

SECTION 23 06 00 - PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.
- B. Provide all chemical treatment required for piping systems each time an individual system is drained and then refilled as a result of work performed under this contract.

1.2 SUBMITTALS

- A. None required.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe and fittings new and marked with manufacturer's name; complying with applicable ASTM and ANSI Standards.

2.2 STEEL PIPING AND FITTINGS

- A. Pipe: Seamless ASTM A53, Schedule 40, or extra strong (Schedule 80) weight; black or galvanized finish as called for; ends chamfered for welding or roll grooved for grooved mechanical connections.
- B. Fittings: Same material and pressure class as adjoining pipe.
 - 1. Welded fittings: Factory forged, seamless construction, butt weld type, chamfered ends.
 - a.) Where branch connections are two or more sizes smaller than main size, use of "Weldolets," "Thredolets" or "Sockolets" acceptable.
 - b.) Mitered elbows, "shaped" nipples, and job fabricated reductions not acceptable unless specifically called for.
 - c.) Socket weld type, 2000 psi wp, where called for.
 - 2. Screwed fittings: Cast or malleable iron, black or galvanized, as called for; drainage type where called for.

C. Flanges, Unions And Couplings:

1. Screwed connections:
 1. Unions: ASA malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.
 2. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.
2. Welded connections:
 1. Flanges: Welding neck type. Slip-on type not to be provided except where called for and shall not be provided in conjunction with butterfly valves.
3. Grooved mechanical connections:
 1. NOT ACCEPTABLE – DO NOT USE

2.3 COPPER PIPE AND SOLDER FITTINGS

- A. Pipe: Hard temper, ASTM B88; Type K, L, M, or DWV, as called for. Soft temper only as called for. Plans show copper tube sizes.
- B. Tees, Elbows, Reducers: Wrought copper or cast bronze; solder end connections; ASTM B62, ANSI B16.22.
- C. Unions And Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp; 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.
- D. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel.
- E. Design Equipment Make: Harris "Stay-Safe 50" and "Bright", Englehart "Silverbright 100", Willard Industries "Solder Safe (silver bearing)", Canfield "Watersafe".

2.4 COPPER PIPE AND BRAZED FITTINGS

- A. Pipe: Hard temper, Type K or L, as called for.
- B. Tees, Elbows, Reducers: Cast bronze ASTM B62, ANSI B16.22.
- C. Unions And Flanges: Unions for 2 in. and smaller, brazed type, cast bronze, ground joint, 150 lb. swp; flanged for 2-1/2 in. and larger, brazed type, cast bronze, companion type, gasketed and bolted, ASME drilled 150 lb. swp.
- D. Brazing Materials: Silver Alloy, Airco Sil-4S or Sil-Fos".

2.5 COPPER PIPE AND PRESS FITTINGS

- A. Pipe: Hard temper, ASTM B88; Type K, L, or M as called for. Soft temper only as called for. Plans show copper tube sizes.
- B. Fittings: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM.

2.6 THERMOPLASTIC (PVC) PIPE AND FITTINGS - DRAINAGE

- A. Interior Thermoplastic Sewer (PVC):
 - 1. Pipe: ASTM D1784 material manufactured to ASTM D1785 standards. Seamless Schedule 40 polyvinyl chloride (PVC) Type 1, Grade 1. Socket type weld couplings ASTM D2466, DR with integral bell end for solvent cementing ASTM D2672. Solvent cement - ASTM D2564.
 - 2. Fittings: Socket type cement weld fittings of same material and pressure class as adjoining pipe. ASTM D2466.

2.7 CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPE AND FITTINGS

- A. Interior CPVC:
- B. Pipe: ASTM D1784 material manufactured to ASTM F441 standards. Seamless Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Type 4, Grade 1 (Cell Classification 23477-BK). Socket type weld couplings ASTM F438, DR with integral bell end for solvent cementing. Solvent cement - ASTM F-493.
- C. Fittings: Socket type cement weld fittings of same material and pressure class as adjoining pipe. ASTM F-438.

2.8 DIELECTRIC PIPE FITTINGS

- A. Tensile strength, ASME B16.8 union 250 psi, or flange design, 175 psi, pressure rating, threaded or solder joint, constructed to prevent gasket from squeezing into internal opening.
- B. Zinc-electroplated steel or ductile iron fitting with male threaded or grooved ends, high temperature LTHS polyolefin polymer lining, 300 psi pressure rating at 230°F. Victaulic Style 47.
- C. Make: Capitol Manufacturing, Epco, Watts, Victaulic.

2.9 REFRIGERATION PIPING

- A. Type L hard temper deoxidized, dehydrated, and sealed copper tubing, refrigerant grade.

- B. Refrigerant grade wrought copper fittings. Long radius elbows.
- C. Factory made suction traps, Melco Type PT.
- D. Piping and system shall meet the requirements of Mechanical Refrigeration Safety Code, ANSI B9.1.
- E. Make: Alco, Detroit, Henry, Mueller, Sporlan.

2.10 HANGERS, INSERTS AND SUPPORTS

- A. Hangers, Inserts, Clamps: Carpenter and Patterson, Central Iron, Fee and Mason, ITT Grinnell.
- B. Hangers:
 - 1. Adjustable, wrought malleable iron or steel. Copper plated or PVC coated where in contact with copper piping. Cadmium plated or galvanized for exterior.
 - 2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.
 - 3. Adjustable steel clevis type for piping 4 in. and larger, and where insulation passes through hanger.
 - 4. Steam (over 50 psi) piping, adjustable yoke pipe roller equivalent to Grinnell Figure #181.
 - 5. Hangers sized to permit passage of insulation through the hanger for steam (over 50 psi) piping.
 - 6. Nuts and rods with electroplated zinc or cadmium (0.005 in. minimum) finish.
- C. Hanger Shields:
 - 1. Pre-insulated type:
 - 1. Insulated pipes shall be protected at point of support by a 360° insert of high density, 100 psi waterproofed calcium silicate, encased in a 360° sheet metal shield. Insulation insert to be same thickness as adjoining pipe insulation and extend 1 in. beyond sheet metal shield.
 - 2. Field-insulated type:
 - 1. #18 USSG, galvanized steel shields, minimum 120° arc. Provide temporary blocking between pipe and hanger to maintain proper spacing for insulation. Provide at all support points.

3. Shield Sizing:

<u>Pipe Size</u>	<u>Shield Length</u>	<u>Minimum Gauge</u>
to 3-1/2"	12 in.	18
to 4"	12 in.	16
and 6"	12 in.	14
to 14"	24 in.	12
to 24"	24 in.	10

1. Hanger shield gauges listed are for use with band type hangers only. For point loading (roller support), increase shield thickness by one gauge, and length by 50%.

D. Spacing Schedule:

<u>Pipe Size</u>	<u>Steel</u>	<u>Copper</u>	<u>PVC Plastic</u>	<u>Rod Size</u>
3/4 to 1 in.	8 ft.	6 ft.	3 ft.	3/8 in.
1 1/4 to 2 in.	10 ft.	8 ft.	3 ft.	3/8 in.
2 1/2 to 4 in.	14 ft.	10 ft.	4 ft.	1/2 in.
5 and 6 in.	14 ft.	10 ft.	4 ft.	5/8 in.
8 in.	14 ft.	10 ft.	4 ft.	3/4 in.
Over 8 in.	To suit loading conditions.			

- E. Inserts: ITT Grinnell Fig. #281, maximum loading 1000 lbs., galvanized finish, and Fig. #285, maximum loading 400 lbs. Make: Globestrut, Grinnell, Unistrut.

F. Supports:

1. For weights under 1000 lbs.: "Drill-In" inserts equivalent to Phillips "Red Head," "U-Channel," "Unistrut," beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.
2. For weights above 1000 lbs.: Drill through floor slabs and provide flat flush plate welded to top of rod or provide additional "Drill-In" inserts and hangers to reduce load per hanger below 1000 lbs. The factor of safety shall be at least four.
3. For metal decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use Phillips "Red Head" devices designed for this application, with a safety factor of four.

2.11 PIPING ACCESSORIES

- A. Escutcheon Plates: Steel or cast iron polished chrome, split hinge type with setscrew, high plates where required for extended sleeves.
- B. Pipe Guides: Cylindrical steel guide sleeve, proper length for travel, integral bottom base anchor; top half removable. Split steel spider to bolt to pipe, copper plated spider for copper pipe. Space between sleeve and spider to

allow for insulation where required. Make: Anaconda, Flexonics, Pipe Shields, Keflex, or equal.

- C. Anchors: Same material as pipe. Make: Keflex, Flexonics, Pipe Shields, or field constructed.
- D. Pipe Roll Stand: Cast iron roll stand. Make: Advanced Thermal Systems, Carpenter and Patterson, ITT Grinnell, Pipe Shields.

2.12 FLEXIBLE EXPANSION LOOPS:

- A. Same materials as pipe. Loop travel to be +/-3" for all pipe sizes. Loops shall impart no thrust loads on anchors. Provide "nested" construction of loops when installed in multiples. Provide a pipe guide within four pipe diameters on each side of the loop. Support loops per manufacturer's recommendations. Loops shall be at 0" deflection at time of installation. Hose braid shall be stainless steel for steel loops, and bronze braid for sweat end copper loops.
- B. Make: Metraflex, Twin City Hose, Flex Hose.

2.13 SLEEVES

- A. Standard Type:
 - 1. Schedule 40 black steel pipe sleeves, two pipe sizes larger than the pipe, for structural surfaces.
 - 2. Schedule 40, PVC sleeves or sheet metal sleeves for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing.
- B. Pre-Insulated Type:
 - 1. Adjustable or fixed length metal cans, 24 gauge minimum, sized for 1 in. spacing between insulation and can. Insulation shall consist of a 360° waterproofed calcium silicate insert sized to extend 1 in. beyond wall or floor penetration. Calcium silicate insert shall be same thickness as adjoining pipe insulation. Spacing between shield and can packed at each end with double neoprene coated rope positively fastened.

2.14 SEALING ELEMENTS

- A. Waterproof Type:
 - 1. Exterior walls, below grade, above floor: Synthetic rubber material with zinc plated bolts. Make: "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.15 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL FLOOR ASSEMBLIES

- A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform with the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.16 SLIPSTREAM WATER FILTRATION AND TREATMENT DEVICE

- A. The Contractor shall furnish and install a full slipstream filtration device that incorporates a shot feeder, magnetic filter and cartridge filter all in one device as shown and detailed on the contract documents. The product provided shall be the Skidmore® X-POT COMPACT® manufactured by Skidmore of Benton Harbor, MI or an approved substitution.
- B. The product shall be all stainless steel construction including all valves and fittings. Maximum working pressure shall be 150psi with flow rates up to 6.3 Gal/min with a temperature range of 32 to 200°F. Dosing capacity shall be a minimum of 1.18 Gallons and Cartridge Filtration range to be no less than 100 to 0.5µ. Magnetic filtration shall consist of no less than four (4) rare earth magnets designed for easy removal and cleaning. Unit to include an automatic air vent. Total system volume capacity shall be no more than 9,130 Gallons. The product must be provided with ½" isolation and drain valves and an insulation jacket. The product must be provided with self-supporting wall-mounting brackets.
- C. The product shall be furnished with a quantity of one (1), 100µ, start-up filter.
- D. Verify field conditions and suitability for installation according to manufacturer's published installation data. Install equipment per manufacturer's published O&M Manual.

2.17 PIPING MATERIALS AND SCHEDULE

- A. See Exhibit "A," "Schedule of Piping Materials" at end of this Section for (HVAC) piping.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

- A. Equipment and systems in accordance with laws, codes, and provisions of each applicable section of these specifications. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing (except where specifically called for), making proper allowance for expansion and anchoring. Arrange piping at equipment with necessary offsets, unions, flanges, valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting units, risers, circuits and systems. Conceal piping unless otherwise called for. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Provide trap seal of adequate depth on drain pans.

3.2 WATER AND GLYCOL SYSTEMS

- A. Top connection for upfeed, bottom or side connection for downfeed. Grade off-level; up in direction of flow and down toward drain.

3.3 HANGERS, INSERTS AND SUPPORTS

- A. Piping shall not be supported by wires, band iron, chains, or from other piping, nor by vertical expansion bolts. Support each pipe with individual hangers from concrete inserts, welded supports, or beam clamps of proper configuration and loading design requirements for each location. Trapeze hangers are acceptable for racking of multiple pipes of 1-1/2" or less in size. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size as called for, using four nuts per rod. Provide additional rustproofed structural steel members, where required for proper support. Provide oversized hangers where insulation/supports must pass between pipe and hanger. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible; "C" type not permitted on joists. Provide riser clamps for each riser at each floor.

3.4 PIPE CONNECTIONS

- A. Solder Connections: Nonacid flux and clean off excess flux and solder.
- B. Brazed Connections: Make joints with silver brazing alloy in accordance with manufacturer's instructions. Remove working parts of valves before applying heat. "Walseal" fittings may be used; if insufficient alloy is showing, face braze such joints.
- C. Threaded Connections: Clean out tapering threads, made up with pipe dope;

screwed until tight connection. Pipe dope must be specific for each application.

- D. Dielectric Pipe Fittings: Provide dielectric unions at all equipment connections where dissimilar metals meet. In addition, provide dielectric unions in all open type piping systems (condensing water, domestic water, etc.) where dissimilar metals are to be joined. Dielectric unions are not required in typical closed systems such as heating water, chilled water, heat pump loop, etc. except for the equipment connections.
- E. Grooved Mechanical Joints: NOT ACCEPTABLE

3.5 WELDING

- A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded piping fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by Owner. Use full length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe with inside smooth and remove splatter, slag and excess material at joints; chamfer ends. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe. When welding galvanized pipe, apply cold galvanizing on joint after welding.

3.6 HANGER SHIELDS

- A. Pre-insulated type or field-insulated type at Contractor's option.
- B. Provide for all chilled water and all "non-direct" connection supports.

3.7 SLEEVES

- A. Provide for pipes passing through floors, walls or ceilings. Not required for floors which are core-drilled, except where floor is waterproofed.
- B. Standard type: Provide for piping, except as called for. Extend 1/8 in. above finished floor in finished areas. In above grade mechanical and other areas with floor drains; use steel pipe sleeves 2 in. above floor. Use steel pipe sleeves in bearing walls, structural slabs, beams and other structural surfaces, and where called for. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating. Fill abandoned sleeves with concrete. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.8 ANCHORS AND GUIDES

- A. Provide piping system anchors and guides as shown on the plans, and as recommended by the expansion joint/loop manufacturer. Where an anchor is shown at a change in piping direction, it shall fully control movement in both directions. In lieu of a single anchor fabricated for two directional control, two (2) individual anchors may be provided.

3.9 SLEEVE PACKING

- A. Seal Void Space At Sleeves As Follows:
- B. Interior locations: Firmly pack with fiberglass and caulk.
- C. Exterior walls and below grade cored holes: Use sealing element.
- D. Fire rated partitions and floor slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.
- E. Waterproofed floors: Use waterproof sealing element, device, or compound.

3.10 ESCUTCHEON PLATES

- A. Provide polished chrome escutcheon plates for exposed piping passing through floors, walls or ceilings, except in Boiler, Fan and Mechanical Rooms.

3.11 CLEANING HOT WATER AND HEATPUMP SYSTEMS

- A. After each closed system has been tested and thoroughly flushed, introduce Trisodium Phosphate (one lb. for each 50 gallons) or Sodium Carbonate (one lb. for each 30 gallons).
- B. Provide Sidestream water filtration and treatment device (Xpot) and connect across pump outlet valve, or as called for, with three-valve bypass. Provide temporary meter or other means of determining amount of water in system.
- C. Operate pumps and arrange control system so that all control valves are open. Fill, vent and circulate system with this solution, while raising to design temperature.
- D. Remove, clean and/or replace air vents, strainers, and check valves, which do not function properly.
- E. After cleaning strainers, circulate for additional time, then clean strainers again; repeat until strainers are found clean. Drain and refill system.
- F. Notify Owner's Representative before starting Work. Pumps shall not be operated continuously until system is flushed and strainers cleaned.
- G. Water Treatment:
 - 1. After system cleaning, furnish report of water test to determine quality.
 - 2. Provide complete water treatment facilities to Owner, including water analysis, feed equipment, metering equipment, pumps, and chemical, obtained from Calgon, Vulcan, Bird Archer, Heating Economy Service, Inc., Mogul, Garratt-Callahan Company, Metropolitan, or Allen-Murray.

3. Recommendations for water treatment reviewed by Owner's Representative before systems are placed into service.
4. Add water treatment as necessary to prevent deterioration of piping system and equipment due to oxygen, acid, scaling.
5. Water treatment shall be deemed complete when circulation has been established throughout, and water runs clear and clean from deposits and discoloration. Submit typewritten letter to inform Owner's Representative upon completion of the Work.

3.12 TESTS

- A. Test piping and accessories before insulation, connecting to existing piping, or concealment. Repeat as many times as necessary to prove tight system. Notify Owner's Representative at least seven days in advance of each test. Isolate valves and equipment not capable of withstanding test pressures. Make leaks tight; no caulking permitted. Remove and replace defective fittings, pipe or connections. Furnish necessary pumps, gauges, equipment, piping, valving, power and labor for testing. Certify that test have been successfully completed.
- B. Schedule Of Test Requirements:
 1. Hot, heatpump water: Hydrostatic, 100 psig at high point of system; two hours duration.

3.13 PIPE LINE SIZING

- A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS (HVAC)
(Notes are at end of Exhibit "A")

<u>Service</u>	<u>Pipe Materials</u>	<u>Fittings</u>	<u>Connections</u>
Hot water heating	Schedule 40, black steel	Malleable iron and butt weld	Screwed 2 in. and smaller Welded 2-1/2 in. and larger
Hot water heating (Optional)	Type L copper	Wrought copper or cast bronze, solder end	No-lead solder
Vent, overflow, drain	Schedule 40, galvanized steel or Type M copper	Cast iron drainage type or wrought copper	Threaded or solder
Coil condensate drain (Optional)	Schedule 40, PVC	Socket type PVC	Socket weld cement

END OF SECTION