

**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. All underground water piping shall be PVC.

- 1.1.1. 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.

1.2. PVC Pipe (Open Trench Construction)

- 1.2.1. 2 Inches to 12 Inches: AWWA C900; Pressure Class 150 (DR 18); Cast Iron O.D. equivalent; with bell end and elastomeric gasket.
- 1.2.2. 4 Inches to 24 Inches: AWWA C905; Pressure Rating 165 (DR 25); Cast Iron O.D. equivalent; with bell end and elastomeric gasket.
- 1.2.3. Gaskets: ASTM F 477, elastomeric seal.

## 1.3. Ductile-Iron Pipe

- 1.3.1. 2 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.
- 1.3.2. Lining: Standard cement lining with asphalt coating.
- 1.3.3. Encasement: AWWA C105, polyethylene film.

## 1.4. Pipe Fittings

- 1.4.1. 2 Inches to 24 Inches: AWWA C153; 350-psi pressure rating.
- 1.4.2. Lining: Standard cement lining with asphalt coating.
- 1.4.3. All pipe fittings shall be cast-iron construction, installed wrapped with AWWA C105 polyethylene film.

## 1.5. Restraints

- 1.5.1. 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. Mechanical joint restraints shall be Megalug 2000 PV, as manufactured by EBAA Iron Inc., Eastland TX, or approved equal.
- 1.5.2. 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-13-92 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

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inches and larger, all as manufactured by EBAA Iron Inc., Eastland TX or approved equal.

- 1.5.3. Rods, nuts and washers:  $\frac{3}{4}$ " SS304 all thread rods, nuts and washers.
- 1.5.4. All pipe restraints shall be installed wrapped with AWWA C105 polyethylene film.
- 1.5.5. 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.

## 1.6. Pipe cleaning pigs

- 1.6.1. Pigs shall be constructed from open cell polyurethane foam with, medium density ranging from 5 lbs/cu. ft. to 8 lbs/cu ft.
- 1.6.2. All pigs used shall be made for hand launching and specifically for the type and size of pipe being installed.
- 1.6.3. Pigs shall be Product Code B-3 as manufactured by Pipeline Pigging Products Inc., Houston TX, or approved equal.

## 2. Installation

### 2.1. Preparation of Trench

- 2.1.1. Trench bottom shall be graded to provide a smooth, firm, stable, and rock-free foundation throughout the length of the piping.
- 2.1.2. 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.
- 2.1.3. 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.
- 2.1.4. 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

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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. PVC (Polyvinyl Chloride) Pipe: Install in accordance with AWWA C605.
- 2.3.2. All joints shall be restrained with joint retainers. All fittings shall be restrained with retainer type packing glands.
- 2.3.3. 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

- 2.3.4. All ductile iron pipe, fittings, valves, etc. shall be wrapped with a polyethylene cover conforming to AWWA C105, and installed per AWWA C600.
- 2.3.5. All dead end mains shall have a dry barrel fire hydrant at the end to facilitate flushing of the main.
- 2.3.6. 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. The balance of the trench shall be mechanically filled to

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six inches below the proposed finished grade of the surrounding terrain. 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.

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. 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 requirements.

3.1.2. Piping Tests: Leak and pressure tests shall follow procedures outlined in AWWA M23. Conduct piping tests before joints are covered. Use only potable water.

3.1.3. Simultaneous Tests: Conduct leak and pressure testing at the same time. All tests shall be conducted in the presence of the Owner's Representative. Test at not less than 100 psig for 1 hour.

3.1.4. Test Report: Submit Test Reports to the Owner's Representative.

## 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 331300 Disinfecting

Section 331114 Potable Water Horizontal Directional Drilling