SECTION 23 20 00 - HVAC PIPES AND TUBES

PART 1 - GENERAL

1.1 SUMMARY:

A. Section includes pipe and pipe fittings for: hot water, chilled water, steam and steam condensate, condenser water, glycol, refrigerant and engine exhaust.

B. Related Sections:
   1. Section 01 17 0 1 – Building Systems Labeling and Identification.
   2. Section 23 00 10 – HVAC Design Criteria

1.2 GENERAL PIPING APPLICATION REQUIREMENTS:

A. Where more than one piping system material is specified, provide compatible system components and joints. Provide dielectric connections between dissimilar metals.

B. Provide flanges or unions at locations requiring servicing.

C. Use flanges or unions upstream and downstream of valves, and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

D. Provide pipe hangers and supports unless required otherwise.

E. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

F. Grooved end piping may be used on condenser water and fire sprinkler systems only; it may not be utilized on heating, dual temperature (seasonal hot and cold water) and chilled water systems.

G. Grooved piping system (couplings and fittings) manufacturer is limited to Victaulic.

H. “ProPress” fittings may be used on copper piping.

I. “Mega-Press” fittings may be used for steel piping, up to 4”

J. Refrigerant piping fittings shall be brazed.

K. Below-grade piping shall be pre-insulated steel, as specified below.
   1. The approved manufacturer is Perma-Pipe and the approved types are “Multi-therm 500” and “Polytherm”.

L. All hydronic piping shall be sized in accordance with ASHRAE 90.1-2013 Table 6.5.4.6 Piping System Design Maximum Flow Rate in GPM.

PART 2 – PRODUCTS:

2.1 HIGH TEMPERATURE HOT WATER PIPING:

A. Steel Pipe:
   1. Materials: ASTM A53 or A106, Grade B, seamless.
   2. Wall thickness:
      a. Up to and including 2 inch diameter: Schedule 80, socket weld ends.
      b. Above 2 inch: Schedule 40, butt-weld ends.

3. Fittings: Socket-weld up to and including 2 inch, butt-weld above 2 inch.
4. Below-Grade: Preinsulated Perma-Pipe “Multi-therm 500”.

2.2 HEATING WATER AND GLYCOL PIPING:

A. Steel Pipe: Schedule 40, black.
1. Fittings: Malleable iron or forged steel, minimum 150 pound service rating.
2. Joints: Screwed through 2”, or welded in any size.
3. Below-Grade: Preinsulated Perma-Pipe “Polytherm”

B. Copper Tubing: Type L hard drawn.
1. Fittings: Cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder shall be lead-free tin and silver with melting range 430 to 535 degrees F, or silver solder minimum 5%.
3. Mechanical joints: “Pro-Press”.

2.3 CHILLED WATER PIPING:

A. Steel Pipe: Schedule 40, black.
1. Fittings: Malleable iron or forged steel, minimum 150 pound service rating.
2. Joints: Screwed through 2”, or welded in any size.
3. Below-Grade: Preinsulated Perma-Pipe “Polytherm”

B. Copper Tubing: Type L hard drawn.
1. Fittings: Cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder shall be lead-free tin and silver with melting range 430 to 535 degrees F, or silver solder minimum 5%.
3. Mechanical joints: “Pro-Press”.

2.4 CONDENSER WATER PIPING:

A. Steel Pipe: Schedule 40 sizes 3 inch and over, black.
1. Fittings: Fittings: Malleable iron or forged steel minimum 150 pound service rating; grooved piping permissible if piping not required to be insulated.
2. Joints: Welded.
3. Below-Grade: Preinsulated Perma-Pipe “Polytherm”

B. Copper Tubing: Type L hard drawn.
1. Fittings: Cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder shall be lead-free tin and silver, with melting range 430 to 535 degrees F, or silver solder minimum 5%.
3. Mechanical joints: “Pro-Press”.

2.5 RADIANT HEATING PIPING:

A. Copper Tubing: Type L hard drawn.
1. Fittings: Cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder shall be lead-free tin and silver with melting range 430 to 535 degrees F, or silver solder minimum 5%.
3. Mechanical joints: “Pro-Press”.

B. Tubing: Composite hose with nitrile liner, braided fiber reinforcing, neoprene cover, 150 psig operating pressure at 205 degrees F, or PEX.
1. Fittings: Copper or PEX.
2. Joints: Nipple with stainless steel clamp.

2.6 MEDIUM AND HIGH PRESSURE STEAM PIPING 150 PSIG MAXIMUM:

A. Steel Pipe: Schedule 80, black.
   1. Fittings: Malleable iron Class 250, or forged steel welding type, Class 300.
   2. Joints: Threaded or welded.
   3. Below-Grade: Preinsulated Perma-Pipe “Multi-therm 500”.

2.7 LOW PRESSURE STEAM PIPING 15 PSIG MAXIMUM:

A. Steel Pipe: Schedule 80, black.
   1. Fittings: Malleable iron or forged steel, minimum 150 pound service rating
   2. Joints: Threaded or welded.
   3. Below-Grade: Preinsulated Perma-Pipe “Multi-therm 500”.

2.8 MEDIUM AND HIGH PRESSURE STEAM UP TO 150 PSIG MAXIMUM CONDENSATE PIPING:

A. Steel Pipe: Schedule 80, black.
   1. Fittings: Malleable iron Class 250, or forged steel welding type, Class 300.
   2. Joints: Threaded or welded.
   3. Below-Grade: Preinsulated Perma-Pipe “Multi-therm 500”.

2.9 LOW PRESSURE STEAM CONDENSATE PIPING:

A. Above- Ground: Steel Pipe: Schedule 80, black.
   1. Fittings: Malleable iron or forged steel Class 150.
   2. Joints: Threaded, or welded.

B. Above- Ground: Stainless steel, schedule 10.

C. Below-Grade: Preinsulated Perma-Pipe “Multi-therm 500”.

2.10 CLEAN STEAM MAKEUP WATER LINES:

A. Softened Water, from softener to steam generator:
   1. Copper Tubing: Type L hard drawn.
      a. Fittings: Cast brass, or ASME B16.22 solder wrought copper.
      b. Joints: Solder shall be lead-free tin and silver with melting range 430 to 535 degrees F, or silver solder minimum 5%.c
      c. Mechanical joints: “Pro-Press”.
   2. Stainless steel, schedule 10.

B. Reverse Osmosis / De-ionized Water (RO/DI) from source to steam generator:
   1. Stainless steel, schedule 10

2.11 EQUIPMENT DRAINS AND OVERFLOWS:

A. Steel Pipe: Schedule 40 galvanized.
   1. Fittings: Galvanized cast iron, or malleable iron.
   2. Joints: Threaded, or grooved mechanical couplings.

B. Copper Tubing: Type L hard drawn.
   1. Fittings: Cast brass, or ASME B16.22 solder wrought copper.

2. Joints: Solder shall be lead-free tin and silver with melting range 430 to 535 degrees F, or silver solder minimum 5%.
3. Mechanical joints: See Part 1.

C. Chilled water condensate: Type L copper.

2.12 ENGINE EXHAUST:

A. Steel Pipe: Schedule 40, black.
1. Fittings: Malleable iron or forged steel welding type.
2. Joints: Threaded for pipe 2 inch and under; welded for pipe over 2 inch.

2.13 REFRIGERANT PIPING:

A. Copper Tubing: Type ACR hard drawn.
1. Fittings: Wrought copper.
2. Joints: Solder shall be lead-free tin and silver with melting range 430 to 535 degrees F, or silver solder minimum 5%.

B. Copper Tubing to 7/8 inch OD: Type K, annealed.
1. Fittings: Cast copper.
2. Joints: Flared or soldered. Solder shall be lead-free tin and silver with melting range 430 to 535 degrees F, or silver solder minimum 5%.

2.14 UNIONS, FLANGES, AND COUPLINGS:

A. Unions for Pipe 2 inches and Under:
1. Ferrous Piping: malleable iron, threaded, 300 PSIG service rating.
2. Copper Pipe: Bronze, soldered joints. Solder shall be lead-free tin and silver with melting range 430 to 535 degrees F, or silver solder minimum 5%.

B. Flanges for Pipe Over 2 inches:
1. Ferrous Piping: 150 psig service: forged steel, slip-on. 300 psig service: 300 psig rated.
2. Copper Piping: Bronze. If soldered, solder shall be lead-free tin and silver, with melting range 430 to 535 degrees F, or silver solder minimum 5%.
3. Gaskets: 1/16 inch thick preformed neoprene for service under 250 degrees F. For above 250 degrees F, use spiral wound 304 stainless steel similar to “Flexitaulic."

C. Grooved and Shouldered Pipe End Couplings where permitted (See Part 1):
1. Housing Clamps: Malleable iron to engage and lock designed to permit some angular deflection, contraction, and expansion.
2. Sealing Gasket: C-shape elastomer composition for operating temperature range from -30 degrees F 230 degrees F.
3. Accessories: Steel bolts, nuts, and washers.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, and water impervious isolation barrier. Solder shall be lead-free tin and silver with melting range 430 to 535 degrees F, or silver solder minimum 5%.

E. For Glycol service, provide compatible metals for all vents and fittings connecting to pipe.

2.15 FLEXIBLE CONNECTORS:

A. Corrugated stainless steel or bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure as required by specific project. If soldered, solder shall be lead-free tin and silver, with melting range 430 to 535 degrees F, or silver solder minimum 5%.

B. At end-suction and split-case pump inlets and discharges, steel-reinforced rubber connections with threaded rod restraints are preferred.

PART 3 – EXECUTION:

3.1 INSTALLATION:

A. Route piping parallel to building structure and maintain gradient.

B. Install piping to conserve building space, and not interfere with use of space.

C. Group piping whenever practical at common elevations.

D. Provide access covers in finished surfaces where valves and fittings are concealed.

E. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain invert of pipe level.
   1. Slope steam piping one inch in 40 feet in direction of flow. Use eccentric reducers to maintain bottom of pipe level.
   2. Slope steam condensate piping one inch in 20 feet. Provide drip trap assembly at low points, before control valves and at the end of lines where piping is dead-ended. Run condensate lines from trap to nearest condensate receiver. Provide loop vents over trapped sections.

F. For condensate piping draining from chilled water coils, use copper piping only. Provide ball valves at intervals in the piping mains and unions at all branches to facilitate maintenance and repair. Install line-size clean-outs at every change in direction and orient away from direction of flow. Minimum line size shall be ¾-inch.

G. Arrange refrigeration piping to return oil to compressor. Provide traps and loops in piping, and where necessary provide double risers. Slope horizontal piping 0.40 percent in direction of flow.

H. Install flexible couplings only where required for vibration isolation; orient with respect to rotating equipment and install per manufacturer's direction. Misaligned piping shall not be permitted to be connected with vibration isolators.

I. Flexible connectors are not permitted at any in-line pump location.

J. Provide for minimal recirculation in all hydronic systems – minimize use of dead legs.

K. Label all piping per requirements of section 01 17 0 1 – Building Systems Labeling and Identification.

3.2 CLEANING:

A. After flushing, clean systems by circulating and draining water a minimum of 2 times. Where work is an expansion or modification to an existing piping system, cleaning or flushing is to include the existing system or portions of the existing system up to the nearest isolation valves.

B. For high temperature hot water systems, add alkaline boil-out chemical.

C. Coordinate with project manager for required permits to dispose of flush water.

D. Remove all construction strainers and replace with normal at completion of the project.

3.3 TESTING:

A. Hydro-test piping systems operating at less than 100 PSIG, at 150 PSIG for a minimum of 1 hour with no leaks. Systems operating above 100 PSIG, test at 150% of operating pressure for a minimum of 1 hour with no leaks.

B. Radiograph 10% of random field welds for above-grade medium temperature hot water, chilled water, condenser water, condensate and steam piping.

C. Radiograph 100% of all welds for both above and below-ground high temperature hot water piping. For socket-welded pipe, use dye penetrant or magnetic particle inspection instead of radiography for welds.

D. Radiograph 100% of all welds for underground piping for chilled water and medium temperature hot water systems.

END OF SECTION