

SECTION 15050
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 PROVISIONS INCLUDED

- A. The Drawings and general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 General Requirements, apply to work specified in this Section.

1.02 SUMMARY

- A. Work Included: This Section specifies the following basic mechanical materials and methods to complement other Division 15 Sections.
 - 1. Submittals.
 - 2. Coordination drawings.
 - 3. Record drawings.
 - 4. Maintenance manuals.
 - 5. Cutting and patching.
 - 6. Field-fabricated equipment supports.
 - 7. Installation requirements common to equipment specification Sections.
 - 8. Nonshrink grout for equipment installations.
 - 9. Piping materials and installation instructions common to most piping systems.
 - 10. Piping specialties.
 - 11. Touchup painting and finishing.
- B. Give necessary notices, obtain permits, pay governmental taxes, fees and other costs as required for the mechanical work, and to file for necessary approvals with the jurisdiction under which the work is to be performed. Obtain Certificate of Inspection for the mechanical work; this certificate is a prerequisite to final acceptance of and final payment for the mechanical work.
- C. Provide piping and ductwork connections to equipment provided by the owner and under other Sections of the specifications including rough-in and final connections to equipment to result in a complete system, fully operational.
- D. Furnish only, for installation under another section:
 - 1. Access doors in finished walls, ceilings and floors, in accordance with Section 08305 specifications.
- E. Related Work Specified in Other Sections:
 - 1. Firestopping of penetrations: Section 07840.
 - 2. Specification for access doors furnished under this section: Section 08310.
 - 3. Installation of access doors, by trade installing the surrounding wall construction: Various sections.

1.03 REFERENCED CODES AND INDUSTRY STANDARDS

- A. Provide materials, equipment and execute the work, including test and inspections, per applicable provisions of Federal, State and Local government laws and ordinances, Utility Company Regulations, latest editions and referenced codes and standards. Governing laws, ordinances, codes and standards constitute minimum requirements.
- B. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements shall govern.

1.04 DEFINITIONS

- A. Wherever the term “mechanical” as in mechanical contractor or mechanical work is used in the specification, it will mean, as appropriate, HVAC, plumbing or fire protection contractor or work.
- B. Wherever the term “shown” is used in the specifications, it shall mean “noted”, “indicated”, “scheduled”, “detailed”, or any other diagrammatic or written reference made on the drawings.
- C. Wherever the term “material” is used in the specifications it will mean any “product”, “equipment”, “device”, “assembly”, or “item” required under the Contract, as indicated by trade or brand name, manufacturer’s name, standard specification reference or other description.
- D. “Concealed” means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction or in crawl spaces. For exterior installations concealed means concealed from view and also protected from weather conditions
- E. “Exposed” means not installed underground or “concealed” as defined above. For exterior installations, exposed means exposed to view or exposed to weather; roof-top equipment is “exposed” even if it is not visible from the ground.
- F. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- G. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

1.05 LIST OF SUBMITTALS; SUBSTITUTIONS

- A. Concurrent with the submittal schedule, required by Section 01330 "Submittals" submit a list identifying the manufacturers from which the Contractor intends to procure all equipment under Division 15.
- B. If the Contractor intends to furnish a product from a manufacturer other than the ones specifically named in this Division 15, then the Contractor shall submit a request for substitution, in accordance with provisions of Section 01600, and this request shall be submitted concurrent with submittal of the list of proposed manufacturers.

- C. The Architect will review proposed substitutions and either accept or reject the proposed manufacturer. If the Architect rejects the proposed substitution, resubmit conforming product within 15 days.
- D. No shop drawings will be reviewed until the list of proposed manufacturers has been approved in its entirety, including substitutions, by the Architect.

1.06 SUBMITTALS

- A. Items to be Submitted: Specific items to be submitted are specified in other Division 15 Sections. Definitions and type of information required for each type of submittal are specified below. When required, include the following information, as a minimum, with each submittal:
 - 1. Make and Model Number: Submit the manufacturer's name, the trade name and the complete model number for the listed product or device. Also, indicate the applicable catalog number and date of publication wherein the product or device is fully described.
 - 2. Shop drawings: Prepare shop drawings to accurate scale except where diagrammatic representations are specifically requested. Show clearance dimensions of critical locations and show dimensions of spaces required for operation and maintenance of equipment. Show piping and ductwork connections and other service connections and show interfaces with other work including structural support. Indicate portions of mechanical work shown on the shop drawings which deviates from requirements indicated in contract documents and explain reasons for the deviations. Show how such deviations coordinate with other portions of the work and with data currently or previously submitted.
 - 3. Samples: Submit samples specified in the individual Division 15 sections. Architect's review of requested samples will not include testing or rigorous inspection except of those samples which are specifically requested for that purpose.
 - 4. Product Data: Submit samples specified in the individual Division 15 sections. In addition, where operating ranges are shown, mark data to show portion of range required for project application. Expansion or elaboration of standard data to describe non-standard product must be processed as a shop drawing submittal. For each product, include manufacturer's production specifications, installation or fabrication instructions, nearest source of supply (including telephone number), piping, ductwork and service line connection sizes and locations, evidence of compliance with required standards and governing regulations (include manufacturer's signed statements if not covered in printed data), and similar information needed to represent compliance with requirements. Submitted data shall be original printed material, not photocopies or facsimile (Fax) copies.
 - 5. Certifications: When indicated, submit warranty which, in addition to execution by authorized officer of each guarantor, is attested to by Secretary of each guarantor and bears corporate seal. Submit draft of each warranty (for Owner's acceptance of text) prior to execution.

6. Test Reports: Submit test reports of the product or device which have been dated and signed by representatives of the testing agency performing test. Prepare test reports in manner consistent with standard or regulation governing test procedure (if any) as indicated. Test reports shall be clear, concise, complete and in typed tabular form.
 - a. Provide notarized executions on test reports. Include name of testing agency and name of individual performing or responsible for the testing.
7. Product Warranties: Submit only specified warranties. Where special project warranty is specified, submit warranty prepared specifically for this project and executed by an authorized officer of the warranting firm.
8. Operating Instructions: Submit type written operating instructions for each product or device and supplement with additional project application instructions where necessary. Prepare and submit specific operating instructions for each system which involves multiple items of equipment, including instructions for charging, start-up, control or sequence of operation, phase or seasonal variations, shut-down, safety and similar operational instructions. Include valve schedule, filter schedule and belt schedule.
9. Maintenance Manual: Prepare maintenance manuals in accordance with the requirements of Section 01770 "Contract Procedures And Submittals". In addition to the requirements specified in Division 1, include the following information for equipment items:
 - a. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - b. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 - c. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - d. Servicing instructions and lubrication charts and schedules.
 - e. Automatic temperature controls as-built shop drawings and start-up, adjustment & testing reports.
 - f. Final Balancing reports.
 - g. Ductwork and piping test reports.
10. Maintenance Materials: Deliver required quantity of product or device to Owner's representative at location as directed, in containers or packages suitable for storage and fully identified.
11. Record Drawings: Prepare record documents in accordance with the requirements of Section 01770 "Contract Procedures And Submittals." In addition to the requirements specified in Division 1, indicate the following installed conditions:
 - a. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
 - b. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (such as traps, strainers, expansion compensators, or tanks). Valve location

- C. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
- D. Qualify welding processes and operators for structural steel according to AWS D1.1 “Structural Welding Code--Steel.”
- E. Qualify welding processes and operators for piping according to ASME “Boiler and Pressure Vessel Code,” Section IX, “Welding and Brazing Qualifications.”
 - 1. Comply with provisions of ASME B31 Series “Code for Pressure Piping.”
 - 2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.
- F. ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- G. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and start-up, adjustment & testing requirements. The Contractor is responsible for installation and service area requirements for substituted equipment. Areas of rooms or depths of ceiling plenums will not be increased to accommodate larger equipment.

1.08 WARRANTY

- A. Provide guarantees and warranties for work under this Contract as indicated in the General Requirements of the Contract.
- B. Provide manufacturers’ standard warranties and guarantees for work by the Mechanical Trades. However, such warranties and guarantees shall be in addition to and not in lieu of other liabilities which the manufacturer and Mechanical Contractor may have by law or by other provisions of the Contract Documents.
- C. Guarantee that all elements of the systems which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth in these specifications or as indicated on drawings.
- D. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Mechanical Subcontractor for his work.
- E. Furnish a written guarantee covering the above requirements before submitting the application for final payment.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Acceptance at the Site: Upon receipt, inspect mechanical equipment (including Owner furnished equipment) in accordance with manufacturers instructions.

1. Do not install equipment until all defects detected during inspection have been corrected.
- B. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- C. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.
- D. Protect flanges, fittings, and piping specialties from moisture and dirt.
- E. Furnish for installation by other trades:
 1. Access panels required for access to mechanical controls specified in this Division.
 2. Metal counterflashing for mechanical piping which penetrates the roof.
 3. Metal counterflashing for roof mounted mechanical equipment.

1.10 SEQUENCE AND SCHEDULING

- A. Coordinate mechanical work with work of other trades, so that all work will be completed without interruption. Make adjustments necessary to conform to structural and architectural conditions.
- B. Connections to Owner-Furnished Equipment: Coordinate location of all equipment with General Contractor. Install all equipment in strict accordance with manufacturers installation diagrams and methods of installation. If additional information is required, obtain from the Architect.
- C. Any changes in construction required for coordination, which deviate from the intent or requirements of the specifications and/or drawings, must be described and detailed in writing and submitted to the Architect for approval.
- D. Require trades providing equipment bases and pads, curbs, chases, pockets and openings to coordinate dimensions with actual dimensions of equipment furnished under this section. Furnish dimensions, templates, bolts, and anchors for support or attachment of mechanical work to other trades requiring them.
- E. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- F. Coordinate connection of electrical services.
- G. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Dielectric Waterway Fittings: Subject to compliance with requirements, provide products by one of the following:
 - 1. Victaulic Company of America
 - 2. Perfection Corp.
 - 3. Watts Regulator Co.
- B. Dielectric Unions: Subject to compliance with requirements, provide products by one of the following:
 - 1. Perfection Corp.
 - 2. Watts Regulator Co.
- C. Thredolets and Weldolets: Subject to compliance with requirements, provide products by one of the following:
 - 1. Bonney-Forge
 - 2. Allied Products Co.
- D. Mechanical Sleeve Seals: Subject to compliance with requirements, provide products by one of the following:
 - 1. Thunderline Corporation, "Link Seal"

2.02 PIPE AND PIPE FITTINGS

- A. Refer to individual piping system specification Sections for pipe and fitting materials.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

- A. Refer to individual piping system specification Sections in Division 15 for special joining materials not listed below.
- B. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3mm) maximum thickness, except where thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125 cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250 cast-iron and steel flanges.
 - 2. ASME B16.20 for grooved, ring-joint, steel flanges.
 - 3. AWWA C110, rubber, flat face, 1/8 inch (3 mm) thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.
- D. Solder Filler Metal: ASTM B 32.
 - 1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent).

2. Alloy E: Tin (approximately 94 percent), silver and copper.
- E. Welding Filler Metals: Comply with AWS D10.12, and ASME Boiler and Pressure Vessel Code, Section II, Part C for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
 - F. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon steel bolts and nuts.
 - G. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.
 1. Sleeve: ASTM A 126, Class B, gray iron.
 2. Followers: ASTM A 47 (ASTM A 47M), Grade 32510 or ASTM A 536 ductile iron.
 3. Gaskets: Rubber.
 4. Bolts and Nuts: AWWA C111.
 5. Finish: Enamel paint.

2.04 PIPING SPECIALTIES

- A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type where required to conceal protruding fittings and sleeves.
 1. Inside Diameter: Closely fit around pipe, tube, and insulation.
 2. Outside Diameter: Completely cover opening.
 3. Cast Brass: One piece with set-screw.
 - a. Finish: Polished chrome plate.
 4. Stamped Steel: One piece with set screw, and chrome-plated finish.
 5. Cast-Iron Floor Plate: One-piece casting.
- B. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.
 1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
 2. Insulating Material: Suitable for system fluid, pressure, and temperature.
 3. Dielectric Unions: Factory-fabricated, union assembly for 250-psig (1725kPa) minimum working pressure at a 180 deg F (82 deg C) temperature.
 4. Dielectric Flanges: Factory-fabricated, companion-flange assembly for 150- or 300-psig (1035kPa or 2070kPa) minimum pressure to suit system pressures.
 5. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035kPa or 2070kPa) minimum working pressure to suit system pressures.
 6. Dielectric Couplings: Galvanized-steel coupling, having inert and noncorrosive, thermoplastic lining, with threaded ends and 300-psig (2070kPa) minimum working pressure at 225 deg F (107 deg C) temperature.
 7. Dielectric Nipples: Electroplated steel nipple, having inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig (2070kPa) working pressure at 225 deg F (107 deg C) temperature.

- C. Mechanical Sleeve Seals: Modular, watertight mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.
- D. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
 - 1. Steel Sheet-Metal: 24-gage (0.70mm) or heavier galvanized sheet metal, round tube closed with welded longitudinal joint.
 - 2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
 - 3. Cast-Iron: Cast or fabricated wall pipe equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
 - 4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.
 - a. Penetrating Pipe Deflection: 5 percent without leakage.
 - b. Housing: Ductile-iron casting having waterstop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
 - c. Pipe Sleeve: AWWA C151, ductile-iron pipe.
 - d. Housing-to-Sleeve Gasket: Rubber or neoprene push-on type of manufacturer's design.
 - 5. Cast-Iron Sleeve Fittings: Commercially made sleeve having an integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set-screws.

2.05 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.50MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory-packaged.

2.06 ACCESS DOORS.

- A. Furnish doors complying with 08310.

PART 3 - EXECUTION

3.01 SUMMATION

- A. The installation is to be in full compliance with the contract documents and, as such, no additional approval by the Architect is required. The various suppliers are expected to submit information that represents equipment that is in full compliance; the various sub-contractors are expected to have checked the submitted information for full compliance prior to forwarding, where required, to the General Contractor; and the General Contractor is expected to have further checked the submitted information for full compliance prior to forwarding,

where required to the Architect.

1. Where submittals are required, they shall either be in full compliance or include a separate typewritten statement that clearly and concisely defines how the submittal varies from the contract documents.

3.02 EXAMINATION

- A. The Contract Drawings are diagrammatic only intending to show general runs and locations of piping, equipment, ductwork and specialties and not necessarily showing all required offsets, details and accessories and equipment to be connected. Install the work to fulfill the diagrammatic intent expressed on the Mechanical Drawings, but in conformity with the dimensions indicated on the final working drawings, field layouts, and shop drawings of all trades. Lay out work accurately in coordination with other Trades to avoid conflicts in placement of the piping, ductwork, pumps, equipment, and similar items, and to obtain a neat installation which will afford maximum accessibility for operation, maintenance and headroom. In case of conflict between sizes shown on plans, details or diagrams, allow for the largest size.
- B. Examine existing conditions and prior construction to determine that they are in proper condition to receive mechanical work prior to beginning installation. Do not permit mechanical work to proceed until conditions detrimental to the installation have been corrected.
- C. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.03 PIPING SYSTEMS--COMMON REQUIREMENTS

- A. Perform mechanical work in conjunction with all other work at the site. Coordinate with the Architect, General Contractor, all other Contractors and equipment suppliers working at the site. Proceed in a manner so as not to delay the progress of the project.
- B. Provide materials, equipment and workmanship to provide for adequate protection of mechanical equipment during the course of construction of the project. Include protection from moisture and all foreign matter. Be responsible for damage caused to the work of other Trades, and remedy such injury at no expense to the Owner.
- C. Coordinate the exact mounting arrangement and location of equipment indicated on the drawings, prior to Installation, to allow proper space requirements. Particular attention shall be given in the field to group installations. If it is questionable that there is sufficient space to avoid conflict with the work of other Contractors, architectural or structural obstructions and that will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, immediately notify the Architect and do not proceed with this part of the Contract work until definite instructions have been given by the Architect.
- D. Do not allow equipment or piping or ductwork to be installed or pass through elevator equipment rooms or hoist ways, electric rooms, electric closets, telephone or data closets, except as approved by the Architect.

- E. Arrange for chases, slots and openings in other building components during progress of construction, to allow for mechanical installations.
- F. Equipment Supports: Provide adequate supports wherever required, whether or not indicated. Fabricate supports from steel channels 1-5/8 inch minimum width, 0.105 inch minimum wall thickness. Use larger size or gauge if required to support weight. All supports shall be clean, rust free and prime painted.
- G. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- H. Where drawing details, plan and/or specification requirements are in conflict and where pipe or duct sizes of same pipe or duct run are shown to be different between plans and/or between plans and sections or details, provide the larger size. Provide systems and equipment called for in the specification and/or shown on the drawings as if these were required by both the drawings and specifications. However, bring such conflicts to the attention of the architect for direction prior to ordering or installing any portion of the work in question.
- I. Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 15 specify piping installation requirements unique to the piping system.
 - 1. Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
 - 2. Install piping at indicated slope.
 - 3. Install components having pressure rating equal to or greater than system operating pressure.
 - 4. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
 - 5. Install piping free of sags and bends.
 - 6. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
 - 7. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
 - 8. Install piping to allow application of insulation plus 1-inch (25mm) clearance around insulation.
 - 9. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
 - 10. Install fittings for changes in direction and branch connections.
 - 11. Install couplings according to manufacturer's printed instructions.
- J. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
 - 1. Chrome-Plated Piping: Cast-brass. Use split-casting escutcheons, where required, for existing piping only.
 - 2. Uninsulated Piping Wall Escutcheons: Cast-brass or stamped-steel.
 - 3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
 - 4. Insulated Piping: Cast-brass or stamped-steel.

5. Piping in Utility Areas: Cast-brass or stamped-steel.
- K. Install dielectric unions to join dissimilar metals.
- L. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs, and where indicated.
1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab to secure clamping ring where specified.
 2. Build sleeves into new walls and slabs as work progresses.
 3. Install large enough sleeves to provide 1/4-inch (6mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than 6 inches (150 mm).
 - b. Steel Sheet-Metal Sleeves: For pipes 6 inches (150 mm) and larger that penetrate gypsum-board partitions.
 - c. Cast-Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Flashing is specified in Division 7 Section "Flashing and Sheet Metal." Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.
 4. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants."
- M. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Sealing of pipe penetrations with firestopping sealant material in accordance with U.L. design is provided by Division 7, "Firestopping".
- N. Verify final equipment locations for roughing in.
- O. Refer to equipment specifications in other Sections for roughing-in requirements.
- P. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
 4. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
 - a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.

- b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
5. Welded Joints: Construct joints according to AWS D10.12 "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe" using qualified processes and welding operators according to the "Quality Assurance" Article.
- a. Where welding branches or connections are taken from a branch or main and the branch or the connection pipe size is the same diameter as the main, a welding tee must be installed in the main for the branch or connection.
 - b. Where branches or connections are made to a welded main and the branch or connection is less than the diameter of the main, and the branch is 2-1/2" and larger, install a weldolet at the branch connection to the main. Where the branch connection to the main is 2" and smaller, install a threadolet at the branch connection to the main. Screwed couplings, half couplings or screwed nipples welded to mains for screwed branches will not be permitted.
6. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
7. Grooved Joints: Assemble joints in accordance with fitting manufacturers written instructions.

- Q. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
- 1. Install unions in piping 2 inches (50 mm) and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch (50mm) or smaller threaded pipe connection.
 - 2. Install flanges in piping 2-1/2 inches (65 mm) and larger adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
 - 3. Dry Piping Systems (Gas, Compressed Air, and Vacuum): Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.04 EQUIPMENT INSTALLATION--COMMON REQUIREMENTS

- A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
- D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.05 HOUSEKEEPING PADS

- A. Concrete pads furnish and install under Division 3.
- B. Concrete housekeeping pads provided under all floor mounted equipment. Pads shall extend no less than 6 inches beyond equipment on all sides and be finished with chamfered edges.
 - 1. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations.

3.06 GROUTING

- A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
 - 1. Clean surfaces that will come into contact with grout.
 - 2. Provide forms for placement of grout, as required.
 - 3. Avoid air entrapment when placing grout.
 - 4. Place grout to completely fill equipment bases.
 - 5. Place grout on concrete bases to provide a smooth bearing surface for equipment.
 - 6. Place grout around anchors.
 - 7. Cure placed grout according to manufacturer's printed instructions.

3.07 CLEANING AND TOUCH-UP

- A. Remove waste materials from the premises promptly as the work progresses.
- B. At the completion of the work, thoroughly clean and polish equipment and installed materials. Turn the mechanical work over to the Owner in a condition satisfactory to the Architect.
- C. Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.
- D. Damage and Touch Up: Touch-up damaged finishes on equipment; use same paint as applied in the shop and prepare surfaces and apply paint in accordance with paint manufacturers instructions. Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.08 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1 "Structural Welding Code--Steel."

3.09 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not 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 members.

C. Attach to substrates as required to support applied loads.

3.10 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.11 DEMONSTRATION

A. Provide on-site services of a competent factory trained Engineer of particular manufacturer of equipment such as, exhaust fans, pumps, chillers, towers, boilers, chemical treatment systems, automation and control, etc. and the owner furnished equipment, described in the respective sections, to inspect, adjust and place in proper operating condition.

B. Within 7 days of the issuance of the Certificate of Substantial Completion, provide an experienced and competent Engineer to instruct the Owner's representative in the proper operation of all systems and equipment provided, prior to the final acceptance of his work. Make arrangements with the Owner, who will designate the person or persons who will be instructed in the operation of the basic and auxiliary mechanical systems. The Owner shall be satisfied that instruction has been thorough and complete and the Mechanical Subcontractor shall provide additional instruction before final payment is made.

C. Provide an experienced and competent Engineer to provide an additional period of instruction for the Owner's representative in the proper operation of all systems and equipment provided, at some period after the final acceptance of his work (as defined in the General and Supplementary General Conditions, and Division 1 General Requirements). Make arrangements with the Owner, who will designate the person or persons who will be instructed in the operation of the basic and auxiliary mechanical systems.

END OF SECTION 15050