where shown on the Drawings and described herein.

1.2 QUALITY ASSURANCE

- A. All equipment and materials shall be new and of first quality. Manufactured products shall be Manufacturer's standard product with specified options but shall not be field or factory modified unless specified.
- B. All materials and equipment shall bear the Manufacturer's nameplate or marking with type, size, catalog numbers and ratings as appropriate.
- C. Pressure and Temperature Ratings:
 - 1. Cast Iron: ANSI/ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
 - 2. Steel: ANSI/ASME B16.34, Valves Flanged, Threaded, and Welding End.
 - 3. Bronze: ANSI/ASME B16.24, Bronze Pipe Flanges and Flanged Fittings; Class 150 and 300.

1.3 SUBMITTALS

- A. Shop Drawings: Not required for A/E review
- B. Product Data: Provide manufacturer's product data on all valves

2.0 PRODUCTS

- 2.1 GENERAL
 - A. Insofar as possible, valves of the same type to be by the same manufacturer but not to the extent of sacrificing quality specified; intent is to provide most suitable valve for each service.
 - B. End Styles shall be compatible with piping systems served.
 - C Use ball valves exclusively unless otherwise specified.

2.2 POTABLE WATER SERVICE VALVES

- A. Ball Valves (2-inch and smaller)
 - 1. Brass/Bronze Body
 - 2. Stainless Steel Ball & Stem
 - 3. Full Port
 - 4. Rated for a minimum 600 PSI CWP.
 - 5. Lead free suitable for use with domestic water.
 - 6. Manufacturer:

- a. Nibco T585-66-LF/S585-66-LF
- b. Apollo 77FLF-140 Series
- B. Swing Check Valves (2-inch and smaller)
 - 1. Horizontal swing type (can be installed in vertical/upflow position), Regrinding type, Y-Pattern
 - 2. Class 125 (125 psi saturated steam)/200 psi CWP
 - 3. Bronze lead free body
 - 4. Bronze lead free disk
 - 5. Threaded ends
 - 6. Renewable seat and disc
 - 7. Suitable for use with domestic water.
 - 8. Manufacturer:
 - a. Nibco T-413-Y-LF
 - b. Apollo 161T-LF
- C. Butterfly Valves (2-1/2" and Larger)
 - 1. Minimum 200 psi rating
 - 2. Ductile Iron Body
 - 3. Lug Type
 - 4. EPDM Liner
 - 5. Aluminum Bronze Disk
 - 6. Standard lever-lock operator
 - 7. Lead free suitable for use with domestic water.
 - 8. Manufacturer:
 - a. Nibco LD-2000
 - b. Apollo LD141

2.3 NATURAL/LP GAS SERVICE VALVES

- A. Ball Valves (3-inch and smaller)
 - 1. Two piece Bronze body ball valve with large port
 - 2. UL listed Gas Shut-off Valve for use with Natural/LP Gas.
 - 3. 600 PSI CWP/250 psig LP Gas
 - 4. Approved Manufacturers
 - 1. Apollo 80-100 Series or approved equal

3.0 EXECUTION

- 3.1 GENERAL
 - A. Valves shall be installed at all points indicated on the Drawings.
 - B. All valves shall be installed with stems vertical upright to horizontal wherever possible and shall not be installed with stems below horizontal under any condition.
 - C. Keep valves clear of maintenance spaces.
 - D. Install valves accessible for operation, inspection, and repair.
 - E. Provide globe valve in bypass around control valves.
 - F. Provide shut-off on each side of control valves.

- G. Support valves individually to relieve pipe stress and allow equipment removal.
- H. Follow manufacturer's recommendation for disassembly of valves for end joining method employed.

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING

1.0 GENERAL

- 1.1 DESCRIPTION
 - A. Contractor:
 - 1. Provide pipe hangers, supports, concrete inserts and anchor bolts including all metallic hanging and supporting devices for supporting exposed piping.

1.2 REFERENCES

- A. American National Standards Institute, ANSI:
 - 1. ANSI B31.1: Power Piping.
- B. Manufacturers Standardization Society of the Valve and Fittings Industry, MSS, 1815 North Fort Myer Drive, Arlington, VA 22209.
 - 1. MSS SP-58: Pipe Hangers and Supports Materials, design and Manufacturer.
 - 2. MSS SP-69: Pipe Hangers and Supports Selection and Application.
- C. Underwriter's Laboratories/Factory Mutual, UL/FM:
 - 1. Provide products UL listed and FM approved.

2.0 PRODUCTS

- 2.1 GENERAL
 - A. All materials used in manufacturing hangers and supports shall be capable of meeting the respective ASTM Standard Specifications with regard to tests and physical and chemical properties and shall be in accordance with MSS SP-58.
 - B. Select matching components sized to exactly fit pipe size for bare piping <u>or</u> to exactly fit around pipe insulation with saddle and shield for insulated piping.
 - C. Use only one type by one manufacturer for each piping service.
 - D. Hanger material shall be compatible with the pipe material. Provide copper plated components for copper piping systems.
 - E. All hangers and supports shall have some form of adjustment available after installation.
 - F. Acceptable Manufacturers:
 - 1. B-Line Systems, Inc.
 - 2. ITT Grinnell Corp.
 - 3. PHD Mfg.
 - 4. Approved equal

2.2 PIPE HANGERS AND SUPPORTS

DESIGN MECHANICAL INC

A. Suspended single pipes shall be supported by hangers suspended by steel rods from concrete inserts, beam clamps, or ceiling mounting bolts as follows:

Pipe Size	ltem	Application	MSS Type	Grinnell Type	B-Line Type
All	Adjustable Clevis Hanger	Steel pipe, not subject to expansion or contraction	1	260	B3100
All	Roller Hanger	Steel pipe, subject to ½" or more longitudinal thermal expansion	43 41	601 603	B3110 B3114
All	Adjustable Ring	Copper Tube	10	CT-99	B3170CT
All	All Threaded Rod	Hanger Rods		253	B3205
All	Beam Clamps	C-Clamp with locknuts	23	95 or 86	B351L or B3036L
All	Riser Clamp	Steel – support vertical piping runs	8	261	B3373
All	Riser Clamp	Copper–support vertical piping runs	8	CT-121	B3373CT
All	Pipe Clamps	To provide flexibility in hanger	4	212	B3140
		assembly due to horizontal	4	216	B3142
		movement	3	295	B3144
			3	295H	B3146

2.3 TRAPEZE HANGERS

- A. Strut channel trapeze hangers shall be used to support parallel piping runs. Pipe racks or stanchions fabricated with strut channel shall be used in areas of multiple pipe runs. Strut clamps, straps, and rollers shall be used to maintain proper alignment.
 - 1. Strut shall be B-Line B22 or heavier as required or equal.
 - 2. Clamps and straps shall be B-Line B2000 series, B2400 series or equal.
 - 3. Rollers shall be B-Line B218, B219, B379, B479, B3126 or equal.

2.4 STANCHIONS

- A. Floor mounted pipes 3" and larger in diameter shall be supported by either cast-in-place concrete supports or adjustable pipe saddle supports. In general, concrete supports shall be used when lateral displacement of the pipe is probable (unless lateral support is provided), and adjustable pipe saddle supports shall be used where lateral displacement of the pipe is not probable.
 - 1. Each adjustable pipe saddle support shall be screwed or welded to the corresponding size base stand. Supporting pipe shall be schedule 40 steel pipe construction. Each base stand shall be secured to the concrete floor by expansion bolts.
 - 2. Adjustable saddle supports shall be B-Line B3093 with B3088T or B3090 with B3088 or equal.

2.5 WELDED STEEL ANGLE BRACKETS

DESIGN MECHANICAL INC

A. Wall or column supported pipes shall be supported by welded steel brackets equal to B-Line B3063 (light duty), B3066 (medium duty) and B3067 (heavy duty) or equal as required for pipe sizes up to and including 20: diameter.

2.6 SADDLES AND SHIELDS

- A. Provide properly sized saddles or shields under piping hangers and supports, factoryfabricated, for all insulated piping.
- B. Types:
 - 1. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation. Saddles shall be B-Line B3160 thru B3165 or equal.
 - 2. Protection Shields: MSS Type 40 with loc tab; length recommended by manufacturer to prevent crushing insulation. Shields shall be B-Line B3153/B3155 or approved equal.
 - 3. Thermal Hanger Shields:
 - a. Constructed of 360' insert of high density, I00 psi, waterproofed calcium silicate, encased in 360' sheet metal shield.
 - b. Provide assembly of same thickness as adjoining insulation.
 - c. Shields shall be B-Line B3380 thru B3384 or equal.

2.7 CONCRETE INSERTS

- A. Concrete inserts for pipe hangers shall be, continuous metal or spot inserts designed to be used in ceilings, walls or floors.
 - 1. Continuous concrete inserts shall be used where applicable and shall be used for hanger rod sizes up to ³/₄" diameter. Inserts to be used where supports are parallel to the main slab reinforcement shall be B-Line B22I, B32I, B52I or equal.
 - 2. Spot concrete inserts shall be used where applicable and shall be used for hanger sizes up to and including 7/8" diameter. Inserts shall be B-Line B2505 thru B2508, B2500, B2501, B3014 or equal.

2.8 SLEEVES

- A. Pipes through Floors Where No Plumbing Fixtures are Installed: 18 gauge galvanized steel.
- B. Pipes through beams, Walls, Fireproofing, Footings, and Potentially Wet Floors: Schedule 40 steel pipe or 18 gauge galvanized steel.
- C. UL Labeled Sleeves: Prefabricated with insulation and fireproofing.
- D. Round Ducts: Galvanized steel.
- E. Rectangular Ducts: Galvanized steel.
- F. Sleeves Through Fire and Smoke Walls: Provide fire caulking in accordance with NFPA 90A to preserve the same fire rating as the partition being penetrated.

- G. Size sleeves to allow for expansion movement and to provide for continuous insulation.
- H. Contractor Provide: Prefabricated Wall Penetration Seals: Modular mechanical type; interlocking synthetic rubber links filling annuler space between pipe and wall opening.
 - 1. Manufacturer:
 - a. Thunderline Corp.: Link-Seal
 - b. Mason Industries: SPS
 - 2. Bolt and pressure plate fasteners and rubber seal provide watertight seal between pipe and wall.
 - 3. Seal provides electrical insulation between pipe and wall.
- 2.9 VIBRATION DAMPENING TUBING CLAMPS (STRUT MOUNTED)
 - A. For refrigeration, air conditioning, hydraulic, pneumatic and domestic water applications use a vibration-dampening clamp in strut-mounted applications. For copper and steel tubing sizes use B-Line BVT series clamps (Vibra-Clamp) or equal or B-Line series Vibra-Cushion with B2000 series clamps or equal.

2.10. PIPE ALIGNMENT GUIDES

- A. Provide factory-fabricated cast semi-steel or heavy fabricated steel; including bolted 2section outer cylinder and base with 2-section guiding spider bolted tight to pipe.
 - 1. Size guide and spiders to clear pipe, insulation, and cylinder.
 - 2. Guide Length: Recommended by manufacturer to allow indicated travel.
 - 3. Pipe alignment guides shall be B-Line B3281 thru B3287 or equal

2.11 MISCELLANEOUS SUPPORT MATERIALS

- A. Metal Framing: NEMA Standard ML 1.
- B. Steel Plates, Shapes and Bars: ANSI/ASTM A36.

3.0 EXECUTION

3.1 GENERAL

- A. Comply with MSS SP-69 for installation of hangers, supports, anchors, inserts, et..
- B. Install in accordance with manufacturer's recommendations and local Building Codes.
- C. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, and fittings and to support and secure the pipe in the intended position and alignment.
- D. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe and personnel contact.
- 3.2 PIPE HANGERS AND SUPPORTS

- A. Install hangers, supports clamps, and attachments directly from building structure complete with inserts, bolts rods, nuts and washers, and accessories.
 - 1. Do not use wire or perforated metal to support piping; pipe support from other piping not permitted.
 - 2. Install hangers with minimum 1/2 inch clear space between finished covering and adjacent work.
 - 3. Place hanger within 1 foot of each horizontal elbow.
 - 4. Use hangers vertically adjustable 1-1/2 inch minimum after piping is erected.
- B. Horizontal Soil, Waste, and Storm Pipe Support: Near each hub, with 5 feet maximum spacing between hangers for cast iron pipe.
- C. Fire Water Pipe Support: Independent of other piping.
- D. Riser Pipe Support: Independent of connected horizontal piping where practical.
- E. Prime Coat Finish
 - 1. Prime coat all exposed steel hangers and supports before installation.
 - 2. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed, and need be primed, only.
- F. Vertical Piping:
 - 1. Support vertical piping at every other floor.
- G. Pipe Movement:
 - 1. Install hangers and supports to allow controlled movement of piping systems; to permit freedom of movement between pipe anchors; and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
 - 2. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement is not transmitted to connected equipment.
 - 3. Pipe slopes:
 - a. Install hangers and supports to provide indicated pipe slopes.
 - b. Do not exceed maximum pipe deflections allowed by ANSI B31.
- H. Pipe Guides: Install pipe guides near expansion loop, expansion joints and ball joints, unless indicated otherwise.
- I. Electrolysis: Prevent electrolysis in copper tubing support with copper-plated hanger and supports or other recognized industry methods.
- J. Steel Joists: Connect all hangers and attachments to bottom chord of all steel joists or beams.
- K. Insulated Piping:
 - 1. Clamps:
 - a. Attach clamps, including spacers, to piping with clamps projecting through insulation.
 - b. Do not exceed ANSI B31 pipe stresses.

- 2. Shields:
 - a. Where low-compressive-strength insulations vapor barriers are specified on cold or chilled water piping, install coated protective shields.
 - b. For pipe 8 inches and over, install wood insulation saddles.
- 3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.3 PIPE HANGER AND SUPPORT SPACING

A. Space hangers and supports in accordance with MSS SP-69, local Building Codes and the following schedule, whichever is more stringent:

Pipe Size	Rod Diameter	Max. Hanger Spacing
Steel Pipe		
1 ¹ / ₄ " and smaller	3/8"	8' oc
1 ½" & 2"	3/8"	10' oc
2 1⁄2" and 3"	1/2"	10' oc
4" & 5"	5/8"	10' oc
6"	3/4"	10' oc
8" to 12"	7/8"	10' oc
Copper Tube		
1" & smaller	3/8"	8' oc
1 ¼" and 2"	3/8"	10' oc
2 ½" and 3"	1/2"	10' oc
4" & 5"	5/8"	10' oc
6"	3/4"	10' oc
8" to 12"	7/8"	10' oc
Plastic Pipe		
1" & smaller	3/8"	4' oc
1 ¼" - 2"	3/8"	4' oc
3"	1/2"	4' oc
4"	5/8"	4' oc
6" and larger	3/4"	4' oc

B. Install additional hangers and supports when supporting additional concentrated loads; including valves, flanges, guides, strainers, expansion joints and at changes in piping direction.

3.4. ANCHORS

- A. Install anchors at locations preventing stresses from exceeding ANSI B31; and preventing transfer of loading and stresses to connected equipment.
 - 1. Install anchors at ends of principal pipe-runs and at intermediate points in piperuns between expansion loops and bends.
 - 2. Preset anchors to accommodate both expansion and contraction of piping.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and structure in compliance with ANSI B31 and AWS.

- C. Anchors for Expansion Compensators: Install anchors in accordance with expansion unit manufacturer's recommendations.
 - a. Limit movement of piping and forces to maximums recommended by manufacturer for each unit.

3.5 ADJUSTING AND CLEANING

A. Adjust hangers and supports and place grout under supports to bring piping to proper levels and elevations.

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING

1.0 GENERAL

- 1.1 WORK INCLUDES
 - A. Contractor:
 - 1. Provide identification for all mechanical systems including but not limited to the following:
 - a. Piping
 - b. Valves
 - c Pumps
 - 2. Identification shall indicate material being transported and direction of flow.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with Uniform Building Code (UBC)- 1991.
 - 2. Uniform Federal Accessibility Standards.
 - 3. NFPA 70.
 - 4. NFPA 90A.
 - 5. OSHA.

1.3 REFERENCES.

- A. American National Standards Institute (ANSI):
 - 1. A13.1 Identification of Piping Systems.
 - 2. Z53.1 Safety Color Code for Marking Physical Hazards.

2.0 PRODUCTS

- 2.1 ACCEPTABLE MANUFACTURERS
 - A. EMED Company, 330 Green St., Box 369, Buffalo, NY, 14240.
 - B. Seton Name Plate Corporation, New Haven, CT, 06505.
 - C. W.H. Brady Co. Signmark Division, 727 W. Glendale Ave., P.O. Box 571, Milwaukee, Wisconsin, 53201.
 - D. National Marker Company, P.O. Box 1659, Pawtucket, RI, 06862.
 - E. R. K. Industries, 1501 Virginia Ave., Baldwin Park, CA 91706.
 - F. Carlton Industries, Inc., P.O. Box 280, Lagrange, TX, 78945.

2.2 MECHANICAL SYSTEM COLOR IDENTIFICATION

A. Use pipe makers to identify the following:

- 1. Domestic Cold Water (CW) Piping
- 2. Domestic Hot Water (HW) Piping
- 3. Domestic Hot Water Return (HWR) Piping
- 4. Natural Gas Piping.

3.0 EXECUTION

- 3.1 INSPECTION
 - A. Inspect equipment to be labeled and ensure that equipment is in proper condition for application of markers.

3.2 INSTALLATION

- A. Placement Provide Identification Markers:
 - 1. On all exposed covered and uncovered pipes at a minimum of 50 foot intervals.
 - 2. On all branches and valves.
 - 3. On both sides of walls where pipes pass through wall.
 - 4. At changes of flow direction.
- B. Ensure that identification markers are proper size and material to properly and clearly identify items as recommended by Marker Manufacturer and in accord with specified regulatory requirements.

3.3 ADJUST & CLEAN

- A. Upon completion of the work, examine entire installation. Correct all errors or defects.
- B. Remove all surplus materials, packaging, rubbish, and debris resulting from the work and legally dispose of off site.
- C. Leave the work area broom clean.

SECTION 22 07 19 - PLUMBING PIPING INSULATION

1.0 GENERAL

- 1.1 WORK INCLUDES
 - A. Contractor:
 - 1. Provide insulation on the following piping systems:
 - a. Domestic Water Piping (Hot, Cold and Hot Water Return)

1.2 QUALITY ASSURANCE

- A. American Society for Testing and Materials, ASTM:
 - a. Flame spread rating: 25 or less, ASTM E84.
 - b. Smoke developed rating: 50 or less, ASTM E84.
- B. National Fire Protection Association, NFPA:
 a. NFPA 255: Test Methods Surface Burning Building Materials.

1.3 SUBMITTALS

- A. Shop Drawings: Not required for A/E Review
- B. Product Data:
 - 1. Indicate complete material data, mastics, and adhesives.
 - 2. List materials proposed for this project and indicate thickness of material for individual services.

1.4 PROJECT CONDITIONS

A. Install adhesives at ambient and equipment temperatures recommended by adhesive manufacturer.

2.0 PRODUCTS

- 2.1 FIBERGLASS PIPE INSULATION:
 - A. Insulation:
 - 1. Fiberglass, heavy density, minimum of 3.7 lbs./cu.ft. density.
 - 2. One (1) piece rigid molded
 - 3. K value of 0.23 @ 75F, suitable for temperatures of -40F. to 450F.
 - B. Jacket:
 - 1. Factory-applied vapor barrier, all-serivce type with self-sealing lap and butt strips.
 - C. Manufacturers:
 - 1. Knauf
 - 2. Manville Corp

3. Owens-Corning

2.2 ELASTOMERIC INSULATION

- A. Acceptable Manufacturers
 - 1. Insulation material shall be a flexible, closed-cell elastomeric insulation in tubular or sheet form: APArmaflex, APArmaflex W, APArmaflex SS, or APArmaflex SA. This product meets the requirements as defined in ASTM C 534, "Specification for preformed elastomeric cellular thermal insulation in sheet and tubular form."
- B. General
 - 2. Insulation materials shall have a closed-cell structure to prevent moisture from wicking which makes it an efficient insulation.
 - 3. Insulation material shall be manufactured without the use of CFC's, HFC's or HCFC's. It is also formaldehyde free, low VOC's, fiber free, dust free and resists mold and mildew.
 - 4. Materials shall have a flame spread index of less than 25 and a smokedeveloped index of less than 50 when tested in accordance with ASTM E 84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, the flame shall not be progressive and all materials shall pass simulated end-use fire tests.
 - 5. Materials shall have a maximum thermal conductivity of 0.27 Btu-in./h-ft2- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.
 - 6. Materials shall have a maximum water vapor transmission of 0.08 perm-inches when tested in accordance with ASTM E 96, Procedure A, latest revision.
 - 7. The material shall be manufactured under an independent third party supervision testing program covering the properties of fire performance, thermal conductivity and water vapor transmission.
- C. Adhesives and Finishes
 - A. Adhesive shall be the insulation manufacturer's recommended contact adhesive: Armaflex 520, Armaflex 520 BLV or Armaflex HT 625 Adhesive.
 - B. Insulation finish shall be the insulation manufacturer's recommended finish: Armaflex WB Finish.
 - C. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings as specified above.

3.0 EXECUTION

3.1 PREPARATION

- A. Before covering, test and approve piping.
- B. Entire surface shall be clean and dry at time of installation.
 - 1. Insulation: dry before and during application.
 - 2. Finish with systems at operating conditions.

3.2 GENERAL

- A. Maintain continuous insulation runs through walls and floors, and at all sleeves and hangers.
- B. All fittings, valve bodies, elbows, etc. shall be wrapped with insulation.
 - 1. Do not insulate unions, flanges, strainers, flexible connections, or expansion joints.
- C. Finish insulation neatly at hanger, supports and other protrusions or interruptions.
- D. Ensure hangers and cradles are properly installed to avoid crushing insulation.
- E. Locate insulation or cover seams in least visible locations.
- F. Install protective metal shields and insulated inserts to prevent insulation compression.

3.3 INSTALLATION (ARMAFLEX)

- A. Piping:
 - Install pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, whenever possible, slide unslit sections over the open ends of piping or tubing. All seams and butt joints shall be adhered and sealed using Armaflex 520 or 520 BLVAdhesive. When using AP Armaflex SS, only the butt joints shall be adhered using Armaflex 520 or 520 BLVAdhesive. Armaflex HT 625 Adhesive shall be used with HT Armaflex.
 - 2. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
 - 3. Tape the ends of the copper tubing before slipping the Armaflex insulation over the new pipes to prevent dust from entering the pipe.
 - 4. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp non-serrated knives must be used.
 - 5. On cold piping, insulation shall be adhered directly to the piping at the high end of the run using a two-inch strip of Armaflex 520 or 520 BLVAdhesive on the ID of the insulation and on the pipe. All exposed end cuts of the insulation shall be coated with Armaflex 520 or 520 BLVAdhesive. All penetrations through the insulation and termination points must be adhered to the substrate to prevent condensation migration.

- 6. Sheet insulation shall be used on all pipes larger than 6² IPS. Insulation shall not be stretched around the pipe. On pipes larger than 12² IPS, adhere insulation directly to the pipe on the lower 1/3 of the pipe. On pipes greater than 24² IPS, complete adhesion is recommended.
- 7. Seams shall be staggered when applying multiple layers of insulation.
- B. Valves, Flanges and Fittings:
 - All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Armaflex 520 or 520 BLVAdhesive. Screwed fittings shall be sleeved and adhered with a minimum 1² overlap onto the adjacent insulation. Armaflex HT 625 Adhesive shall be used with HT Armaflex.
 - 2. Valves, flanges, strainers, and Victaulic couplings shall be insulated using Armaflex donuts that shall then be covered with sheet or oversized tubular insulation.
- C. Hangers:
 - 1. Support piping system using high density inserts with sufficient compressive strength. The pipe support insulation shall be elastomeric foam with the same or greater thickness than the pipe insulation. All joints shall be sealed with Armaflex 520 or 520 BLV adhesive.
 - 2. Standard and split hangers -- Piping supported by ring hangers shall have hangers insulated with the same insulation thickness as the adjacent pipe. All seams and butt joints shall be sealed with Armaflex 520 or 520 BLVAdhesive. Armaflex HT 625 Adhesive shall be used with HT Armaflex. Ring hangers may be sleeved using oversized tubular insulation. On cold piping, insulation shall extend up the hanger rod a distance equal to four times the insulation thickness. Insulation tape may be used to a thickness equal to the adjacent insulation thickness.
 - 3. Clevis hangers or other pipe support systems -- Saddles shall be installed under all insulated lines at unistrut clamps, clevis hangers, or locations where the insulation may be compressed due to the weight of the pipe. All piping shall have wooden dowels or blocks of a thickness equal to the insulation inserted and adhered to the insulation between the pipe and the saddle. It is highly recommended for continuous insulation protection to use hanger sizes equal to the outer diameter of the pipe plus insulation thickness.
 - 4. Armafix IPH or Armafix NPH can be used to prevent compression of insulation at standard split, clevis hangers or other pipe support systems. To minimize the movement of Armafix, it is recommended that a pair of non-skid pads be adhered to the clamps. In addition, to prevent loosening of the clamps, use of an antivibratory fastener, such as a nylon-locking nut, is also recommended.

3.4 PIPE INSULATION SCHEDULE (Conductivity 0.21 – 0.28): Provide insulation according to the following schedule unless otherwise noted on the drawings.

Service	System Temp.	Pipe Size	Minimum Thickness
Domestic Hot Water and Hot Water Return	105F-140F	Up to 1-1/4"	1"
		1 $\frac{1}{2}$ and up	1 1⁄2"
Domestic Cold Water	40-55F	All	1"

SECTION 22 11 16 - DOMESTIC WATER PIPING

1.0 GENERAL

1.1 WORK INCLUDES

- A. Contractor:
 - 1. Furnish and install domestic/potable water piping system complete with necessary valves, connections, and other appurtenances as required for a complete and proper system.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM B 88, "Standard Specification for Seamless Copper Water Tube"
- B. American Society of Mechanical Engineers (ASME)
 - 2. ASME B16.18, "Cast Copper Alloy Solder Joint Pressure Fittings"
 - 3. ASME B16.22, "Wrought Copper and Copper Alloy Solder Joint Pressure Fittings"

1.4 QUALITY ASSURANCE

A. Comply with Illinois Plumbing Code latest addition.

2.0 PRODUCTS

- 2.1 PIPE
 - A. Copper meeting the requirements of ASTM B88.
 - 1. Above-Grade: Type L copper.
 - 2. Below-Grade or below concrete slab:
 - a. 2" and smaller: Type K soft copper
 - B. Piping sizes shown on the drawings are nominal pipe sizes.

2.2. FITTINGS

A. Cast bronze or wrought copper fittings conforming to ASME B16.18 and B16.22.

2.3. JOINTS/CONNECTIONS

- A. Above-Grade
 - 1. Sweat copper type with 95/5 or 96/4 Tin-Antimony solder or Silvabrite 100 solder.
 - 2. Use only lead-free solder conforming to ASTM B32.
- B. Below-Grade
 - 1. Brazed using rods and flux suitable for intended service (Do not use rods containing Cadmium).
 - 2. Joints under slab acceptable only if allowed by local codes.

3.0 EXECUTION

3.1 INSTALLATION

- A. Above-Grade
 - 1. Install piping parallel to building walls at such heights as not to obstruct portion of window, doorway, stairway or passageway.
 - a. Where interference develops in field, offset or reroute piping as required to clear such interferences.
 - b. Consult Drawings for location of pipe spaces, ceiling heights, door and window openings or other architectural details and report discrepancies to the A/E, before installing piping.
 - 2. Piping shall be securely hung and anchored, free to expand and contract quietly, without imposing strains on structure, piping, valves, devices, equipment. Piping shall be run parallel or perpendicular to building lines.
- B. Below-Grade
 - 1. Install piping under slabs without joints where possible.
 - 2. Insulate water piping buried within building perimeter with insulation suitable for below grade application.
 - 3. Bury water piping six (6) inches minimum below bottom of slab and encase in two (2) inches minimum of sand.
- C. Locate cold water lines a minimum of six (6) inches from hot water lines.
- D. Connections between dissimilar metals shall be separated by dielectric couplings.
- E. Water piping shall vent through fixtures or equipment above or shall have accessible manual air vents at all high points.
- F. Water piping shall drain completely through fixtures or shall have accessible drains at low points.
- G. All piping installed through fire-rated construction shall be fire caulked.

3.2 FIELD QUALITY CONTROL

- A. System Pressure Test To be completed before pipes are covered.
 - 1. Water supply system shall be tested and proved tight under water pressure at least 1-1/2 times the system pressure (minimum of 100 psi) for a minimum of 15 minutes.

3.3 CLEANING

- A. Sterilize potable water system with solution containing 200 parts per million minimum of chlorine. Valve off and allow sterilization solution to remain for 3 hours.
- B. After sterilization, flush solution from system with clean water until residual chlorine content is less than 0.2 parts per million.

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

1.0 GENERAL

1.1 WORK INCLUDES

- A. Contractor
 - 1. Furnish and install sanitary waste and vent piping systems within building and connect to building sewer five (5) feet from outside of building as shown on plans.
 - 2. Perform excavation and backfill required by work of this Section.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - I. ASTM D 2665-98, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe Fittings.
 - 2. ASTM D 2949-98, Specification for 3.25-in Outside Diameter Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
 - 3. ASTM D 3311-94, Specification for Drain, Waste and Vent (DWV) Plastic Fittings Patterns.
 - 4. ASTM D 2855-96, Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
 - 5. ASTM F 656-96, Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
 - 6. ASTM A 888-98e1, Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Application.
 - 7. ASTM A 74-98, Specification for Cast Iron Soil Pipe and Fittings

1.4 QUALITY ASSURANCE

A. Comply with the Illinois Plumbing Code, latest edition, and amendments thereto.

2.0 PRODUCTS

2.1 SANITARY DRAINAGE AND VENT PIPING

- A. Underground and above-ground:
 - 1. Pipe: Schedule 40 polyvinyl chloride (PVC) plastic pipe (Type DWV) meeting requirements of ASTM D 2665 or ASTM D 2949.
 - a. Fittings: Approved for installation with the piping material installed and shall conform to ASTM D 3311 or ASTM D 2665.
 - b. Joints: A purple primer that conforms to ASTM F 656 shall be applied and the joints solvent–welded in accordance with ASTM D 2855.
- B. In Air Plenum:
 - 1. General:
 - a. All materials exposed in air plenums must have a Flame Spread Index
(FSI) of 25 or less and a Smoke Developed Index (SDI) of 50 or less as tested in accordance with ASTM E84.

- 2. Pipe Materials:
 - a. No-Hub Cast Iron meeting requirements of ASTM A 74 or ASTM A 888.
 - b. Schedule 40 polyvinyl chloride (PVC) plastic pipe (Type DWV) meeting requirements of ASTM D 2665 or ASTM D 2949 covered with fire barrier plenum wrap (3M Fire Barrier Plenum Wrap 5A+ or equal) to achieve the above FSI & SDI ratings.

3.0 EXECUTION

3.1 INSTALLATION

- A. Grade soil and waste lines within building perimeter as follows:
 - 1. Pipe less than 2" in diameter: minimum 1/4 inch fall per ft in direction of flow.
 - 2. Pipe 3" to 8" in diameter: minimum 1/8 inch fall per ft in direction of flow.
- B. Install piping with cleanouts installed as follows
 - 1. Where shown on Drawings and near bottom of each stack and riser.
 - 2. At every 135 degrees of accumulative change in direction for horizontal lines.
 - 3. Every 50 feet of horizontal runs.
 - 4. Extend piping to accessible surface. Do not install piping so cleanouts must be installed in carpeted floors. In such locations, configure piping so wall type cleanouts may be used.
- C. Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have seal trap in connection with complete venting system so gasses pass freely to atmosphere with no pressure or syphon condition on water seal.
- D. Vent entire waste system to atmosphere. Discharge 14 inches above roof. Join vent lines together in fewest practicable numbers before projecting above roof. Set back vent lines so they will not penetrate roof near edge or valley.
- E. Piping shall be securely hung and anchored, free to expand and contract quietly, without imposing strains on structure, piping, valves, devices, equipment. Piping shall be run parallel or perpendicular to building lines.
- F. All piping installed through fire-rated construction shall be fire caulked with an approved material.
- G. Minimum size of waste piping installed under floor slab on grade shall be 2-inches.

3.2 EXCAVATION AND BACKFILLING

- A. Depth of bury of cover over exterior underground piping shall not be less than 4'-0" unless otherwise noted.
- B. Contractor shall do excavating required to install his work, including pockets as required

for fittings, etc., and after same are in place and tested and approved, he shall replace drives, curbs and remove surplus earth and debris from the premises as directed by A/E.

- C. Backfill under concrete and within 5'-0" of same shall be thoroughly compacted sand or small size gravel. All other backfill shall be free of debris, rock, concrete, etc. and settled with water in layers as directed by A/E. No materials except clean sand shall be placed within 6" of any pipe.
- D. Excessive excavations, excavations required to reach undisturbed soil, lower trenches, etc., shall be filled with thoroughly water compacted sand or small size gravel to provide adequate bedding and support.
- E. Pipe shall be firmly and uniformly bedded throughout its total length on 3" minimum compacted sand or gravel.
- F. Backfill shall be 6" minimum compacted sand or gravel on sides and top.
- G. No trenches shall be filled until work had been inspected and approved by A/E.

3.3 TESTING

A. Site Tests - After backfilling and compacting is complete but before placing floor slab, conduct tests for leaks and defective work. Notify Architect prior to testing. Fill waste and vent system to roof level with water, 10-foot head of water minimum, and show no leaks for two (2) hours. Correct leaks and defective work.

SECTION 22 16 16 - NATURAL/LIQUID PETROLEUM GAS PIPING

1.0 GENERAL

- 1.1 WORK INCLUDES
 - A. Contractor:
 - A. Furnish and install gas piping and fittings.

1.2 REFERENCES.

- A. American Society for Testing and Materials
 - 1. ASTM A53-90b, "Specification for Pipe, Steel, Black & Hot-Dipped Zinc-Coated Welded & Seamless".
 - 2. ASTM A234-92a, "Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
 - 3. ASTM D2513-93a, Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings".

1.3 QUALITY ASSURANCE

A. Qualifications – Welders shall be certified and bare evidence of certification 30 days before commencing work on project. If there is doubt as to proficiency of welder, Contracting Officer may require welder to take antoher test. This shall be done at no cost to Government. Certification shall be by Pittsburgh Testing Laboratories or other approved authority.

2.0 PRODUCTS

- 2.1 PIPE & FITTINGS
 - A. Above-Ground:
 - 1. Pipe: Black carbon steel, Schedule 40 pipe meeting requirements of ASTM A53.
 - 2. Joints & Fittings:
 - a. 2" and smaller: Joints shall be threaded. Fittings shall be wrought-steel with dimensions and tolerances conforming to ANSI B16.11. Unions shall be wrought steel. Threaded joints shall be made up with thread compound suitable for use with natural/LP gas.
 - b. 2 ¹/₂" and larger: welded steel fittings matching pipe as to finish, construction and working pressure. Welding to be done only by certified welders in compliance with current codes.
 - B. Below-Ground:
 - 1. Pipe & Fittings Polyethylene pipe and fittings meeting requirements of ASTM D2513.

3.0 EXECUTION

3.1 INSTALLATION

- A. Steel pipe 2-1/2 inches and larger shall have welded fittings and joints. Other steel pipe may have screwed or welded fittings.
- B. Install gas cocks on lines serving gas-fired equipment adjacent to equipment, on outside of equipment cabinet, and easily accessible.
- C. Do not use flexible pipe connections to gas-fired equipment.
- D. Install 6 inch long minimum dirt leg, with pipe cap, on vertical gas drop serving each gasfired equipment unit.
- E. Use fittings for changes of direction in pipe and for branch runouts.
- F. Lay underground ippe in accordance with Manufacturer's recommendations and local gas suppliers regulations and specifications.

3.2 FIELD QUALITY CONTROL

A. Site Tests – Before pipes are buried or concealsed frm view, test systems at 60 psig for 4 hours and show no drop in pressure. Submit test results to Contracting Officer.

SECTION 22 40 00 - PLUMBING FIXTURES

1.0 GENERAL

- 1.1 WORK INCLUDES
 - A. Contractor:
 - 1. Furnish and install all materials, accessories, tools, equipment, transportation, labor, services, and all operations required to complete the following:
 - a. Plumbing fixtures and specialties.

1.2 QUALITY ASSURANCE

- A. Standards: Any procedure, material or operation specified by reference to applicable standards or codes shall comply with the current or most recent edition. In conflicts between listed standards, the more stringent shall govern.
 - 1. Applicable Standards:
 - a. Illinois Plumbing Code, latest edition
 - b. Local plumbing code
 - c. International Fuel Gas Code, latest edition
 - d. International Mechanical Code, latest edition
- B. Contractor shall obtain all necessary permits and arrange for all inspections required by State or Local authorities.
- C. Materials must be new and in first class condition.
- D. Work must be done by trained, experienced, skilled journeyman under an approved full time supervisor, with every possible precaution taken by contractor to assure safety of all persons of all categories.

1.3 SUBMITTALS

- A. Product Information:
 - 1. Plumbing fixtures and specialties

1.4 GUARANTEE

- A Each entire overall installation, including every special item, device, and part and every specialized system shall be fully guaranteed from standpoint of satisfactory performance, safety, workmanship and material for one year after formal written acceptance by Architect/Engineer (A/E), any unsuitable, unsatisfactory, noisy, ineffective, defective, improperly sized or applied equipment or material, or unacceptable workmanship shall be quickly replaced or modified during guarantee period or any extension thereof, as directed and as approved by A/E in writing.
- B. Individual items and systems shall be guaranteed for same period in addition to the above regardless of any limitations of manufacturer's guarantee period.

C. Vapor Barrier covering guarantee - covering on pipe, fittings, devices, unions, etc. must be unconditionally guaranteed to be free of condensation, water logging, water staining, water drip, water accumulation and mildew for one (1) full year after mechanical installation is accepted by A/E. Any such defective work must be completely replaced and refinished when condition is reported to contractor within above guarantee period by A/E without delay or cost to Owner, and guaranteed in same manner for another one (1) full year period.

2.0 PRODUCTS

2.1 FLASHING

A. Openings in roofs shall be flashed as necessary to be compatible with roofing system using approved methods. Disturbed existing piping through roof shall be properly flashed and weather-tight.

2.2 PLUMBING FIXTURES

- A. All plumbing fixtures and non-metal accessories shall be white in color, except where shown or specified otherwise.
- B. Fixture trim shall be cast brass with polished chrome-plated finish on exposed surfaces, except where shown or specified otherwise.
- C. Provide a separate trap with cleanout for each fixture. Exposed fixture traps shall be tubular wall type, minimum 17 gauge with integral cleanout plugs, polished chrome plated finish, except where shown or specified otherwise. Size trap to fit fixture tailpiece. Comply with local plumbing code.
- D. Provide an accessible loose key or screwdriver stop in all water supplies to all fixtures.
- E. Provide a chrome plated brass escutcheon plate fastened in place for all wall penetrations for exposed connections to fixtures.
- F. Each wall hung fixture shall have a suitable wall hanger, bolted to wall and/or fixture; exposed portions of hangers shall match fixture as to finish.
- G. Fixtures shall have water, drain, waste, soil, vent and other connections and accessories as required.
- H. Each water connection to fixtures shall have an air gap or vacuum breaker as required by local or state departments of health. Water connection sizes are minimums and must be increased to correspond to manufacturer's standards.
- Each water connection to fixtures: provide pipe air chamber, as close to fixture as possible, extending vertically up, with capped top, as follows: Fixtures - Full size x 12" (min.) Mains - Full size x 24" (min.)
- J. Provide additional air chambers, as may be required to assure quiet operation without increase in contract price.
- K. Verify fixture locations and coordinate them with architectural designs and other devices and equipment, as approved by the A/E, before roughing in connections.

- L. Install all handicapped fixtures to respective ADA Standards requirements.
- M. Refer to drawings for schedule of fixtures.
- N. Acceptable Manufacturer's
 - 1. Fixtures: American Standard, Kohler, Zurn, Toto
 - 2. Carrier: Wade, Zurn, J.R. Smith
 - 3. Flush Valve: Sloan, Zurn, Toto
 - 4. Supplies, Strainer & Traps: McGuire, Dearborn, Brass Craft, Engineered Brass, American Standard, Kohler
 - 5. Faucets: Chicago, Elkay, Kohler, Zurn, Sloan
 - 6. Sinks: Elkay, Kohler, Just

3.0 EXECUTION

3.1 PREPARATION

- A. Quantities Required and Clarifications:
 - 1. Contractor shall determine quantities required from drawings and job conditions, except that where specifications call for specific quantities, these quantities shall also govern. If there is conflict between quantities called for on drawings and in specifications, greater quantity shall govern.
 - 2. Where an item is specified by a manufacturer's number, such number is for general information only, and shall be modified by any additional data, size, etc., which may be shown and/or specified. Where there is conflict between number and other data, it shall be contractor's responsibility to request clarification from A/E.
 - 3. Where clarification is required for any purpose, including discrepancies within written specifications on drawings, or between them, it shall be contractor's responsibility to request such clarification from A/E at least 7 days before bids are due and in all cases subsequent interpretations or clarifications made by A/E shall be final.
- B. Cleaning
 - 1. Piping, conduit, equipment, devices, etc. shall be thoroughly cleaned before being offered for acceptance.
 - 2. The following shall be thoroughly cleaned, or finished out, or blown out before installation is offered for acceptance.
 - a. Plumbing equipment, fixtures, devices, etc.
 - 3. Labels, stickers, temporary protection, etc. shall be removed and work shall be provided by contractor without increase in contract price.
- C. Permits, Fees, Enlargements, Extensions, Etc.
 - 1. Contractor shall secure and pay for all licenses, assessments, permits; shall pay for inspections required by county, state and local utilities; and shall replace new

or present paving, etc. as approved by A/E and all governmental bodies having jurisdiction. All without increase in contract price.

- D. Verification of Points of Connection
 - 1. Before submitting his bid, contractor shall visit site to verify all exposed, concealed and buried points of connection as to location, flow, size, type, depth, pressure, elevation, operating characteristics, etc., including but not limited to the following:
 - a. Water service and shut-offs.
 - b. Sanitary sewer connections
 - c. Storm sewer location
 - 2. If contractor finds that any present point or points of connection to existing facilities are incorrectly shown on plans or incorrectly specified, he shall notify A/E in writing at least 7 days before bids are due to be submitted. A/E will issue an addendum to all contractors, calling their attention to revised point or points of connection.
 - 3. If contractor fails to notify A/E in writing as outlined above, it will be assumed that his bid includes everything required to provide proper connections to all present points of connection as they actually exist and will pay for all relocations, replacements, additional runs and extensions, without increase in contract price.

3.2 PIPING INSTALLATION

- A. Piping shall be securely hung and anchored, free to expand and contract quietly, without imposing strains on structure, piping, valves, devices, equipment. Piping shall be run parallel or perpendicular to building lines.
- B. Connections between dissimilar metals shall be separated by dielectric couplings.
- C. Valves, devices, equipment, etc. must be
 - 1. Accessible for operating, servicing and replacing
 - 2. Have interior assemblies removable without removing bodies
 - 3. Be free of all strain or stress.
- D. Water piping shall vent through fixtures, or equipment above or shall have accessible vents at all high points. Vent shall be manual air vents. Also, such piping shall drain completely through fixtures, or shall have accessible drains at:
 - 1. All low points, $\frac{3}{4}$ " or larger
 - 2. Brass caps or plugs elsewhere.
- E. All piping installed through fire-rated construction shall be fire caulked.
- F. Soil and Waste Piping
 - 1. Install new soil and waste lines as indicated and connect to sanitary system as required.
 - 2. Provide cleanouts throughout the plumbing system where indicated or required by code and the nature of the work.
 - 3. Make changes in line or grade with the proper fitting.

- 4. All vent pipe shall be firmly and uniformly supported throughout its total length using hangers as specified.
- G. Vent Piping
 - 1. Minimum venting shall be as shown on the drawings; otherwise, all venting shall comply with the rules of the specified codes.
 - 2. Vent all parts of the soil and waste system to prevent siphonage of traps of plumbing fixtures.
 - 3. Vent pipe sizes may be increased at contractor's option

3.3 EXCAVATION AND BACKFILLING

- A. Depth of bury of cover over exterior underground piping shall not be less than 4'-0" unless otherwise noted.
- B. Contractor shall do excavating required to install his work, including pockets as required for fittings, etc., and after same are in place and tested and approved, he shall replace drives, curbs and remove surplus earth and debris from the premises as directed by A/E.
- C. Backfill under concrete and within 5'-0" of same shall be thoroughly compacted sand or small size gravel. All other backfill shall be free of debris, rock, concrete, etc. and settled with water in layers as directed by A/E. No materials except clean sand shall be placed within 6" of any pipe.
- D. Excessive excavations, excavations required to reach undisturbed soil, lower trenches, etc., shall be filled with thoroughly water compacted sand or small size gravel to provide adequate bedding and support.
- E. Pipe shall be firmly and uniformly bedded throughout its total length on 3" minimum compacted sand or gravel.
- F. Backfill shall be 6" minimum compacted sand or gravel on sides and top.
- G. No trenches shall be filled until work had been inspected and approved by A/E.

SECTION 23 05 00 - BASIC MECHANICAL REQUIREMENTS

1.0 GENERAL

1.1 WORK INCLUDES

- A. Contractor:
 - 1. Provide basic mechanical materials and methods as shown on the Drawings and specified herein for a complete and proper installation.

1.2 SUBMITTALS

A. Product/Catalog Data

- 1. Submit Manufacturer's catalog data for each manufactured item.
 - a. Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
 - b. Include name, address, and phone number of each supplier.
- B. Shop Drawings
 - 1. Provide schematic control diagrams for each separate fan system, heating system, control panel, etc. Each diagram shall show locations of all control and operational components and devices. Mark correct operating settings for each control device on these diagrams.
 - 2. Provide diagram for electrical control system showing wiring of related electrical control items such as fuses, interlocks, electrical switches, and relays. Provide drawings showing electrical power requirements and connection locations.
 - 3. Provide other shop drawings required by Division 15 trade Sections.
- C. Operations and Maintenance Manuals
 - 1. Provide three (3) sets of manufacturers printed information in three (3) ring binders containing information on installation, operation, and maintenance for each piece of equipment supplied.
 - 2. The information shall list any maintenance requirements and time duration between required maintenance.
 - 3. The information shall show all parts and part numbers of available replacement parts for each piece of equipment.
 - A cross-index of material and equipment shall be furnished containing:
 - a. An alphabetical listing of material and equipment including manufacturer's name, address and contact person of the local sales representative.
 - b. An alphabetical listing of all subcontractors including name, address, contact person, and specific work performed.

1.3 QUALITY ASSURANCE

4.

- A. Requirements of Regulatory Agencies
 - 1. Perform work in accordance with applicable provisions of local Plumbing Code, Gas Ordinances, and adoptions thereof. Provide materials and labor necessary to comply with rules, regulations, and ordinances.

- 2. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify A/E in writing of such differences.
- B. Identification Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to Owner.

1.4 COORDINATION

A. Coordinate clearances about all mechanical equipment with existing conditions, building structure and other trades to ensure all manufacturers required clearances are met. Reroute and/or relocate all ductwork, piping, conduit, etc. as necessary to accommodate equipment clearances. It shall be the Contractor's responsibility to ensure that all manufacturers' required clearances are met.

1.5 WARRANTIES

- A. In addition to guarantee specified in General Conditions, guarantee heating, cooling, and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
- B. Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.

1.5 SYSTEM START-UP

- A. Provide manufacturer's representative to start-up all mechanical equipment and systems and provide start-up report for all mechanical equipment. Start-up report(s) shall be included in the O&M manual.
- B. Off-Season Start-up
 - 1. If Substantial Completion inspection occurs during heating season, schedule spring start-up of cooling systems. If inspection occurs during cooling season, schedule autumn start-up for heating systems.
 - 2. Notify Owner 7 days minimum before scheduled start-up.
 - 3. Time shall be allowed to completely service, test, check, and off-season start systems.
 - 4. At end of off-season start-up, furnish Owner with letter confirming that above work has been satisfactorily completed.

1.6 OWNER'S INSTRUCTIONS/TRAINING

- A. Contractor shall train Owner's representatives in operation and maintenance of all mechanical equipment and systems.
- B. Provide system training to include (but not limited to) such items as the following: modification of data displays and time schedules, alarm and status descriptions, thermostat programming and maintenance schedules. Provide this training to a minimum of three (3) persons.
- C. Provide training above in 2-different 2-hour sessions, each on a different day as part of the contract.

D. Training sessions shall be individualized in nature and specific for this project. Generalized "group" sessions involving multiple building operators from non related facilities will be specifically prohibited.

2.0 PRODUCTS

2.1 NON-FUSED DISCONNECT SWITCHES

- A. Unless otherwise specified, provide non-fused disconnect switches for all mechanical equipment supplied under Division 23. Coordinate size with equipment manufacturer.
- B. Disconnect switches shall be listed by a Nationally Recognized Testing Laboratory and constructed and tested in accordance with NEMA standards.
- C. Acceptable Manufacturer's
 - 1. SquareD
 - 2. Siemens
 - 3. Cutler-Hammer

3.0 EXECUTION

3.1 GENERAL

- A. Site Inspection
 - 1. Examine premises to understand conditions which may affect performance of work of this Division before submitting proposals for this work.
 - 2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

B. Drawings

- 1. Plumbing, and Mechanical Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
- 2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing, and Mechanical Drawings.
- 3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.
- C. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

3.2 INSTALLATION

- A. Interface with other Work
 - 1. Electrical Furnish exact location of electrical connections and complete

information on motor controls to installer of electrical system.

- 2. Testing & Balancing
 - a. Put mechanical systems into full operation and continue their operation during each working day of testing and balancing.
 - b. Make changes in pulleys, belts, fan speeds, and dampers or add dampers as required for correct balance at no additional cost to Owner.
- B. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.
- C. Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.

3.3 PENETRATIONS

- A. Seal all penetrations thru fire-rated construction (i.e. walls, floors, ceilings, etc.). Install firestopping material to seal penetrations through fire rated structures and draft stops.
- B. Seal openings through building exterior caused by penetrations of elements of mechanical systems.

3.4 REPAIR/RESTORATION

- A. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
- B. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
- C. Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

3.5 ADJUSTMENT

- A. Properly lubricate equipment before Owner's acceptance.
- B. Repair damaged finishes and leave everything in working order.

3.6 CLEANING

A. Clean exposed piping, ductwork, equipment, and fixtures.

3.7 PROTECTION

A. Do not operate equipment used for moving supply air without proper air filters installed.

SECTION 23 31 13 - DUCTWORK

1.0 GENERAL

1.1 WORK INCLUDES

- A. Contractor provide:
 - a. Ductwork, fittings, and accessories.
 - b. Turning vanes
 - c. Volume dampers.
 - d. Fire and smoke dampers.

1.2 QUALITY ASSURANCE

- A. Design and Installation Standards:
 - 1. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
 - 2. NFPA 90B Warm Air Heating and Air Conditioning Systems
 - 3. NFPA 96 Standard for the Installation of Equipment for Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.
 - 4. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) HVAC Duct Construction Standard.
 - 5. ASHRAE Standards on duct construction.
 - 6. Underwriters' Laboratories standard UL 181 requirements for class 1 air duct material
- B. Fire and Smoke Rating Standards: ASTM-E84, NFPA 255 and UL 723.
- C. Dimensions on Drawings indicate inside dimensions of air flow area. Outside duct dimensions must be increased for internally lined ducts to allow for liner thickness.

1.3 SUBMITTALS

A. Submit ductwork fabrication and installation drawings.

1.4 COORDINATION

A. Installation of ducts shall be coordinated with the building structure, lighting fixtures, piping, conduit, reflected ceiling plans and other trades as necessary.

2.0 PRODUCTS

- 2.1 SHEET METAL DUCTWORK
 - A. Material
 - 1. All ducts unless specified otherwise shall be constructed from sheets or rolls of G60 or better galvanized steel ASTM-A525.
 - 2. Exhaust ducts in shower rooms or other wet areas shall be constructed from 3003-H14 series aluminum. Shower or wet area exhaust where tied to general exhaust shall be aluminum from the air device to the point indicated on the Drawings.

- B. Construction
 - 1. All ductwork unless specified otherwise shall be constructed of gauges and reinforcement in accordance with SMACNA HVAC Duct Construction Standard as follows:
 - a. Rectangular duct: Table 1-5 (6" w.g. static pressure)
 - b. Round Duct: Table 3-2 (6" w.g. static pressure)
 - 2. Where local code requires gauges heavier than required by SMACNA then the local code shall govern.
 - 3. All ductwork shall be neatly constructed and stiffened on the outside surfaces where necessary to prevent vibration or buckling. Panels in all ducts 12" and larger shall be cross-broken. All ducts, housings, etc. shall be fabricated as detailed on the Drawings and in the SMACNA HVAC Duct Construction Standard.
- C. Longitudinal Joints
 - 1. Unless specified otherwise, all rectangular duct longitudinal joints shall be "Pittsburgh Lock".
 - 2. Unless specified otherwise, all round and oval ducts 18-inches and larger shall have spiral seams or continuously welded longitudinal seams. Snap Lock seams may be used for round ducts under 18-inches.
- D. Transverse Joints
 - 1. All transverse joints in rectangular ductwork 18-inches and larger shall be made by a flanged duct connection system. Transverse joints in rectangular ductwork smaller than 18-inches shall be made in accordance with SMACNA suitable with the pressure class.
 - 2. All transverse joints in round and oval ductwork 18-inches and larger shall be made by a round/oval flanged duct connection system. Transverse joints in round and oval ductwork smaller than 18-inches shall be made by beaded sleeve joints.
 - 3. The rectangular flanged duct connection system shall consist of roll-formed flanges, corner pieces, gaskets and cleats described as follows:
 - a. Flanges attach to the duct wall and have integral mastic, which allows the flange to seal itself to the duct.
 - b. Corner pieces are used to add rigidity to the flange, hold the ductwork together and provide a sealing surface for the gasket.
 - c. The gasket serves as a seal between the flanges.
 - d. The cleat insures even compression of the gasket along the length of the flange.
 - 4. Approved Manufacture's
 - a. Ductmate Industries, Inc. or approved equal.
- E. Fittings
 - 1. Fittings shall be in accordance with Section II of SMACNA HVAC Duct Construction Standard.

- 2. Radius elbows without vanes: Radius Ratio (R/W) shall be 1.5 or greater
- 3. Radius elbows with vanes:
 - a. R/W = 0.75 to 1.0: Provide 3 vanes in elbow
 - b. R/W = 1.0 to 1.25: Provide 2 vanes in elbow
 - c. R/W = 1.25 to 1.5: Provide 1 vane in elbow
 - d. Dual Radius: Per Figure 2.5, SMACNA HVAC Duct Construction Standards.
- 4. Where square elbows are indicated or required, provide with turning vanes.
- 5. Branch Connections:
 - a. Round: conical or 45 degree conical
 - b. Rectangular: 45 degree entry type. Spin in fittings are not acceptable.
- 6. Provide necessary transition pieces and duct collars to make connections to ductwork and from neck sizes shown on the Drawings.

2.5 DUCT HANGERS AND SUPPORTS

- A. Duct systems shall be installed with support systems as indicated in Tables 4-1 to 4-3 and Figures 4-1 to 4-8 of SMACNA HVAC Duct Construction Standard, Section IV and additionally as required to maintain alignment.
- B. Horizontal ducts shall have a support within two (2) feet of each elbow and within four (4) feet of each branch intersection.

2.6 DUCT SEALANT

- A. Duct sealant shall be flexible, water based, adhesive sealant designed for use in 2" static pressure systems. Sealant shall be U.L. Listed and conform to ASTM E84.
- B. All supply ductwork unless specified otherwise shall be SMACNA's seal class A.
- C. All return, exhaust and supply ductwork downstream of terminal units shall be SMACNA's seal class B.
- D. Approved Manufacturer's
 - a. Ductmate PROseal
 - b. United McGill AirFlow Corp. Uni-Mastic
 - c. Duro-Dyne DSW

2.7 TURNING VANES

- A. Double vane, runner Type 2, 2-inch vane radius, 2 1/8-inch vane spacing and minimum 26 GA. where indicated on the drawings or specified herein.
 - a. For widths over 60-inches, install vanes in 2 or more sections or use tie rods to limit the unbraced vane length.
- B. Rectangular mitered elbows shall have double thickness turning vanes for elbows from 60 degrees through 90 degrees.
- C. Acceptable Manufacturers a. Titus

- b. Aero-Dyne
- c. Airsan

2.8 ACCESS DOORS

- A. Provide access doors at fire, smoke, or duct mounted damper locations and where indicated on the Drawings.
- B. Access doors shall permit easy visual inspection of fire and/or smoke dampers.
- C. Provide door handles and gasket seals on all doors.
- D. Acceptable Manufacturers
 - a. United McGill AirFlow Corp.
 - b. Air Balance Inc./American Warming & Ventilating Co.
 - c. PCI Industries/Pottorff
 - d. Ruskin

2.9 DAMPERS

- A. Manual Volume Dampers (Round)
 - 1. Provide manual volume dampers at <u>all runouts</u> and where indicated on the drawings.
 - 2. Factory built and assembled, butterfly type dampers with circular blade mounted to shaft and self-lubricating nylon or stainless steel sleeve. Minimum 14 GA galv. steel frame, 16 GA galv. Steel blade and ½-inch diameter shaft.
 - Acceptable Manufacturers

 Greenheck Model MBDR-50 ROUND or approved equal.
- B. Manual Volume Dampers (Rectangular)
 - 1. Provide manual volume dampers at <u>all runouts</u> and where indicated on the drawings.
 - 2. Factory built and assembled damper with a single rectangular blade mounted to a shaft and self-lubricating nylon or stainless steel sleeve. Minimum 22 GA galv. steel frame, 20 GA galv. Steel blade and ½-inch diameter shaft.
 - 3. Acceptable Manufacturers
 - a. Greenheck Model MBD-10 or approved equal.
- C. Backdraft Dampers
 - 1. Aluminum, counterbalanced, gravity operated
 - 2. Acceptable Manufacturers
 - a. Ruskin Manufacturing Co.
 - b. Air Balance, Inc
 - c. PCI Industries/Pottorff

3.0 EXECUTION

3.1 INSTALLATION OF DUCTWORK

- A. Ductwork shown on drawings shall be considered as diagrammatic and may not be shown in its actual location for clarity. The drawings are not intended to indicate <u>all</u> offsets or transitions as required for actual installation. Ductwork sizes indicated are inside dimensions. Where dimensions are altered to avoid interferences, conflicts or clearance difficulties, the revised size shall provide the same air handling characteristics and be noted on the final As-Built drawings.
- B. Install ductwork in accordance with SMACNA recommendations. Support directly from structure.
- C. Coordinate duct locations with all affected Contractors before beginning installation.
- D. Conceal ductwork in finished spaces unless indicated otherwise.
- E. Install test holes in locations required for air balancing.
- F. All joints and seems shall be sealed with tape or mastic.

3.2 INSTALLATION OF FIRE AND SMOKE DAMPERS

- A. Install in accordance with Manufacturer's instructions.
- B. Seal smoke, fire and combination fire-smoke dampers at wall or floor opening and between damper and sleeve or duct around one side of damper's downstream face.

3.3 INSPECTION

A. Inspect and test ductwork before insulation is applied. Repair or replace damaged duct materials. Seal visible holes. Do not rely on insulation to seal holes.

END OF SECTION

SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

1.0 GENERAL

1.1 WORK INCLUDES

- A. Electrical Contractor:
 - 1. Provide all materials, labor, tools, transportation, incidentals, and appurtenances to complete all items of work shown on the Drawings and described herein.

1.2 SUBMITTALS

A. Product/Catalog Data

- 1. Submit Manufacturer's catalog data for each manufactured item.
 - a. Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
 - b. Include name, address, and phone number of each supplier.
- B. Operations and Maintenance Manuals
 - 1. Provide three (3) sets of manufacturers printed information in three (3) ring binders containing information on installation, operation, and maintenance for each piece of equipment supplied.
 - a. The information shall list any maintenance requirements and time duration between required maintenance.
 - b. The information shall show all parts and part numbers of available replacement parts for each piece of equipment.
 - c. A cross-index of material and equipment shall be furnished containing:
 - 1.) An alphabetical listing of material and equipment including manufacturer's name, address and contact person of the local sales representative.
 - 2). An alphabetical listing of all subcontractors including name, address, contact person, and specific work performed.

1.3 QUALITY ASSURANCE

- A. Complete installation shall conform with all applicable Federal and State Codes including, but not limited to the latest approved editions of the following:
 - 1. State Building Codes.
 - 2. Code of Federal Regulations (CFR)
 - 3. National Electrical Code (NFPA-70)
 - 4. Life Safety Code, NFPA-101.
 - 5. Occupational Safety and Health Act (OSHA) of 1971 and all amendments thereto.
 - 6. Illinois Department of Public Health (IDPH)
- B. Nothing contained in the drawings and specifications shall be construed to conflict with these laws and codes and they are hereby included in these specifications.

1.4 COORDINATION

A. Coordinate clearances about all electrical equipment with existing conditions, building structure and other trades to ensure all manufacturers required clearances are met. Reroute and/or relocate all conduit, etc. as necessary to accommodate equipment clearances. It shall be the Contractor's responsibility to ensure that all manufacturers' required clearances are met.

1.5 OWNER'S INSTRUCTIONS/TRAINING

- A. Contractor shall train Owner's representatives in operation and maintenance of all electrical equipment and systems.
- B. Provide this training to a minimum of three (3) persons.
- C. Provide training above in 2-different 4-hour sessions, each on a different day as part of the contract.
- D. Training sessions shall be individualized in nature and specific for this project. Generalized "group" sessions involving multiple building operators from non related facilities will be specifically prohibited.

2.0 PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. All equipment and materials furnished and installed by Contractor shall be new. The equipment to be furnished and installed shall be standard cataloged products of manufacturers regularly engaged in the production of electrical equipment and shall be of the latest design. Equipment of the same general type shall be of the same make throughout the project.
- B. The Contractor shall be responsible for the physical fit and configuration of the equipment to suit the space available and the intent of the Work. Due consideration shall be included for external connections and service maintenance access of the Project Documents.
- C. The Contractor shall verify in the course of preparing the submittals that the respective material and equipment comply with the criteria set forth in the Project Documents.

3.0 EXECUTION

3.1 GENERAL

- A. Contractor must read the entire Specifications covering other branches of Work. Contractor is responsible for coordination of his work with work performed by other trades.
- B. Consult all Contract Documents which may affect the location of any equipment or apparatus furnished under this Work and make minor adjustments in location as necessary to secure coordination.
- C. System layout is schematic and exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be

arbitrarily changed. The equipment layout is to fit into the building as constructed and to coordinate with equipment included under other Divisions of Work.

- D. Contractor shall contact the A/E immediately if he notices any discrepancies or omissions in the Contract Documents, or if there are any questions regarding the meaning or intent thereof.
- E. Submit all changes, other than minor adjustments to the A/E for approval before proceeding with the work.
- F. All workmanship to be of the highest quality in accordance with the best practices of the trade by craftsmen skilled in this particular work.

3.2 DRAWINGS

- A. Drawings are schematic and show approximate locations of electrical equipment. Exact location should be coordinated by the Contractor and verified in field prior to rough-in.
- B. Significant deviations from drawings must be approved by the A/E.
- C. A/E reserves the right to make minor changes in the location of outlets and equipment, up to the time of rough-in, without additional cost.

3.3 PROTECTION AND CLEANING

- A. Protect all fixtures against damage from leaks or abuse and pay the cost of repair or replacement of fixtures or equipment made necessary by failure to provide suitable safeguards or protection.
- B. After all fixtures have been set, thoroughly clean all fixtures with manufacturers recommended cleaning agents, removing stickers and other foreign matter and leave every part in acceptable condition, clean and ready for use. Install all new lamps and check for satisfactory operation.
- C. Repair all dents and scratches in factory prime or finish coats on all electrical equipment. If damage is excessive, replacement may be required.

3.4 CUTTING AND PATCHING

A. The Contractor shall be responsible for all required digging, cutting, etc., incident to his work and shall make all required repairs thereafter to the satisfaction of the A/E, but in no case shall the Contractor cut into any major structural element, beam or column without the written approval the A/E. The Contractor or trade requiring the opening shall be responsible for verifying the existence of any concealed utilities or services within the surface and shall pay all costs of repairing or replacing any such surfaces or utilities which are damaged.

3.5 PENETRATIONS

- A. Sleeves shall be installed in all walls and floors where conduits or raceways are to pass through. Use heavy wall steel pipe sleeves, anchored to building construction and finished plumb with wall, ceiling, or floor lines. Sealing assembly shall be UL listed.
- B. Seal all penetrations thru fire-rated construction (i.e. walls, floors, ceilings, etc.) in accordance with NEC. Fill void space around raceway.

3.6 TESTING AND ADJUSTING

- A. The Contractor shall, at the conclusion of the project, performance test and adjust all of the electrical systems to verify the performance of all systems and subsystems installed and in all areas of the building.
- B. All power systems, communication systems, control systems and other related devices and subsystems shall be operated by the Contractor for a period of no less than seventy-two (72) hours and shall be systematically tested for proper sequencing, control, connection, phasing, rotation and calibration.

END OF SECTION

SECTION 26 05 19 - WIRE, CABLE & CONNECTORS

1.0 GENERAL

1.1 WORK INCLUDES

- A. Electrical Contractor:
 - 1. Provide all necessary wire and cable of the sizes and types shown on the plans or specified herein for:
 - a. General power distribution and branch circuit system
 - b. Lighting systems
 - c. Control systems

1.2 QUALITY ASSURANCE

- A. Installation shall comply with NFPA 70 National Electric Code (NEC).
- B. Insulation types, ratings and usage shall be in accordance with National Electrical Code requirements.
- C. Wire and cable shall be constructed in accordance with ICEA, NFPA, NEMA and IEEE published standards and shall be UL listed.

1.3 SUBMITTALS

A. No submittals required when using specified materials.

2.0 PRODUCTS

- 2.1 LOW VOLTAGE WIRE AND CABLE (600V OR LESS)
 - A. General
 - 1. All conductors shall be 98% conductivity copper.
 - 2. Unless otherwise noted, minimum wire size for lighting and power branch circuits shall be No. 12 AWG. For control and auxiliary systems the minimum size shall be No. 14 AWG.
 - 3. Conductors for emergency power and exit wiring shall be minimum #12 AWG.
 - 4. Insulation on power and control systems wiring 480 volts and below shall be 600 volt rated, type XHHW, THWN or THHN. Insulation of conductors for other systems shall be 600 volt unless otherwise noted.
 - 5. Type XHHW or THWN insulation must be used for all conductors installed in wet locations. This includes all outdoor feeders and branch circuits, underground conduit runs and conduits run in slab on grade.
 - 6. Conductors size 8 AWG and larger shall be Class B stranded. Conductors size 10 AWG and smaller may be solid or stranded. Conductors size 14 AWG for control and auxiliary systems shall be stranded.
 - B. Acceptable Manufacturers: Cable and wire shall be a standard type as manufactured by:
 - 1. General Cable Company

- 2. Carol
- 3. Anaconda
- 4. Roma
- 5. ITT Royal
- 6. Beldon Wire and Cable

2.3 CONNECTIONS AND SPLICES

- A. 600V and Less
 - 1. All components used at wiring terminations, connections and splices shall be UL listed.
 - 2. Connectors for joints #10 AWG and smaller sizes to be made with spring connectors insulated with vinyl skirt and live spring. Prior to installation, wires shall be properly twisted together.
 - 3. Connectors for #8 AWG (copper) and up to #2/0 sizes to be high-pressure type mechanical crimp connectors applied to a cleaned wire surface. Insulate splices with electrical insulating putty and tape to cover with four layers, half lapped.
 - 4. Connections for #3/0 (copper) and larger shall be Cadwelded. Insulate splices using electrical insulating putty and tape to cover with four layers, half lapped.
- B. Acceptable Manufacturers
 - 1. Thomas and Betts
 - 2. 3M
 - 3. Buchanan
 - 4. Ideal

3.0 EXECUTION

- 3.1 INSTALLATION
 - A. General
 - 1. A separate neutral, sized in accordance with the National Electrical Code shall be installed for each feeder or branch circuit.
 - 2. Install vinyl markers to identify branch circuits where they enter panel boards, pull boxes, junction boxes and device boxes.
 - 3. Color coding shall occur at all conductor termination points and in all junction boxes and pullboxes. Identification may be by colored insulation or colored electrical tape at the Contractor's option (See Section 16075 Electrical Identification).
 - B. Power and Branch Circuits
 - 1. Conductor sizes as shown on the Drawings and specified herein are minimum and shall be increased as required to maintain a minimum voltage drop of 3% for any branch circuit and 5% at any point in the system. Conductor size shall be increased as required by NEC where more conductors are installed in a common raceway than indicated on the Drawings.

- 2. Conductors shall be color coded for their entire length in accordance with NEC; all wiring shall be color coded using the same color for each conductor within a system.
- 3. Wire size shall be #12 AWG minimum for branch circuit wiring.
- 4. Minimum size conductors for 120/208V or 277/480V shall be #12 AWG. Increase conductors at least one (1) size for home run feeders over 75 feet long or if furthest outlet is greater than 125 feet from feeder panel.
- C. Control Systems
 - 1. Control and systems wiring shall be terminated using forked tongue terminals.
 - 2. Terminal strip connectors shall be ratchet-tooled in accordance with manufacturer's recommendations. Plier type crip is not acceptable.
- D. Provide self adhesive tape minimum 3-inch wide band on larger size conductors for color codes. Tape color shall be per conductor color codes. Tape shall be provided at all terminations in switchgear, panelboards, pull boxes, motor controllers, disconnect and starters.
- F. All fasteners and lugs used for electrical connections shall be torqued to values indicated by manufacturer's instructions. Use particular care to equalize lug torques where parallel conductor feeders are used. Use approved lugs when copper conductor is to be connected to aluminum bus.
- 3.2 TESTING
 - A. Upon completion of cable and wire installation, but before termination to equipment, test each wire for grounds and short circuits. Replace or correct defective wiring.

END OF SECTION

SECTION 26 05 33 - CONDUIT, BOXES AND RACEWAYS

1.0 GENERAL

1.1 WORK INCLUDES

- A. Electrical Contractor:
 - 1. Furnish and install complete conduit and raceway systems as required for power, lighting, control, communications, fire and safety systems as shown in the Drawings and specified herein.
 - 2. Furnish and install all outlet, junction and pull boxes as indicated on the Drawings and as necessary to install the required conduit and wiring in a neat and workmanlike manner, as specified herein.

1.2 QUALITY ASSURANCE

- A. Pull boxes and junction boxes shall be in accordance with NEC requirements and shall be listed by a Nationally Recognized Testing Laboratory.
- B. Raceways shall meet NEMA standards and shall be listed and labeled by a Nationally Recognized Testing Laboratory.

2.0 PRODUCTS

2.1 CONDUIT

- A. Thin wall conduit (EMT) shall be installed for all work except where noted otherwise.
 - 1. EMT, couplings, and fittings shall have a circular cross section of sufficient diameter to meet all State Codes. The wall thickness shall be uniform throughout with the interior surface free of defects. Welding of seams shall be continuous.
- B. Rigid galvanized steel conduits shall be used outdoors and in all mechanical rooms where not supported directly to walls or ceilings.
 - 1. Rigid conduit shall be heavy wall, threaded, hot dipped galvanized steel. Each section of conduit furnished shall be free from blisters and other surface defects. Galvanizing shall not crack or flake when conduit is bent.
- C. PVC conduits shall be installed underground or in concrete slabs. Rigid galvanized elbows shall be used for all stub-ups through or out of concrete slabs.
 - 1. PVC conduit shall be extra heavy wall, Schedule 80. Conduit shall be suitable for use with 90 degree C insulated wire. Conduit, fittings, and cement shall be of the same manufacturer.
- D. Jacketed flexible steel conduit (Sealtite) shall be used in wet areas where flexible conduit connections are required and on all motorized equipment and motors.
 - 1. Flexible steel conduit shall be made from a continuous length of galvanized cold rolled steel strip, spirally wound. Adjacent strips shall have locked typed construction with all the edges turned in.

- E. Liquid-tight flexible steel conduit shall consist of a steel core of the same construction as specified for flexible steel conduits, with an extruded PVC jacket.
- F. Minimum conduit size shall be ³/₄-inch for all home runs. Runouts serving a single electrical device may be ¹/₂-inch.
- G. All conduit shall be listed by a Nationally Recognized Testing Laboratory.
- H. Acceptable Manufacturer's
 - 1. Pittsburgh Steel
 - 2. Allied
 - 3. Republic Steel
 - 4. National Electric
 - 5. Keystone
 - 6. Jones and Laughlin
 - 7. Carlon

2.2 FITTINGS

- A. All fittings shall be UL Listed, insulated-throat type.
- B. Couplings and connectors for thin wall conduit shall be all steel type. No die cast connectors will be allowed.
- C. Expansion and deflection fittings shall be of a type suitable for the particular condition and shall be complete with bonding jumper.
- D. Acceptable Manufacturer's
 - 1. Thomas and Betts (T&B)
 - 2. O-Z Gedney
 - 3. Appleton
 - 4. Raco

2.3 BOXES

- A. Flush outlet and switch boxes shall be made of code gauge galvanized steel, minimum 3-1/2" depth, unless otherwise specified or shown on the Drawings. Box sizes shall be selected as required to comply with the NEC.
- B. Junction and pull boxes shall be made of code gauge galvanized steel, minimum 4" square and 1-1/2" deep, with removable cover plates fastened with screws or hinged doors as indicated or required. Box sizes shall be increased as required to comply with the NEC.
- C. Boxes for exposed work in finished areas shall be Type FS/FD with threaded hubs and rigid conduit risers.
- D. Steel boxes cast in concrete or installed in masonry construction shall be specifically designed for concrete installation.
- E. Boxes used outdoors shall be weatherproof.
- F. Acceptable Manufacturer's

- 1. Appleton
- 2. Raco
- 3. Killark
- 4. Hoffman
- 5. Thomas and Betts/Steel City
- 6. Square D
- 7. O.Z./Gedney

3.0 EXECUTION

- 3.1 CONDUIT
 - A. In finished areas, conduit must be concealed above accessible ceilings, within the building structure, or within chases. Exposed conduits to be run tight to wall or ceiling and installed in a neat workmanlike manner, ready for painting.
 - B. All conduit shall be supported by suitable clamps or hangers attached to the elements of the building structure at the required spacing to provide rigid installation. In no case shall conduit be attached to or supported from adjoining ductwork or pipe, ceiling systems, or installed in such manner as to prevent the ready removal of other pipe for repairs.
 - C. Install conduit parallel or perpendicular to building lines (except where run in or below floor slabs). Keep conduit runs as close to underside of structure as possible.
 - D. No more than the equivalent of four (4) 90 degree bends will be allowed in any one conduit run. Where more bends are necessary in any single run, a pull box shall be installed. Pull boxes shall also be installed in long runs at a maximum separation of 100'-0".
 - E. Exercise necessary precautions to prevent accumulation of water, dirt, or concrete in conduits during execution of electrical work. Conduit in which water or foreign material has been permitted to accumulate shall be thoroughly cleaned, or replaced where such accumulations cannot be removed.
 - F. Do not run conduit in slabs under boilers, hot water heaters or other heat-producing equipment and maintain minimum 6" clearance from hot water piping.
 - G. Install a 240 lb. tensile strength poly pull line or a #12 THHN or THWN pull wire in all empty conduits.
 - H. Install expansion fittings at all locations where conduits cross building expansion joints.
 - I. Secure rigid conduit at cabinets and boxes using insulated throat type grounding and bonding bushings. Locknuts shall be tightened to cut through painted surfaces.
 - J. Where a number of conduits are to be run exposed and parallel, one with another, they shall be grouped and supported by trapeze hangers or unistrut racks tight to the building structure. Hanger rods shall be fastened to concrete ceiling slab with threaded rod in steel expansion bolt type inserts. Trapeze hangers shall be Unistrut, angle iron or channel iron. Each conduit shall be clamped to the trapeze hanger with conduit clamps.
 - K. Metallic conduit systems shall be grounded in accordance with the NEC, and as shown on the Drawings. Metallic conduit systems shall be metallically joined together into a

continuous electrical conductor and shall be so connected to all boxes, fittings, and cabinets to provide effective electrical continuity.

- L. Threaded couplings shall be used for joints on rigid metallic conduit. Field joints shall be cut square, reamed smooth to remove burrs and sharp and rough edges, and properly threaded to receive couplings. The use of running threads is not permitted.
- M. Conduit systems shall be supported at each elbow and the end of every straight run terminating in a box or cabinet. Fastening shall be provided at maximum spacing of 7 ft. for horizontal runs and 8 ft. for vertical runs, unless codes require more stringent supporting. Conduit shall not be fastened to other pipe or installed to prevent ready removal of other pipe for repairs. The use of perforated strap hangers is not permitted.
- N. Conduit to be buried shall be installed a minimum of 24 in. below finished grade.
- O. Where telephone/data outlet locations are indicated on the Drawings, install 1" EMT from telephone outlet box and 1" conduit from data outlet box (4" x 4" x 1-1/2" or 4" x 2" x 1-1/2") to top of finished wall or a point above accessible ceiling.

3.2 BOXES

- A. Support all boxes independently of conduit except for cast boxes connected to two (2) rigid conduits both supported within 12-inches of box.
- B. Provide knockout closures of the correct size to cap unused knockout holes where blanks have been removed.
- C. Outlet Boxes
 - 1. Flush mount outlet boxes in areas other than mechanical rooms, electrical rooms and above removable ceilings.
 - 2. Provide at least 6-inch separation between outlet boxes. Do not install boxes back to back in same wall unless specifically noted on the plans. If specifically noted on the plans, install 2 pieces of 5/8" drywall between the boxes to maintain both fire rating and soundproofing of wall.
 - 3. Use multiple gang boxes where possible when more than one device is mounted together. Provide barriers to separate different voltage systems.
 - 4. Provide weatherproof cast boxes for exterior and wet locations.
- D. Junction and Pull Boxes
 - a. Mount junction and pull boxes securely to building structure in a location that meets the requirements of the National Electrical Code for accessibility and work space clearance. Coordinate exact locations of work with other trades.
 - b. Support independent of conduit
 - c. Locate pull or junction boxes to limit conduit runs to no more than 100 linear feet or four (4) 90 degree bends between pulling points.
- E. Provide covers for all boxes.

3.3 MOTOR CONNECTIONS

A. The final 18 in. of connections to motors shall be made in liquid-tight flexible steel conduit.

SECTION 26 27 26 - WIRING DEVICES

1.0 GENERAL

1.1 WORK INCLUDES

- A. Electrical Contractor
 - 1. Furnish and install wiring devices, complete with cover plates, as shown on the Drawings and specified herein.
 - 2. Provide receptacle ampacity and electrode configuration to accommodate equipment to be served.
- 1.2 QUALITY ASSURANCE
 - A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
 - B. Wiring Devices shall be listed and labeled by a Nationally Recognized Testing Laboratory.
 - C. Wiring Devices shall be in accordance with NEC, NFPA, and NEMA standards.

1.3 SUBMITTALS

- A. Submit product literature for the following:
 - 1. Receptacles
 - 2. Switches
- B. Provide color selection information for receptacles, switches and cover plates. A/E will select color.

2.0 PRODUCTS

- 2.1 GENERAL
 - A. Grounding type devices shall meet all requirements set forth by the NEC and/or State Codes.
 - B. Unless noted otherwise, all wiring devices shall be specification grade.
 - C. Colors for receptacles, switches and cover plates shall be selected by the A/E.
- 2.2 RECEPTACLES
 - A. General
 - 1. Unless otherwise noted, receptacles shall be white in color, duplex, polarized, 3wire, grounding type with bronze contacts, rated for 20 Amp at 120 VAC, with parallel slots and two ground terminals. Receptacles shall have screw terminals arranged for back or side wiring.
 - 2. Weatherproof receptacles shall weatherproof while in use type.

- 3. Special purpose receptacles shall be of the capacity and design indicated on the Drawings.
- B. General Purpose Receptacles
 - 1. General-purpose receptacles for all wall type convenience outlets in non-hazardous locations shall be 20 Amp, 120V, 3-wire, grounding type, NEMA 5-20R, back and side wire compatible, heavy-duty industrial specification grade.
 - 2. Acceptable Manufacturers
 - a. Leviton 5362-A
 - b. Hubbell HBL5362
 - c. Pass & Seymour 5362-A
- C. GFCI Receptacles
 - 1. Duplex receptacles with ground fault circuit interrupters (GFCI) shall comply with UL Class A GFCI testing in accordance with UL Standard No. 943. Receptacles shall be 20 Amp with NEMA 5-20R receptacle configuration. Receptacle shall be back and side wire compatible, feed-thru type.
 - 2. Acceptable Manufacturers
 - a. Leviton 6899
 - b. Hubbell GF5362
 - c. Pass & Seymour 2091-S

2.3 SWITCHES

- A. General Purpose Toggle Switches: Switches for use in non-hazardous locations shall be white in color (unless otherwise noted), furnished with screw terminals for looped or back wiring and be of the quiet, toggle type. Switches shall be industrial specification grade, rated for 20 Amp at 120/277 VAC.
 - 1. Single Pole
 - a. Leviton 1221-2
 - b. Hubbell HBL1221
 - c. Pass & Seymour 20AC1
 - 2. Two Pole
 - a. Leviton 1222-2
 - b. Hubbell HBL1222
 - c. Pass & Seymour 20AC2
 - 3. 3-way
 - a. Leviton 1223-2
 - b. Hubbell HBL1223
 - c. Pass & Seymour 20AC3
 - 4. 4-way
 - a. Leviton 1224-2
 - b. Hubbell HBL1224
 - c. Pass & Seymour 20AC4

2.4 COVER PLATES

- A. Indoors: Cover plates shall be high-strength, scratch-resistant, smooth nylon, white in color (unless otherwise noted).
- B. Outdoors:
 - 1. Dry Locations: Cover plates shall be stainless steel or die cast aluminum. Plates of non-ferrous metal shall be not less than 0.04 in. thick; those of ferrous metal shall be not less than 0.03 in. thick
 - 2. Wet Locations: Cover plates shall be die cast aluminum or impact resistant thermoplastic construction and rated weatherproof while-in-use.
- C. Acceptable Manufacturer's
 - 1. Leviton
 - 2. Hubbell
 - 3. Pass & Seymour

3.0 EXECUTION

3.1 GENERAL INSTALLATION

- A. Boxes and devices shall be mounted vertically and securely fastened.
- B. Mount switches in multi-gang boxes wherever several devices are grouped together.
- C. Where more than one switch is shown at a location, switches shall be installed under a gang plate
- D. Unless otherwise noted on the drawings, all toggle switches shall be installed 46-inches above finished floor level and all general purpose receptacles shall be 18-inches above finished floor level. All dimensions refer to the centerline of the box.
- E. Boxes and devices located in a brick veneer wall shall be mounted horizontally in the brick course.
- F. All receptacles shall be installed with the grounding electrode terminal in the top or up position.

END 262726

SECTION 26 51 00 – LIGHTING FIXTURES

1. GENERAL

1.1 WORK INCLUDES

- A. Electrical Contractor
 - 1. Furnish and install lighting fixtures complete with lamps in accordance with the lighting fixture schedule shown on the Drawings and described herein.
 - 2. Units shall be complete with suspension accessories, canopies, sockets, louvers, frames, and rough-in boxes, wired and assembled for a complete working system.

1.2 REGULATORY REQUIREMENTS

- A. All fixtures and accessories shall be listed by a Nationally Recognized Testing Laboratory (NTSL).
- B. All fixtures shall be in accordance with NEC.

1.3 SUBMITTALS

A. Provide manufacturer's product information for all Luminaries.

1.4 WARRANTY

A. In addition to standard one (1) year warranty on all labor and materials, provide a five (5) year warranty on electronic ballasts for all fluorescent lighting fixtures.

2. PRODUCTS

2.1 GENERAL

- A. All fixtures shall come pre-assembled and complete with all sockets (incandescent to be spring supported), lamp ends, ballasts, transformers, fixture ends, trim rings, plates and low density mounting kits (as required) for a complete installation.
- B. Electrical Contractor shall be responsible for reviewing all mounting arrangements prior to ordering any products. Electrical Contractor shall be responsible for ordering all of the proper fixtures, mounting hardware and misc. for a complete project.
- C. All recessed fixtures shall fit tight to ceiling to eliminate all light leaks.
- D. Trim kits, when not secured internally to fixture, shall be secured to structure at a minimum of two points.
- E. Incandescent and high intensity discharge recessed lighting fixtures are to be furnished with thermal cut outs as required by the NEC.

2.2 FIXTURES

- A. As noted on the Drawings
- B. Equal manufacturers shall include the following
 - 1. Acuity Brands
 - 2. HE Williams
 - 3. Day-Brite
 - 4. Cooper Lighting
- C. Equal products will be evaluated during the shop drawing process and may need to be revised as necessary based on engineering review. If the contractor is not sure a lighting product or package is equal, they should bid the specified light fixtures and offer the alternate package as a voluntary deductive alternate.

3. EXECUTION

3.1 INSTALLATION

- A. Use steel wire hangers fastened to the building structure to support recessed fixtures at diagonal corners (Two corners suspended). Fixtures are to fit tight against construction to eliminate light leaks. Recessed downlights are to be provided with adjustable mounting bars/frames for drywall or lay-in ceilings as required. Fixtures supported by the lay-in ceiling grid are not acceptable.
- B. Wall-mounted fixtures shall be mounted plumb with building lines and installed with proper box and cover hardware.
- C. Install all surface mounted or suspended lighting fixtures such that the weight of the fixture is supported, either directly or indirectly, by a sound and safe structural member of the building, using adequate number and type of fastenings to assure safe installation. Screwed fastenings, and toggle bolts through ceiling material or wall paneling, are not acceptable. Mount suspended fixtures at 8'-0" to bottom of fixture above finished floor unless otherwise noted on the Drawings.
- E. Wire fixtures with fixture wiring of at least 50°C rating. Where fixtures are mounted in continuous rows, provide conductors in wiring channels of the same size as the circuit wires supplying the row of fixtures.
- F. Fixtures in mechanical rooms shall be located to clear piping, ductwork, valves and other equipment.
- G. At completion of installation and before turning over to Owner, clean and remove all dirt and smudges from all lighting fixtures including lenses, louvers and reflectors.

END OF SECTION