

Design Standard HVAC Piping

Revisions Log:

Version	Date	Description of changes/updates
2	April 30, 2015	<ul style="list-style-type: none"> • Expansion of direction pertaining to rooftop installations of copper piping

Purpose:

The heating, ventilating and air-conditioning piping materials are an essential element of the mechanical systems. This design standard has the purpose of creating a consistent application of HVAC piping material requirements throughout the East Side Union High School District therefore achieving a standard of quality for maintenance, reliability, and energy efficiency throughout all renovation and new building projects.

Design Standard:

Design and specify work to include: Materials, installation and testing of pipe, tubing and fittings for complete and operable systems.

Electrical Equipment Clearances: Do not route piping through electrical rooms, transformer vaults, elevator equipment rooms, and other electrical or electronic equipment spaces and enclosures. Within mechanical or plumbing equipment rooms, provide minimum 3 feet lateral clearance from sides of electric switchgear panels, MCC's, etc. Do not route piping above any electric power or lighting panel, switchgear, or similar electric device, signal rack or cabinet. Coordinate with electrical and coordinate exact pipe routing to provide proper clearance with such items.

Welding Qualification: Qualify welding procedures, welders and operators in accordance with ANSI B31.9 for shop and project site welding of piping work.

All piping shall meet the piping material requirements set forth:

- Steel pipe:
 - ASTM A53, Hot Dipped, Zinc Coated Welded or Seamless, Grade B: Black
- Copper tube:
 - Temper: Annealed (hard drawn)
- Pre-insulated underground piping systems:

- Factory pre-insulated piping system, consisting of an inner media carrier pipe, insulation around the carrier pipe, and a water/vapor seal jacket over the insulation
- Carrier Pipe Material: Schedule 40 black steel pipe with 150 PSI malleable screwed fittings
- Insulation: Rigid closed cell polyurethane, average density of at least 2 lb./ft.3, conforming to ASTM C552, Type II, Class 1, K factor of not more than 0.14 (BTU/in)/(hr/sq.ft./deg. F) at 50F
- Outer Casing: PVC pipe of minimum 60 mils thickness. Each factory prefabricated section provides complete sealing of the insulation at each end of the conduit section. Provide permanent water and vapor seal. Carry over the outer casing and extend it to the carrier pipe. Use prefabricated caps specifically designed for end seal of prefabricated insulation systems. Fabricate caps of the same material as the outer casing
- Includes: Expansion loops, Ells, Welded fitting and elbows, Moisture barrier and end seals, Anchors, Thrust Blocks.
- After anchor blocks are poured and cured, a hydrostatic test of 150 PSIG or 1-1/2 times operating pressure, whichever is greater, required for a period of 4 hours
- Rooftop piping systems insulation:
 - ESUHSD has found that birds pick at and damage the insulation on rooftop piping. Designers should specify the installation of PVC or metal jacketing over all the insulated piping on the roof. The PVC jacket shall be white, installed over the entire diameter of the pipe; jacketing shall have tabs and slots that snap together over the pipe, along with molded corners to fit over elbows.
 - ESUHSD has experienced theft of copper pipe installed on rooftop equipment. Avoid rooftop installations of HVAC equipment requiring exposed copper piping. For condensate drain piping, specify plastic piping out of the unit, transitioning to galvanized piping to the roof drain.
- Fittings for steel pipe:
 - Flanges, fittings, unions and other products, mark in accordance with MSS SP-25
 - Welding Fittings: Wrought carbon steel fittings, ASTM A234, ANSI B16.9, B16.28. Butt-welding type unless otherwise indicated to be socket welding type
 - Branch Connections: From mains or headers 2-1/2 inches or larger, welded tees or forged welding outlets
 - Welding Outlets: "Weldolets" or "Threadolets" equivalent to Bonney Forge. Use forged welding outlets wherever branch line is at least 1 nominal pipe size smaller than local main or header
 - Threaded Fittings: ANSI B2.1, ASTM A47, 150 PSI rating, except where otherwise specified, prevailing codes or requirements or Specifications dictate use of 300 PSI rating. Fabricate from standard malleable iron with dimensions conforming to ANSI B16.3

- Flanges: Carbon steel conforming to ASTM A105, ANSI B16.5, and factory forged in the USA. Flanges which have been remade, painted, or are of non-domestic origin are not acceptable. Provide raised or full face ends wherever indicated or required
- Unions: ANSI B16.39, ASTM A47, and be fabricated from malleable iron with bronze-to-iron ground joints rated at 150 percent design operating pressure. Threads: ANSI B2.1
- Fasteners: Semi-finished carbon steel bolts and hex nuts conforming to ASTM A307. Threads and Dimensions: ANSI B1.1 and B18.2. Fasteners exposed to weather should be stainless steel with suitable anti-seize lubricant (typical for all systems).
- Threaded Pipe Plugs: ANSI B16.14
- Provide thread lubricant
- Designers can use mechanical couplings for pipe systems identified in Design Standard 23 21 05 if there is a cost benefit in doing so. The increased cost of mechanical couplings shall be weighed against the ease of installation and reduced installation time. The Design Standard recommends that designers allow the contractor to decide if they will or will not use mechanical couplings on systems allowing such. Mechanical couplings for steel pipe:
 - Coupling Housings: Malleable iron ASTM A47 or ductile iron ASTM A536
 - Coupling Housing Description: Grooved or rolled mechanical type, which engages grooved or rolled shouldered pipe ends, encasing an elastomeric gasket which bridges pipe ends to create seal. Cast in two or more parts, secured together during assembly with nuts and bolts. Permit degree of contraction and expansion as specified in manufacturer's published literature
 - Gaskets: Mechanical grooved or rolled coupling design, pressure responsive so that internal pressure serves to increase seal's tightness, constructed of elastomers having properties as designated by ASTM D2000. Water Services: EDPM Grade E, with green color code identification
 - Bolts and Nuts: Heat treated carbon steel, ASTM A183, minimum tensile 110,000 PSI
 - Branch Stub-Ins: Upper housing with full locating collar for rigid positioning engaging machine-cut hole in pipe, encasing elastomeric gasket conforming to pipe outside diameter around hole, and lower housing with positioning lugs, secured together during assembly with nuts and bolts
 - Fittings: Grooved or rolled shouldered end design to accept grooved or rolled mechanical couplings: Malleable Iron: ASTM A47, Ductile Iron: ASTM A536; Fabricated Steel: ASTM A53, Type F for 3/4 to 1-1/2 inches, Type E or S, Grade B for 2 to 20 inches; Steel: ASTM A234
 - Flanges: Class 125 cast iron and Class 150 steel bolt hole alignment: Malleable Iron: ASTM A47, Ductile Iron: ASTM A536
 - Pipe/Grooved: Carbon steel, A-53B/A-106B/A135 Schedule 40. Roll or cut grooved-ends as appropriate to pipe material, wall thickness, pressures,

size and method of joining. Pipe ends to be grooved or rolled in accordance with current listed standards conforming to ANSI/AWWA C-606

- Fittings for copper tubing: Wrought copper/bronze solder joint fittings complying with ANSI B16.22.
- ESUHSD's strong preference is to avoid the use of dielectric unions or dielectric pipe nipples on heating hot water, domestic and chilled water piping applications, exterior and interior. The inevitable corrosion issues present unacceptable maintenance headaches. ESUHSD prefers high-grade brass nipples and brass unions at transition points. If the use of dielectric unions is unavoidable, the design professional shall specify Elster Perfection Clearflow[®] Dielectric Waterway Fittings (or equivalent), which separate dissimilar metals in the electrolyte (waterway) - reducing the local galvanic cell.
- Welding Materials: Comply with Section 2-C of ASME Boiler Code, as applicable.
- Tin-Antimony Soldering Materials: ASTM B13.
- Gaskets for Flanged Joints: ANSI B16.12; full faced for cast iron flanges; raised face for steel flanges, unless otherwise indicated or recommended by manufacturer. Gaskets: Minimum 1/8-inch thick fabricated from non-asbestos bases.
- Copper-Brazed: Make brazed joints for copper tubing and fittings with code approved brazing filler alloys meeting ASTM and AWS standards and listings. Filler alloys of BCuP2 classification (e.g., "Phos-O" or "Fos-Copper") may not be used to make joints between copper tubing and cast brass or bronze fittings. Installations conform to accepted published procedures, i.e., CPC Installation Standard 3-75 and CDA Publications. Use of steel wool for cleaning tube and fittings is prohibited.
- Unions: Provide unions at all threaded connections to equipment, regulators, and controls that may have to be removed or replaced and at all points where necessary for the disassembly of piping for maintenance. Detail piping and unions to allow removal of equipment without springing pipe.
 - Steel Pipe Union: 150 PSI malleable iron, brass to iron seat, ground joint, black or galvanized to match pipe
 - Copper Pipe Union: 200 PSI working pressure. Bronze body, solder or grooved ends. Pipes 2 inches and under use ground joint, pipes 2-1/2 inches and larger use flanged face or grooved ends
 - Insulating Unions: 250 PSI working pressure. Pipe ends and material to match piping. Electric current below 1 percent of galvanic current. Gasket material as recommended by manufacturer. Epco or approved
- Escutcheons:
 - Brass material, chrome plated finish. Size sufficient to cover pipe openings through wall, floor or ceiling. Set screw or spring to secure to pipe. Coordinate opening sizes
- Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1 inch above finished floor. Caulk pipes passing through floor with non-shrinking grout or approved caulking compound. Provide

"Link-Seal" sleeve sealing system for slab on grade or exterior wall penetrations. Caulk/seal piping and ductwork passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local AHJ requirements.

- Corrosion Control: Underground Steel Piping Corrosion Protection: Factory wrap un-insulated underground steel piping systems with protective coating composed of a coal-tar saturated wrapping tape over a 20 mil thick coal-tar epoxy coating, equivalent to "Republic X-Tru-Coat." Wrap joints spirally with a minimum overlap of 1/2 tape width. Extend wrap not less than 3 inches above grade. . Provide cathodic protection to meet requirements of NACE Standard RP0169-2002.
- Pipe Tests:
 - Make test before pipes are concealed
 - Fill system and remove air from system at least 24 hours before test begins
 - Correct leaks in screwed fittings by remaking the joint. Cut out leaks in welded joints and reweld; caulking is not permitted
 - Apply test pressure of 125 PSI or 150% of work pressure (whichever is higher) and maintain for 1 hour with no visible leaks and no appreciable drop after the test pump has been disconnected

Approved Manufacturers:

- Pre-insulated underground piping systems
 - Rovanco
 - Thermacore
 - PERMA-PIPE
- Mechanical Couplings
 - Victaulic
 - Gruvlok
- Elster Perfection Clearflow© Dielectric Waterway Fittings

Substitutes Allowed:

Yes, if performance and quality equivalency can be evidenced.

Associated Design Standards and Construction Specifications

- 23 05 29 - Hangers And Supports for HVAC Piping And Equipment Design Standard
- 23 05 53 - Identification for HVAC Piping And Equipment Design Standard
- 23 21 05 - Hydronic Piping Systems Design Standard

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