

GENERAL:

The scope of this document is to provide instruction for the installation and testing of chilled water piping installed for the University of Missouri.

DESIGN GUIDELINES:

1. Materials

1.1. Pipe and Pipe Fittings – General

1.1.1. PVC (Polyvinyl Chloride) Pipe (for open trench construction):

1.1.1.1. 4 Inches to 12 Inches: AWWA C900; Pressure Class 150 (DR 18);
Cast Iron O.D. equivalent; with bell end and elastomeric gasket.

1.1.1.2. 14 Inches to 24 Inches: AWWA C905; Pressure Rating 165 (DR 25);
Cast Iron O.D. equivalent; with bell end and elastomeric gasket.

1.1.1.3. Gaskets: ASTM F 477, elastomeric seal.

1.2.1 PVC (Polyvinyl Chloride) Pipe (for trenchless construction):

1.2.1.1 4 inches to 12 inches: AWWA C900; Class 150 (DR 18); cast iron
O.D. equivalent; with grooved ends suitable for restrained joint
coupling.

1.2.1.2 Couplings: Non-metallic restrained joint coupling with PVC
precision machined housing, nylon joint retaining splines, elastomeric
O-ring seals, beveled leading edges, with pressure rating equal to or
greater than pipe.

1.2.1.3 Gaskets: ASTM F477, elastomeric seal.

1.2.1.4 Coupling Lubricant: Coupling manufacturer's standard for permanent
joints.

1.2.1.5 Compliance: Complete restrained joint pipe and coupling system
shall be Factory Mutual approved, Underwriter's Laboratory Listed,
and shall comply with National Sanitation Foundation Standard No.
61 and UNI-BELL UNI-B-13.

1.2.1.6 Restrained joint piping system shall be Certain Teed Certa-Lok
C900/RJ system, or approved equal.

1.1.2. Ductile-Iron Pipe:

1.1.2.1. 4 Inches to 24 Inches: AWWA C151; Mechanical Joint Pipe; 150
psi working pressure; Minimum Thickness Class 50; with integrally
cast flanged bell, cast iron gland, and rubber gasket.

1.1.2.2. Lining: Standard cement lining with asphalt coating.

1.1.2.3. Encasement: AWWA C105, polyethylene film.

1.1.3. Ductile-Iron Pipe Fittings:

1.1.3.1. 4 Inches to 24 Inches: AWWA C153; 350-psi pressure rating.

1.1.3.2. Lining: Standard cement lining with asphalt coating.

1.1.3.3. Encasement: AWWA C105, polyethylene film.

1.1.3.4. Fitting Restraint:

- 1.1.3.4.1. Mechanical joint: AWWA C111. Provide retainer type packing glands with rubber gasket, for use with PVC pipe and conforming to Uni-B-13-92. Pipe sizes 4" to 12" must also be FM approved. EBAA Megalug 2000 PV or approved equal.
- 1.1.3.4.2. Rods, nuts and washers: 3/4" SS304 all thread rods, nuts and washers.
- 1.1.3.4.3. Joint Retainers: Provide ductile iron clamp and rod type joint retainers for PVC bell and spigot joints. Clamps shall be designed for use with PVC pipe and shall meet Uni-B-13-92 Standards and be FM approved on sizes 4" to 12".
- 1.1.3.4.4. EBAA Series 1600 for pipe 4 inches to 12 inches, or approved equal.
- 1.1.3.4.5. EBAA Series 2800 for pipe 14 inches and larger, or approved equal.
- 1.1.3.4.6. Link Assembly: Seal annular space for piping passing through walls with interlocking synthetic rubber link assembly, Link-Seal by Thunderline Corporation or equal.

2. Installation

2.1. Preparation of Trench

- 2.1.1. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation throughout the length of the piping. All rock greater than one inch in diameter found in the trench shall be removed for a depth of six inches below the bottom of the pipe and replaced by suitable bedding material.
- 2.1.2. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with crushed stone as indicated on the drawings.
- 2.1.3. Provide layers of crushed stone in the bottom of trench as indicated on the drawings. Shape stone layer to fit bottom of piping. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.
- 2.1.4. Finished pipe installation shall have minimum 12" separation to all other utilities.

2.2. Installation of Pipe and Pipe Fittings

- 2.2.1. PVC (Polyvinyl Chloride) Pipe: Install in accordance with AWWA C605.
- 2.2.2. All underground water / chilled water piping shall be PVC.
- 2.2.3. EXCEPTION: Lines passing directly over steam tunnels or direct buried steam/condensate lines must be ductile iron with 2" R-5 extruded polystyrene insulation board between the pipe and steam lines.
- 2.2.4. All joints shall be restrained with joint retainers. All fittings shall be

restrained with retainer type packing glands.

- 2.2.5. Install stainless steel rods between fittings on all offsets and between fittings, valves, and blind flanges, in addition to the Megalugs. On isolated fittings, valves, etc., attach restraint rings to PVC pipe and install stainless steel rods between fitting and restraint rings. Position rods through the bolt holes in fitting and Megalug. Requires four nuts and washers on each rod. Duct lugs are acceptable. The number of stainless steel rods required per fitting flange are as follows:

<u>Pipe Diameter</u>	<u>No. of Rods</u>
to 10"	2
12"	3
14"	4
16"	5
18"	6

- 2.2.6. Ductile iron pipe, fittings and valves shall be wrapped with a polyethylene cover conforming to AWWA C105. Install per AWWA C600.
- 2.2.7. Installation of Trenchless Piping System: Trenchless piping installed using directional drilling equipment shall be installed in full compliance with restrained joint piping system manufacturer's instructions.
- 2.2.8. Field grooving tools, pulling heads, spline insertion tools, etc. shall be piping system manufacturer's standard.
- 2.2.9. Comply with piping system manufacturer's requirements on maximum pulling force, minimum bend radius, maximum deflection, etc.
- 2.2.10. Provide pressure relief holes at close enough intervals to prevent buckling of pavement/sidewalks. If damage does occur, the contractor shall repair in accordance with pavement details provided.
- 2.2.11. Trace wire shall be pulled with pipe, without splices. Trace wire shall be tested for continuity in presence of Owner's Representative, after pulling is completed.
- 2.2.12. Pipe shall be installed in clean condition, and shall never be laid in trenches with standing water. Contractor shall make provisions to keep the trench dewatered during installation of the water line. Protect open pipe ends with a hard cap or inflatable plug at the end of the work day. **NO PLYWOOD OR DUCTTAPE COVERINGS WILL BE ALLOWED.**

3. Identification

- 3.1. Install continuous plastic underground warning tape during back-filling of trench for underground water / chilled water and compressed air piping. Locate 24 inches above pipe, directly over each water line.
- 3.2. Tape trace wire to the top of each water / chilled water line with duct tape every 5 feet. Contractor shall minimize wire splices. Terminate trace wires inside building and inside valve boxes. Drill 1/4" hole in PVC valve box 1" below cast iron cover. Route wire up outside of valve box, through 1/4" hole and knot.

4. Trenchless Piping Installation

- 4.1. It is the desire of system owners to assure that trenchless piping installation be completed in a timely, quality and accurate manner utilizing good, well-maintained equipment and trained competent personnel. Trenchless piping must be installed on a route as close to the drawings as possible to prevent interference with buried utilities and other obstructions, and to prevent future accidental excavation damage.
- 4.2. Trenchless piping installation shall only be allowed if previously approved by system owner.
- 4.3. Directional drilling and pipe installation shall be done only by an experienced operator specializing in directional drilling and whose key personnel have at least five (5) year experience in this work.
- 4.4. Pipe installed by the directional drilled method must be located in plan as shown on the Drawings, and must be no shallower than shown on the Drawings unless otherwise approved. The actual horizontal and vertical alignment of the pilot bore shall be plotted at intervals not exceeding twenty (20) feet. This "as built" plan and profile shall be updated as the pilot bore is advanced. Instrumentation shall be utilized at all times that will accurately locate the pilot hole and measure drilling fluid flow and pressure.
- 4.5. Pilot hole shall be drilled on bore path with no deviations greater than 5 feet left/right/depth over a length of 100 feet. In the event that pilot does deviate from bore path more than this amount, the Engineer shall be notified and Engineer may require the pilot drill to be pulled back and redrilled from the location along bore path before the deviation. The final exit point of pilot hole shall be within five (5) feet of the location shown on the drawings.
- 4.6. Trenchless piping installed using directional drilling equipment shall be installed in full compliance with restrained joint piping system manufacturer's instructions.
- 4.7. Field grooving tools, pulling heads, spline insertion tools, etc. shall be piping system manufacturer's standard.
- 4.8. Comply with piping system manufacturer's requirements on maximum pulling force, minimum bend radius, maximum deflection, etc. During pull-back operations, no more than the maximum safe pipe pull pressure shall be applied at any time. Maximum allowable tensile force imposed on the pull section shall be equal to, or less than 80% of the pipe manufacturer's safe pull (tensile) strength.
- 4.9. Provide pressure relief holes at close enough intervals to prevent buckling of pavement/sidewalks. If damage does occur, the pavement shall be repaired in accordance with pavement details provided.
- 4.10. Trace wire shall be pulled with pipe, without splices. Upon completion of installation, a continuity test on the wire shall be performed and all breaks shall be repaired.

5. Testing

5.1. Field Quality Control

- 5.1.1. Piping Tests: Leak and pressure tests shall follow procedures outlined in

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AWWA M23. Conduct piping tests before joints are covered. Use only potable water.

- 5.1.2. Simultaneous Tests: Conduct leak and pressure testing at the same time. All tests shall be conducted in the presence of the Energy Management – Steam and Water personnel or their designee. Test at not less than 100 psig for 1 hour.
- 5.1.3. Test Report: Submit Test Reports to the system owner personnel.

5.2 Cleaning

- 5.2.1 Cleaning of all piping shall be performed as detailed in section 331300 Disinfecting of Water Utility Distribution. Chilled water distribution piping does not require disinfection.

6. Commissioning

- 6.1. System shall be placed in operation only after piping has been leak tested, flushed clean and approved by system owner personnel.

REFERENCES