

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Buried piping requirements.
- B. Pre-insulated piping system, buried.
- C. Expansion Cushions.
- D. Manholes.

1.02 DEFINITIONS

- A. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Sequencing:
 - 1. Document and mark existing utilities prior to starting excavation.
 - 2. Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

- A. Submit in accordance with conditions of Contract and Division 01 submittal procedures.
- B. Reference Division 23 Section, “Basic Piping Materials and Methods” for additional submittal requirements.
- C. Reports as specified in Part 3 of this Section.

1.05 QUALITY ASSURANCE

- A. Comply with Division 23 Section, “Basic Piping Materials and Methods.”
- B. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this Section, with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this Section, with minimum three years of documented experience.

- D. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Division 23 Section, “Basic Piping Materials and Methods.”

PART 2 - PRODUCTS AND MATERIALS

2.01 BURIED HYDRONIC SYSTEM REQUIREMENTS

- A. Coordinate the material type and pressure class of underground piping with above ground piping systems specified in other Division 23 sections. Provide required transition fittings and adapters where different materials are specified for above ground and underground joined piping systems.
- B. Mechanically Joined Hydronic Piping:
 - 1. Contractor shall not use mechanically joined hydronic piping systems for hydronic piping in lieu of welded, threaded or flanged piping methods.
- C. Antifreeze and Water Treatment:
 - 2. Refer to Division 23 Section “HVAC Water Treatment” for antifreeze and water treatment products.
- D. Piping Materials:
 - 3. Carbon Steel Pipe:
 - a) NPS 2 inch and Smaller: ASTM A53 or A106, Type E electric-resistance welded or Type S seamless, Grade B, Schedule 40 and Schedule 80, black steel, plain ends.
 - b) NPS 2-1/2 inch through 10 inch: ASTM A53 or A106, Type E electric-resistance welded or Type S seamless, Grade B, Schedule 40 and Schedule 80, black steel, plain or beveled ends.
 - 2. Galvanized Steel Pipe:
 - a. NPS 2 inch and Smaller: ASTM A53 or A106, Type E electric-resistance welded or Type S seamless, Grade B, Schedule 40 hot-dipped galvanized according to ASTM A123 on both inside and outside of pipe, plain ends.
 - b. NPS 2-1/2 inch through 10 inch: ASTM A53 or A106, Type E electric-resistance welded or Type S seamless, Grade B, Schedule 40 hot-dipped galvanized according to ASTM A123 on both inside and outside of pipe, plain or beveled ends.
 - 3. Stainless Steel Pipe:
 - c. NPS 2 inch and Smaller: ASTM A312, Type 304 or 316, Schedule 10S, plain ends.

- a) NPS 2-1/2 inch and larger: ASTM A312, Type 304 or 316, Schedule 5S, plain or beveled ends.
4. Copper Tubing:
- a) Copper Tube Size (CTS): ASTM B88, Type K, drawn.
- E. Fittings:
1. General: Fittings shall be of wall thickness, pressure rating, and material matching adjoining pipe.
 2. Reference Division 23 Section “Basic Piping Materials and Methods” for additional fittings.
 3. Threaded:
 - a) All threads shall conform to ASME B1.20.1.
 - b) Malleable-Iron: ASME B16.3, standard pattern.
 - c) Cast-Iron: ASME B16.4, standard pattern.
 - d) Cast-Stainless Steel: ASTM A351, standard pattern.
 4. Flanged:
 - a) Cast-Iron Threaded: ASME B16.1, raised ground face, bolt holes spot faced.
 - b) Cast-Bronze Flanges: ASME B16.24, raised ground face, bolt holes spot faced.
 - c) Wrought Cast-Iron and Stainless Steel: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connection, and facing:
 - 1) Material Group: 1.1.
 - 2) End Connections: Butt welding.
 - 3) Facings: Raised face.
 - d) Gaskets: ASME B16.21, non-metallic, asbestos free, 1/8 inch thick, full-face for cast-iron flanges and raised-face steel flanges, suitable for chemical and thermal conditions of piping system contents.
 - e) Flange bolts and nuts: ASME B18.2.1, hex head carbon steel according to ASTM A307, Grade B.
 5. Welded:
 - a) Carbon and Galvanized Steel: ASME B16.9, seamless weld conforming to ASTM A234.
 - b) Wrought Stainless Steel: ASME B16.9, seamless weld conforming to ASTM A403.
 6. Solder-Joint: Wrought-copper, ASME B16.22, streamlined pattern.
 7. Brazed-Joint: Wrought-copper, ASME B16.50, streamlined pattern.
 8. Transition Fittings for plastic to metal piping shall be of the plastic material of the adjoining pipe, one-piece, with a threaded brass or copper insert and schedule 80 solvent cement or fusion end.

F. Joining Materials:

4. Reference Division 23 Section “Basic Piping Materials and Methods” for basic joining materials.

2.02 PRE-INSULATED PIPING SYSTEM, BURIED

A. Manufacturers

1. Insul-Tek Piping Systems, Inc.
2. ISCO Industries.
3. Perma-Pipe, Inc.
4. Rovanco Piping Systems, Inc.
5. Thermacor Process, L. P.
6. Tricon Piping Systems, Inc.
7. Urecon Pre-Insulated Pipe

B. Conduit Pipe Pre-Insulated System:

1. Description: Factory-fabricated, watertight, drainable, pressure-tested conduit piping system with internal carrier pipe, pipe supports, and insulation.
2. Carrier Pipe: As specified for the buried hydronic system in Part 3.
3. Carrier Pipe Insulation:
 - a) Mineral-Wool (Fiberglass): ASTM C547, Type I or II, Grade A.
 - b) Calcium Silicate: ASTM C533, Type I.
 - c) Polyisocyanurate: ASTM C591, unfaced.
 - d) Polyurethane: ASTM C591, unfaced.
4. Carrier Pipe Support Spacer: Corrugated galvanized steel with a maximum spacing of 10 feet.
 - a) Carrier pipe support shall provide the following minimum clearances:
 - 1) Between carrier pipe insulation and conduit, 1-inch.
 - 2) Between insulation of multiple carrier pipes, 3/16 inch.
 - 3) Between bottom of uninsulated carrier pipe and casing, 1-3/8 inches.
5. Conduit Pipe:
 - a) Material: ASTM D3350 HDPE, with outside dimensions and wall thickness per ASTM D3035 or D2447.
 - b) Fittings: Factory-fabricated and -insulated elbows and tees compatible with the carrier pipe. Elbows may be bent pipe equal to carrier pipe.
 - c) Joints: Half-shell kits, with pourable or split insulation, casing sleeve, and shrink wrap sleeve.
 - d) Expansion Compensation: Size conduit at offsets with additional clearance required to contain piping expansion.

6. Accessories:
 - a) Water Shed: Terminal end protector for carrier pipes entering building through floor, 3 inches deep and 2 inches larger than conduit; terminate casing 20 inches above the floor level.
 - b) Guides and Anchors: Steel plate welded to carrier pipes, complete with vent and drainage openings inside casing.
 - c) End Seals: Steel plate welded to carrier pipes, complete with drain and vent openings on vertical centerline.
 - d) Gland Seals: Packed stuffing box and gland follower mounted on steel plate, welded to end of conduit, permitting axial movement of carrier piping, with drain and vent connections on vertical centerline.

C. Cased Pipe Pre-Insulated System:

1. Description: Factory-fabricated, watertight, drainable, cased piping system with internal carrier pipe and insulation.
2. Carrier Pipe: As specified for the buried hydronic system in Part 3.
3. Carrier Pipe Insulation:
 - a) Polyurethane: Unfaced, preformed, rigid cellular polyurethane material intended for use as thermal insulation, conforming to ASTM C591.
4. Casing:
 - a) Material: ASTM D3350 HDPE, with minimum wall thickness as specified:
 - 1) Jacket size less than or equal to 12": 100 mils.
 - 2) Jacket sizes 12" to 24": 125 mils.
 - 3) Jacket sizes larger than 24": 150 mils.
 - b) Fittings: Factory-fabricated and -insulated elbows and tees compatible with the carrier pipe. Elbows may be bent pipe equal to carrier pipe.
 - c) Joints: Half-shell kits, with pourable or split insulation, casing sleeve, and shrink wrap sleeve.
 - d) Expansion Compensation: Provide expansion cushions external to the system or elastomeric foam insulation blanket internal to the casing, formed to fit over carrier pipe and sized to accommodate the thermal expansion.
5. Accessories:
 - a) Water Shed: Terminal end protector for carrier pipes entering building through floor, 3 inches deep and 2 inches larger than conduit; terminate casing 20 inches above the floor level.
 - b) Guides and Anchors: Steel plate welded to carrier pipes, complete with vent and drainage openings inside casing.

- c) End Seals: Insulated and sealed watertight around casing and carrier pipe.
- d) Gland Seals: Packed stuffing box and gland follower mounted on steel plate, welded to end of conduit, permitting axial movement of carrier piping, with drain and vent connections on vertical centerline.

2.03 EXPANSION CUSHIONS

- A. Flexible Elastomeric Insulation: ASTM C534, Type I, with water absorption of 0.2 percent by volume and density of 4.0 lbs/cu.ft, suitable for direct buried applications.
- B. Mineral Fiber (Fiberglass) Insulation: ASTM C547, Type I, with density between 3 to 6 lbs/cu.ft, with temperature rating that exceeds the design operating temperature of the fluid in the piping system it is protecting.
- C. Manufacturers:
 - 1. Flexible Elastomeric Insulation:
 - a) Aeroflex USA.
 - b) Armacell.e
 - c) K-Flex USA.
 - d) Nomaco.
 - 2. Mineral Fiber Insulation:
 - a) Certainteed.
 - b) Johns Manville.
 - c) Knauf.

2.04 MANHOLES

- A. General: Black steel with lifting eyes.
- B. Finish: Spray-applied urethane, minimum 30 mils thick.
- C. Access: 30-inch- diameter waterproof cover with gasket, ladder, and two 6-inch vents, one high and one low, extending above grade with rain caps.
- D. Conduit Stub-Outs and Seals: Welded steel with drain and vent openings.
- E. Sump: 12 inches in diameter, 12 inches deep.
- F. Floatation Anchor: Oversized bottom keyed into concrete base.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Install products in accordance with manufacturer's instructions.
- B. Install piping to ASME B31.9 requirements.
- C. Coordinate the location of underground piping systems with other underground utilities.
- D. Do not install underground piping when bedding is wet or frozen.
- B. Reference Division 23 Section "Basic Piping Materials and Methods" for general piping installation requirements.
- E. Provide manholes where access to the underground piping system is needed.

3.02 EARTHWORK

- A. See Division 31 Section "Earth Moving" for excavation, trenching, and backfilling.
- B. Reference Division 23 Section, "General Mechanical Requirements" for additional excavation, trenching, and backfilling requirements.

3.03 PIPE APPLICATION SCHEDULE

- A. Heating Hot Water Piping:
 - 1. Acceptable Carrier Pipe Materials:
 - a) Schedule 40 carbon or galvanized steel with threaded fittings for pipes 2 inch and smaller, and welded or flanged fittings for pipes 2-1/2 inch and larger.
 - 1) Provide galvanized steel pipe in direct-bury applications.
 - b) Stainless steel with threaded fittings for pipes 2 inch and smaller, and welded or flanged fittings for pipes 2-1/2 inch and larger.
 - c) Type K copper with soldered, brazed, or flanged fittings.
 - d) Flanged fittings are only acceptable in direct-bury applications.
 - 2. Fitting Pressure Class: Minimum rating of 150 psig.
 - 2. Acceptable Bury Methods:
 - a) Conduit pipe pre-insulated system.
 - b) Cased pipe pre-insulated system.
 - 3. Insulation Thickness:
 - a) Pre-Insulated Piping Systems: 1 inch.
- B. Chilled Water Piping:

3. Acceptable Carrier Pipe Materials:
 - a) Schedule 40 carbon or galvanized steel with threaded fittings for pipes 2 inch and smaller, and welded or flanged fittings for pipes 2-1/2 inch and larger.
 - 1) Provide galvanized steel pipe in direct-bury applications.
 - b) Stainless steel with threaded fittings for pipes 2 inch and smaller, and welded or flanged fittings for pipes 2-1/2 inch and larger.
 - c) Type K copper with soldered, brazed, or flanged fittings.
 - d) Flanged fittings are only acceptable in direct-bury applications.
4. Fitting Pressure Class: Minimum rating of 150 psig.
 2. Acceptable Bury Methods:
 - a) Conduit pipe pre-insulated system.
 - b) Cased pipe pre-insulated system.
 3. Insulation Thickness:
 - a) Pre-Insulated Piping Systems: 1 inch.

3.04 EXPANSION CUSHION APPLICATION

- A. Direct Buried Piping: For direct buried piping, use flexible elastomeric insulation.
- B. Loose Fill Insulation: For piping buried in loose fill insulation, use flexible elastomeric or mineral fiber insulation.

3.05 PREPARATION

- A. Preparation of foundation for below ground water distribution pipe and fittings
 1. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.
 2. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.
 3. Pipe Beds for Pre-Insulated Piping Systems or Uninsulated direct-buried piping:
 - a) Provide 6 inch thick sand pipe bed underneath and around sides of pipe, up to middle half of the pipe, including fittings. Tamp bed with mechanical tamper to 85 to 95 percent compaction. Provide first layer of sand backfill 6 inches above pipe, tamp backfill with mechanical tamper to 85 to 95 percent compaction.
 - b) For piping with rock trench bottoms, provide sand pipe bed 6 inches underneath and around sides of pipe, including fittings.
 - c) Provide backfill above top of pipe bed as required for field conditions.

- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.
- D. Remove scale and dirt on inside and outside before assembly.
- E. Prepare piping connections to equipment using jointing system specified.
- F. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.06 PIPING INSTALLATIONS

- A. Remove standing water in the bottom of trench.
- B. Do not backfill piping trench until field quality-control testing has been completed and results approved.
- C. Maintain 6 inches clearance from obstructions and provide thrust blocks at every branch connection and change in direction.
- D. Provide long radius elbows with a minimum centerline radius of 1-1/2 times the pipe diameter. Short radius elbows with a minimum centerline radius of 1 times the pipe diameter may be used only where space does not permit the long radius elbows.
- E. Install piping at uniform grade of 1 inch in 40 feet upward in the direction of flow.
- F. Make reductions in pipe sizes using eccentric reducer fitting installed with the level side up.
- G. Install branch connections to mains using Tee fittings in main with take-off out the top or side of the main unless otherwise shown on the drawings. Up-feed risers shall have take-off out the top of the main line.
 - 1. Tee-drilling is prohibited as a means for connecting branch taps into any main.
 - 2. Bull-head tees are prohibited. Do not install tee fittings in such a way that the flow through the branch leg equals the sum of the flows through the two main legs.
- H. Secure anchors with concrete thrust blocks. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
- I. See Division 26 Section "Cathodic Protection" for cathodic devices and connections to piping and conduit systems.

3.07 PIPE JOINT CONSTRUCTION

- C. Reference Division 23 Section, “Basic Piping Materials and Methods” for basic pipe joint construction.
- D. Reference Division 23 Section, “Expansion Fittings and Loops for HVAC Piping” for installation of anchors and expansion joints.
 - A. Where more than one pipe material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
 - B. Install non-conductive dielectric connections whenever joining dissimilar metals. Reference Section 230510 Basic Piping Materials and Methods.
 - C. Pipe-to-Valve and Pipe-to-Equipment Connection: Install flanges or unions between piping and valves and equipment for servicing. Do not use direct welded, brazed, or soldered connections unless specifically called for in the manufacturer’s installation instructions.
 - D. Fusion Joints: Fuse joints in accordance with ASTM F2620.
 - E. Conduit and Cased Piping Joints: Assemble sections and finish joints with pourable or split insulation and exterior jacket sleeve, and apply shrink-wrap seals.

3.08 EXPANSION CUSHION INSTALLATION

- A. General: Install expansion cushions at expansion joints or elbows in accordance with manufacturer’s installation instructions. Provide thickness of cushion in single or multiple layers as required by the manufacturer to absorb the expansion of the piping.
- B. Flexible Elastomeric: Provide layers of flexible elastomeric insulation to absorb the pipe expansion. Length of each layer on each side of the elbow shall be as needed to absorb the expansion along the pipe. Refer to manufacturer’s recommendations. Secure the insulation layers to the pipe with fiber reinforced tape or plastic straps.
- C. Mineral Wool: Wrap mineral fiber cushion around pipe elbows at changes of direction and at expansion loops. Ensure there is sufficient space or flexibility between cushions to allow loose fill insulation to pour and consolidate under and around the piping. Secure cushion to the pipe with fiber reinforced tape.

3.09 IDENTIFICATION

- A. Install continuous plastic underground warning tapes during back filling of trenches for underground piping. Locate tapes 6 to 8 inches below finished grade, directly

over piping. See Division 31 Section "Earth Moving" for warning-tape materials and devices and their installation.

3.010 FIELD QUALITY CONTROL

- A. Reference Division 23 Section "Hydronic Piping" for additional Field Quality Control requirements for carrier pipe testing and flushing.
- B. Pressure Testing of Conduit Pipe Pre-Insulated System:
 - 1. Seal vents and drains and subject conduit to 15 psig for four hours with no loss of pressure. Repair leaks and retest as required.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.

3.011 ADJUSTING AND CLEANING

- A. Reference Division 23 Section, "Hydronic Piping" for additional Adjusting and Cleaning requirements.

3.012 STARTUP

- A. Reference Division 23 Section, "Hydronic Piping" for startup requirements.

END OF SECTION

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