

**GENERAL:**

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The scope of this document is to provide instruction for the installation and testing of underground domestic water lines.

**DESIGN GUIDELINES:**

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## 1. Materials, Pipe and Pipe Fittings

1.1. Typical construction of underground water piping shall be PVC with ductile iron fittings.

1.1.1. EXCEPTION 1: Domestic water service lines 2" or less shall be Type K copper or high density polyethylene (HDPE) piping.

1.1.2. EXCEPTION 2: Lines passing directly over or under steam tunnels or within six feet of direct buried steam/condensate lines must be ductile iron or Type K copper (2" or less) with 4" R-5 extruded polystyrene insulation board between the pipe and steam lines.

1.2. PVC Pipe (Open Trench Construction)

1.2.1. 4 Inches to 12 Inches (Standard Pipe Sizes: 4,6,8,12): AWWA C900; Pressure Class 235 (DR 18); Cast Iron O.D. equivalent; with bell end and elastomeric gasket.

1.2.2. Gaskets: ASTM F 477, elastomeric seal.

1.3. Ductile-Iron Pipe

1.3.1. 4 Inches to 12 Inches (Standard Pipe Sizes: 4,6,8,12): AWWA C151; Mechanical Joint Pipe; Minimum Thickness Class 52 or Pressure Class 350; with integrally cast flanged bell, cast iron gland, and rubber gasket.

1.3.2. Lining: Standard cement lining with asphalt coating.

1.3.3. Encasement: AWWA C105, V-Bio polyethylene film.

1.4. High-Density Polyethylene (HDPE) Pipe and Fittings

1.4.1. 2 Inches and Less: SDR9 CTS Premium Grade Pipe, AWWA C901, ASTM D3035, NSF 14 and 61, 200 psi pressure rating. Pipe to be CenCore HDPE as manufactured by Centennial Plastics or approved equal.

1.4.2. Fittings and Joints: All molded fittings and fabricated fittings shall be fully pressure rated to match the pipe pressure rating. All fittings shall be molded or fabricated by the pipe manufacturer. Connections must be made by either the use of brass/stainless steel compression couplings with insert rings or by creating a fusion butt weld all in strict accordance with manufacturer's recommendations. All brass fittings shall be lead free.

### 1.5. Pipe Fittings

- 1.5.1. 4 Inches to 12 Inches: AWWA C153; 350-psi pressure rating.
- 1.5.2. Lining: Standard cement lining with asphalt coating.
- 1.5.3. All pipe fittings shall be cast-iron construction, installed wrapped with AWWA C105, V-Bio polyethylene film.

### 1.6. Restraints

- 1.6.1. Mechanical joint: AWWA C111. Provide retainer type packing glands with rubber gasket, for use with PVC pipe and conforming to Uni-B-13 Pipe sizes 4" to 12" must also be FM approved. Mechanical joint restraints shall be Megalug 2000 PV, as manufactured by EBAA Iron Inc., Eastland TX, or approved equal.
- 1.6.2. Joint Retainers: Provide ductile iron split serrated ring harnesses 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 Standards and be FM approved on sizes 4" to 12". Restraint harnesses shall be Series 1500 for pipe 4 inches to 12 inches, and Series 2800 for pipe 14 inches and larger, all as manufactured by EBAA Iron Inc., Eastland TX or approved equal.
- 1.6.3. Rods, nuts and washers: 3/4" SS304 all thread rods, nuts and washers.
- 1.6.4. All pipe joint restraints, retainers and ductile iron fittings shall be installed wrapped with AWWA C105, V-Bio polyethylene film.
- 1.6.5. Link Assembly: Seal annular space for piping passing through walls with interlocking synthetic rubber link assembly, Link-Seal® as manufactured by PSI-Thunderline Corporation, Houston TX, or approved equal.

### 1.7 Trace Wire

- 1.7.1 **MU:** Tracer wire shall be #14 AWG Solid, steel core soft drawn high strength tracer wire, 250# average tensile break load, 30 mil high molecular weight-high density blue polyethylene jacket complying with ASTM-D-1248, 30 volt rating. No THHN insulated wire shall be allowed. Tracer wire shall be Copperhead Industries HS-CCS or approved equal.
- 1.7.2 **MS&T:** Tracer wire shall be #12 THHN attached to top of pipe at 5' intervals. The tracer wire ends will terminate at a tracer wire test station.
- 1.7.3 **MU:** Tracer wire shall have moisture resistant splices for direct bury applications. Splices shall be Copperhead Industries Snakebite or 3M DBR or approved equal.

**MU:** Tracer wire test stations shall be designed to be easily detected by magnetic and electronic locators. A magnet shall be securely attached at the top of the upper tube of the box for locating purposes. Lid shall be blue and have a brass terminal for attaching locating equipment and a brass 5 sided nut for removing cap. Tracer wire test station shall be Copperhead Industries Snake Pit or approved equal.

## 2. Installation

### 2.1. Preparation of Trench

- 2.1.1. Final bury depth shall have a minimum of 42" cover to the top of the pipe.

- 2.1.2. Trench bottom shall be graded to provide a smooth, firm, stable, and rock-free foundation throughout the length of the piping.
  - 2.1.3. 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.
  - 2.1.4. Unstable, soft, and unsuitable materials shall be removed at the surface upon which pipes are to be laid and backfill with crushed stone as indicated on the drawings.
  - 2.1.5. Layers of crushed stone shall be installed 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.
- 2.2. Pipe Separation
- 2.2.1. Finished pipe installation shall have minimum 12" separation to all other utilities.
  - 2.2.2. Maintain at least a ten foot (10') horizontal separation of water mains from any existing or proposed sanitary sewer. The distance must be measured edge to edge. Installation of the water main closer to a sanitary sewer is acceptable where the water main is laid in a separate trench or on an undisturbed earth shelf located on one (1) side of the sanitary sewer at an elevation so the bottom of the water main is at least eighteen inches (18") above the top of the sanitary sewer.
  - 2.2.3. Provide a minimum vertical distance of eighteen inches (18") between the outside of the water main and the outside of the sanitary sewer where water mains cross the sanitary sewer mains. This shall be the case where the water main is either above or below the sanitary sewer. At crossings, one (1) full length of water pipe must be located so both joints will be as far from the sanitary sewer line as possible. Special structural support for the water and sanitary sewer pipes may be required.
  - 2.2.4. Provide at least a ten-foot (10') horizontal separation between water mains and sanitary sewer force mains. There shall be an eighteen-inch (18") vertical separation at crossings
  - 2.2.5. Locate water mains so that they do not pass through or come in contact with any sanitary sewer manhole
  - 2.2.6. Consult the system owner where above conditions cannot be met.
- 2.3. Installation of Pipe and Pipe Fittings
- 2.3.1. Piping 2" and less:
    - 2.3.1.1. All domestic water service piping from the water main to the building with a nominal diameter of two inches and less shall be Type K copper or HDPE piping.
    - 2.3.1.2. In all installations, Type K copper shall be used where the water line enters the building. If the water meter is located in a meter pit, the piping within the meter pit, and stubbed out on either side shall also be Type K copper.
    - 2.3.1.3. All buried copper piping shall be wrapped with V-Bio poly wrap.

- 2.3.1.4. For pulled pipe installations, tracer 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.
- 2.3.1.5. For trenched pipe installation, tracer wire shall be taped to the pipe at the three o'clock position every 5 feet. Upon completion of installation, a continuity test on the wire shall be performed and all breaks shall be repaired.

- 2.3.2. PVC (Polyvinyl Chloride) Pipe: Install in accordance with AWWA C605.
- 2.3.3. All joints shall be restrained with joint retainers. All fittings shall be restrained with retainer type packing glands.
- 2.3.4. 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. Rods shall be positioned through the bolt holes in fitting and Megalug. Each rod will require four nuts and washers. Duct lugs are acceptable. The number of stainless steel rods required per fitting flange shall be as follows:

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

- 2.3.5. All ductile iron pipe, fittings, valves, bell end restraints, etc. shall be wrapped with a V-Bio polyethylene cover conforming to AWWA C105, and installed per AWWA C600.
- 2.3.6. All dead end mains shall have a dry barrel fire hydrant at the end to facilitate flushing of the main.
- 2.3.7. Pipe shall be installed in clean condition, and shall never be laid in trenches with standing water. The trench shall be dewatered during installation of the water line. Open pipe ends shall be protected with a hard cap or inflatable plug at the end of the work day. **NO PLYWOOD OR DUCTTAPE COVERINGS WILL BE ALLOWED.**

2.4 Backfill

- 2.4.1 Under Pipe: All backfill under the barrel of the pipe shall be free from debris, organic matter, and stones larger than one inch, and shall be tamped into place. Sand or crushed stone aggregate (95% passing a 1/2" screen but not more than 10% passing a #200 sieve) are acceptable substitutes for soil.
- 2.4.2 Adjacent To and Top of Pipe: The first one foot of backfill over the top of pipe shall be "3/4 inch minus waste rock with fines" uncleaned crushed stone aggregate or suitable soil. Backfill shall be free of debris, brush, roots and stones or rubble more than one inch.

- 2.4.3 Rough final grading of subgrade and the placement of final topsoil shall be detailed on the drawings.
- 2.4.4 All sidewalks, paving, etc. which are removed or damaged during construction shall be replaced and shall match existing.

### 2.5 Identification

- 2.5.1 Install continuous plastic underground warning tape during back-filling of trench for underground water piping. Tape shall be located twenty-four (24) inches above pipe, directly over each water line. **MS&T: Tape shall be located at least twelve (12) inches above the pipe, directly over each water line.**
- 2.5.2 Tape trace wire to the top of each water line with duct tape every five (5) feet. Wire splices shall be minimized. Terminate trace wires inside building and inside valve boxes. Drill ¼” hole in PVC valve box one inch below cast iron cover. Route wire up outside of valve box, through ¼” hole and knot. A tracer wire test station shall be installed at all fire hydrants and at all runs of piping without valves every 400 feet. Upon completion of installation and final grading, a continuity test on the wire shall be performed and all breaks shall be repaired.

### 3. Testing

#### 3.1. Field Quality Control

- 3.1.1. See section 331300 Disinfecting for cleaning and disinfection, and pressure test requirements.

### 4. Commissioning

- 4.1. System shall be placed in operation only after testing shows the absence of bacteriological contamination and approved by Owner’s Representative.
- 4.2. At MU: Only Campus Facilities - Energy Management Steam and Water personnel will be allowed to operate valves on new water systems.

## REFERENCES

Section 331015 Water Utility Distribution General (MU)  
Section 331114 Potable Water Horizontal Directional Drilling  
Section 331216 Water Utilities Distribution Valves  
Section 331219 Water Utilities Distribution Fire Hydrants  
Section 331233 Water Utilities Metering  
Section 331300 Disinfecting