

SECTION 232500 - UNDERGROUND DOMESTIC WATER SYSTEM

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

A. Domestic Water Distribution Systems:

1. River Campus and Medical Center - These University of Rochester Campuses are served by the City of Rochester's potable water system with supply points at various locations of the campuses. The City service is protected by back flow preventers. The system pressure ranges from 30-60 psig under normal conditions.
2. South Campus, Alumni Building, LLE, and UFC – These University of Rochester Campuses are served by the Monroe County Water Authority (MCWA) potable water system with supply locations along Kendrick, East River and Southland Drive. The MCWA service is protected by back flow preventers. The system pressures range from 30 to 40 psig under normal conditions.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:

1. Contractor shall be responsible for inspecting materials delivered to site for damage.
2. Polyvinyl Chloride Pipe (PVC) piping and rubber gaskets shall be stored under cover, out of direct sunlight.
3. All piping materials shall have ends plugged during storage on site and while installing in the trench until just prior to connection to adjacent pipe sections. Piping that has dirt and debris on the inside will be rejected.

B. Handling:

1. Pipe, fittings, valves, and other accessories shall be handled in such a manner as to ensure delivery to the job site in sound, undamaged condition.
2. Special care shall be taken to avoid injury to coatings and linings on pipe and fittings. The Contractor shall repair damaged coatings and linings to the satisfaction of the Owner.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, VALVES AND APPURTENANCES 3 INCH AND LARGER DIAMETER

- A. Polyvinyl Chloride Pipe (PVC): Pipe shall conform to AWWA C900 / AWWA C905 DR 18, cast-iron O.D. sizes, working pressure to 235 psi. Pipe shall be of domestic manufacture: JM Mfg. Co., PW Eagle Pipe, or Certainteed Fluid Tite, North American Pipe; no substitutions. Pipe shall be furnished with integral bells. Spigot end pipe with separate double hub couplings is not acceptable.
- B. Ductile Iron Pipe (DIP): Where in close proximity to steam lines and for pipe entering through foundation or manhole walls the underground piping shall be DIP. Ductile iron pipe shall conform to AWWA C151, minimum pressure class 250. All ductile iron pipes shall be cement mortar lined in conformance with AWWA C104 and shall have a 1 mil thick exterior petroleum asphaltic coating. Pipe shall be of domestic

manufacture: U.S. Pipe, American Ductile Iron Pipe (American Pipe), or Atlantic States. No substitutions.

- C. High Density Polyethylene (HDPE) Pipe: Where pipe installation shall be by directional drilling techniques the underground piping shall be HDPE. High Density Polyethylene Pipe shall conform to AWWA C906-99, SDR 7.3 with a minimum working pressure of 254 psi. Pipe shall be of a North American manufacture: Isco, JM Eagle, Plexco Chevron or IPEX Inc; no substitutions.

2.2 WATER LINES 2-INCHES AND SMALLER DIAMETER

- A. Pipe shall be annealed (soft) Type "K" copper (Cu). No hard copper tubing is permitted.

2.3 POLYETHYLENE ENCASEMENT

- A. Buried ductile iron pipe and fittings shall be encased in polyethylene sleeves in accordance with AWWA C105.

2.4 COUPLINGS AND SLEEVES

- A. General: All couplings and sleeves for plain end pipe, and accessories shall be of domestic manufacture; U.S. Pipe, Tyler/Union Foundry, Smith-Blair; no substitutions.
- B. Solid sleeves shall be mechanical joint type conforming to AWWA C153 as manufactured by Tyler/Union Foundry, US Pipe, or American Ductile Iron Pipe. No substitutions.
- C. Couplings: Quantum Couplings as manufactured by Smith-Blair, Inc or Dresser Style 38, by Dresser Piping Specialties. No substitutions.
- D. Unless otherwise noted, flanges on all DIP spools shall conform to AWWA C115.

2.5 COPPER TUBING

- A. Couplings and pipe thread adaptors for copper tubing shall be Mueller 110 Compression Connection or Ford Meter Box Company, Inc., Compression Couplings or University approved equal. Soldered joints are not permitted.

2.6 ASSEMBLY BOLTS AND NUTS

- A. Bolts and nuts for above ground flanges shall be standard hex head, cadmium plated machine bolts with American Standard Heavy, hot pressed, cadmium plated hexagonal nuts. Bolts and nuts for mechanical joints shall be high-strength, low-alloy corrosion resistant steel conforming to ASTM A 325 (type 3).

2.7 FITTINGS

- A. Fittings for pipe sizes 4-inches thru 12-inches shall be mechanical joint, AWWA C153, 350 psi working pressure rated, ductile iron for use with the type of pipe specified. Fittings shall be cement mortar lined per AWWA C104 and shall have a 1 mil thick exterior petroleum asphaltic coating. T-bolts shall be AWWA C111, high strength, low alloy steel. Fittings and all accessories shall be of domestic manufacture; U.S. Pipe TrimTyte, Union Foundry, Tyler; no substitutions.
- B. Fittings for pipe sizes 14-inches thru 36-inches shall be mechanical joint, AWWA C153, 350 psi working pressure rated, ductile iron for use with the type of pipe specified. Fittings shall be cement mortar lined per AWWA C104 and shall have a 1 mil thick exterior petroleum asphaltic coating. T-bolts shall be AWWA C111, high strength, low alloy steel. Fittings and all accessories shall be of domestic manufacture and shall be supplied by same manufacture as the pipe manufacture.
- C. Fittings for copper pipe 2-inches in diameter and smaller shall be soldered wrought copper.

2.8 MECHANICAL JOINT RESTRAINTS

- A. Mechanical joint restraints for Ductile Iron pipe and PVC pipe sizes 4-inches thru 24-inches shall be Mega-Lug® type as manufactured by EBAA, Inc. Series 1100 or Uni Flange Retainer (UFR 1400 D) for Ductile Iron pipe and EBAA, Inc. Series 2000PV or Ford meter Box UFR 1500 for PVC pipe. No Substitutions.
- B. PVC piping shall be restrained at each joint. The restraint method shall incorporate the use of a restraint harness. A split serrated ring shall be used to grip the plain-end of the pipe. A split serrated ring shall also be used to grip the barrel of the pipe behind the bell, and a sufficient number of bolts shall be used to connect the restraint rings. The combination shall be the MegaLug Series 1900 as manufactured by EBAA Iron Works or Smith Blair Bell-Lock Joints, no substitutions.
- C. DIP piping shall incorporate the use of restrained joint pipe systems at every joint. The allowed restraint mechanisms are as follows:
 - 1. Restraint harness comprised of a split serrated ring shall be used to grip the plain-end of the pipe; a sufficient number of bolts shall connect the restraint ring to the ductile iron fitting. The restraint for mechanical joint fittings shall be the MegaLug Series 1100; the restraint for push-on fittings with restraining ears shall be the MegaLug 1700 as manufactured by EBAA; or Smith Blair Bell-Lock Joints no substitutions.
 - 2. Locking gaskets such as Field-Lok gaskets as manufactured by US Pipe or “Fast-Grip” brand as manufactured by American Pipe, rated to withstand pressures of up to 250 psig.

2.9 GATE VALVES

- A. Buried gate valves 4-inches thru 24-inches diameter shall be Mueller resilient wedge gate valve model A 2360 series, or Kennedy Valve AWWA C509, 250 psi working pressure, non rising stem with square operating nut (turned counterclockwise to open), and –“O” ring packing; no substitutions, 3-inches size shall be by an approved manufacturer.
- B. Valves larger than 24-diameter shall be specified and selected by Central Utilities Director.
- C. Above ground Gate valves 2-inches and smaller shall be Milwaukee with hand wheel or University approved equal, buried gate valve shall be Kennedy AWWA 509, or University approved equal.
- D. Provide valves with shaft extensions with centering rings to within one foot of grade.
- E. Valve boxes shall be 2 – piece cast iron, screw type, 5¼-inches shaft with stay-put heavy-duty traffic weight lid marked “WATER” to match piping system. Boxes shall be manufactured by Bibby-STE-Croix, Tyler Union or Bingham & Taylor. Valve boxes to be coated with coal tar for buried service application.

2.10 HYDRANTS

- A. Hydrants shall be manufactured in accordance with AWWA Specification C502-latest revision. They shall be designed for 150 psi working pressure and tested to 300 psi hydrostatic pressure.
- B. Hydrants shall be manufactured for five-foot six-inch (5’ - 6”) bury with breakaway flange construction and six-inch mechanical joint inlets. They shall open left and be painted yellow. Main valve opening shall be five and one-quarter inches (5-1/4”) and packing shall consist of “O” ring. The manufacturer shall be Mueller and the model, Centurion A-423 or U.S. Pipe, Metropolitan 250 for three way hydrants.
- C. Anchoring pipe shall be Clow or Tyler and shall be cement lined in accordance with ANSI Specification A21.4-

latest revision and coated inside and outside with a coal tar bituminous coating. All anchoring pipes shall meet pressure requirements equivalent to that for pipe. Anchor pipe shall be used on all hydrant branches and valve outlets.

- D. All hydrants shall be installed where indicated on the drawings or as ordered by the Engineer. Hydrants shall be oriented with nozzles facing the pavement.
- E. All hydrants shall have bolts tightened and shall be inspected, cleaned, lubricated and tested to ensure they are in proper working order prior to installation.
- F. The Contractor shall excavate to a depth which will permit the connection of the hydrant to the branch pipe and provide a minimum of five feet (5') of cover for the branch and valve. The hydrants shall be installed such that they are plumb. Excavation for the hydrant shall be to a depth, which will provide a 23 inch clearance between the center of the hose nozzle and the finished ground elevation.
- G. Hydrants shall be connected to branch valves with ductile iron anchor pipe. Hydrants shall be carefully placed in a vertical position on a solid concrete block support. The Contractor shall maintain the alignment of hydrants until completion of the project and shall make all necessary adjustments so that hydrants will project the proper height over the finish ground grade.
- H. All new hydrant installations shall be pressure tested and shall be watertight.
- I. All hydrants shall be brush painted with a paint approved by the University. The Contractor shall repaint any scrapes in the hydrants and then apply one overall coat of paint to each hydrant.
- J. Ten cubic feet (10 cu. ft.) of No. 2 crushed stone shall be placed from the bottom of the excavation at the base of the hydrant, to a point one foot (1') above the weep holes. The Contractor shall cover the stone with a plastic sheet prior to backfilling. If groundwater is encountered, the stone may be omitted and the weep holes plugged. A tag shall be attached to all hydrants where the weep holes have been plugged and the Central Utilities Distribution Manager notified in writing.

2.11 TAPPING SLEEVE AND VALVE

- A. Tapping sleeves for 4-inches thru 12-inches mains shall be cast iron, 200 psi working pressure; Mueller H 615/H 619, or University approved equal.
- B. Tapping valves shall be Mueller resilient wedge gate valve model A 2360-16, or Kennedy 8950 SS, 250 psi working pressure, non rising stem with 2-inches square operating nut (turned counterclockwise to open), and "O" ring packing; no substitutions, with flanged or mechanical joint ends.
- C. Tapping sleeves and valves for mains 14-inches diameter and larger shall be Mueller H 615/H 619 or approved equal.

2.12 SERVICE SADDLES

- A. Service saddles for pipes 4-inches thru 12-inches diameter shall be Mueller BR2B Double strap bronze with AWWA I.P. thread or Ford Meter Box 202B. Tap diameter to match service connection size.
- B. Pipes 14-inches thru 36-inches diameter shall be Smith Blair model 317 with fusion nylon coated body; 2-inches IP threaded outlet, or Ford Meter Box FCD202, double stainless steel straps and stainless steel bolts and nuts.
- C. Corporation stops (for use with air release valve connections): Corporation stops shall be 2-inches size, cast bronze body, plugs, and trim, and IP threaded for saddles, Mueller H-15023, or Ford Meter Box FB1000, no substitutions.

2.13 ACCESSORIES

- A. Wall Penetration Sleeves: 1/8 inch hot-dip galvanized steel sleeve with 1/8 inch continuously welded 2-inches weep ring shall be provided.
- B. Wall Penetration Seals: Elastomeric link-type mechanical seal; Thunderline, Link-Seal or University approved equal.

2.14 TRACER WIRE

- A. No. 8 AWG insulated copper wire, solid or stranded, shall be provided in sufficient length to be continuous over each separate run of pipe and looped into each valve box.

2.15 MARKING TAPE

- A. All buried pipelines shall have plastic warning tape installed a minimum of 12-inches above the top of the pipelines. The warning tape shall be a minimum of 2-inches wide and blue with black lettering reading "CAUTION DOMESTIC WATER MAIN BURIED BELOW".

2.16 PIPE BEDDING MATERIAL

- A. Ductile Iron Pipe shall be bedded in sand 12 inches all around the piping meeting the gradation requirements of the manufacture. All compaction to AWWA standards.
- B. PVC piping shall be bedded in 1" minus washed crushed stone 12 inches all around the piping meeting the gradation requirements of the manufacture. All compaction to AWWA standards.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Except as noted herein or on the plans, all water system structures, components, and appurtenances shall be constructed and installed in accordance with the applicable AWWA specifications.
- B. Connections to Buildings:
 - 1. Buried connections to buildings shall be made with plain end (PE) x flanged end (FE) ductile iron pipe (flange assemblies facing the inside of the building). Transition from C900 PVC to ductile iron to occur 5-feet from foundation wall
 - 2. Pipe entering the building shall be anchored to the building wall or otherwise restrained against hydrostatic forces resulting from unrestrained joints in the pipe system external to the building.
 - 3. All pipes entering or existing the building shall be sleeved.

3.2 MINIMUM COVER FOR UNDERGROUND LINES

- A. The following minimum cover dimensions shall apply to all buried piping:
 - Lines less than 4-inches diameter: 60-inches minimum cover.
 - Paved areas: 60-inches minimum cover.
 - Landscaped and unimproved areas: 60-inches minimum cover.
 - Lines 4-inches and greater diameter: 60-inches minimum cover.

3.3 PIPE BACKFILL REQUIREMENTS

- A. Trenches shall be backfilled immediately after installing the pipe.
- B. Bedding and Backfill Around Pipe
 - 1. All pipe beds shall be hand shaped and of the material as specified herein.
 - 2. When conditions warrant, crushed stone shall be used within rock and within unstable trench bottom conditions below the pipe bedding.
 - 3. Bedding material shall be deposited up to the spring line of the pipe, completely encasing the lower half of the pipe. The material shall then be thoroughly hand compacted to 95% standard proctor density to the side of the trench wall.
- C. Trench Backfill and Maintenance
 - 1. From top of the bedding of the pipe, the trench shall be backfilled with:
 - On-site Material - under lawn areas
 - Gravel or Crusher Run Stone - under driveway, parking areas, emergency access ways, sidewalks, roads or any other paved surface.
 - 2. Backfill material shall be deposited in twelve inch (12") lifts and thoroughly compacted to 95% standard proctor densities.
 - 3. It is important that the trench be dry during the backfill operation and that the trench be backfilled immediately after the pipe is bedded. The method of consolidation shall be dependent upon the type of backfill material and the finished ground surface above the trench. Mechanical compaction is acceptable.

3.4 WASTE MATERIAL DISPOSAL

- A. Excess excavated material, debris, waste construction materials shall be properly disposed of. The Contractor shall haul the material to an offsite location. All cost associated with disposal shall be the contractors.
- B. Asphalt and concrete materials shall be handled separately from earthen materials and be directed toward the appropriate material recycler.

3.5 SITE GRADING

- A. Unless otherwise indicated on the plans, the construction site shall be returned to its original elevations.
- B. Lawn areas disturbed shall be backfilled to within the specified distance of the original grade and filled the remainder of the way with topsoil, previously stockpiled from the area or imported from an approved source.
- C. Road, driveways, and parking areas shall be backfilled to the original grade with the temporary asphalt materials. The Contractor shall maintain this temporary surface, filling all settlements as they occur until final surfaces restoration is complete. No extra payment will be made for this work.

3.6 THRUST BLOCKS

- A. Thrust block locations may not be shown on the drawings, but blocks shall be provided for all pressure pipe fittings, changes in pipe alignment/direction, and at all other points where there is a possibility of joint separation under pressure and no other method of restraint is specified. Provide anchors and supports where necessary for fastening work into place. Thrust blocks shall be placed between solid ground and the

pipe or fittings to be anchored as detailed. Thrust blocks shall be as detailed on the drawings, or where not detailed, in accordance with AWWA C600 and pipe manufacturer's recommendations.

- B. Where concrete thrust blocking is not possible due to space limitations or unstable soil conditions, the Contractor shall provide an alternate means of thrust restraint. Thrust restraint methods shall conform to NFPA 24 requirements. Acceptable methods include mechanical joint ductile iron retainer glands, restrained mechanical joints, and restrained push on joints. Tie rods shall not be used unless tie rod materials, tie rod arrangement, and corrosion protection methods have been specifically submitted and approved by the University of Rochester Central Utilities Department for the actual field conditions encountered. Submissions to be submitted through Campus Planning, Design & Construction Management Project Manager on CPDCM projects.
- C. Backfilling operations at thrust blocks may begin as soon as the concrete has set sufficiently to remain in position and withstand the weight of the earth. Concrete shall not be disturbed or pressure loaded for at least five (5) days after placing unless otherwise permitted by the Owner.

3.7 UNDERGROUND PENETRATIONS OF BUILDING AND MANHOLE WALLS

- A. Penetrations of existing concrete walls shall be core-drilled holes with seals.
- B. Penetrations of new cast-in-place walls shall be steel sleeved with wall pipe and seals.
- C. Penetrations of masonry walls shall be steel sleeves with seals.
- D. Seals shall be installed in accordance with manufacturer's instructions.

3.8 FLUSHING

- A. Prior to hydrostatic testing, pipe system shall be flushed with fresh water until piping is free of dirt and foreign matter. Contractor shall provide all necessary pumps, hoses and connections. Contractor shall be responsible for properly disposing of flush water.
- B. After flushing water main, Contractor shall demonstrate that the main is free of debris by capturing flushed water in a screen. Flushing may cease after the screen is free of debris following a flush at a flow rate not less than 8ft/sec for 20 mins or as otherwise required by Monroe County Department of Health MCDOH.
- C. Upon completion of the flushing and pressure testing process the contractor shall disinfect the system per Monroe County Department of Health requirements and testing procedures and receive approval form the MCDOH prior to putting any line in service.

3.9 HYDROSTATIC PIPELINE TESTING

- A. After the pipe has been laid and backfilled it shall be subjected to hydrostatic pressure tests. Tests shall not be conducted until at least 12 hours have elapsed since pipe laying and at least five (5) days have elapsed since placing of concrete thrust blocks. The pipe shall be filled with water, which shall remain without external application of pressure for 24 hours before tests are conducted.
- B. Prior to hydrostatic testing, flush pipe system with fresh water until piping is free of dirt and foreign matter.
- C. Pressure shall be applied by a pump and measured by a test gage. The Contractor shall furnish all necessary apparatus and labor for conducting the pressure and leakage tests.
- D. The Contractor is responsible to ensure the release of air from the line during filling, as well as the prevention of collapse due to vacuum when dewatering the line.

- E. For pressure test, use a hydrostatic pressure not less than 200 psi. The duration of the test shall not be less than 4 hours. The pressure shall not vary by more than 5 psi for the duration of the test.
- F. For portions of new mains with butterfly valves, use a hydrostatic test pressure of not less than 200-psi. Protect new butterfly valves from pressures above 150 psig. The duration of the test shall not be less than 4 hours. The pressure shall not vary by more than 5-psi for the duration of the test.
- G. Leakage Defined. Leakage shall be defined as the quantity of water that must be supplied into a newly laid pipe or any valve section to maintain pressure within 5-psi of the specified test pressure after the pipe has been filled with water and the air expelled. A drop in pressure in the test section shall not measure leakage over a period of time.
- H. Allowable Leakage. No pipe installation will be accepted if the leakage is greater than that determined by the following formula per AWWA C600-93:

$$L = (S*D*\sqrt{P})/ 133,200$$

Where:

L = allowable leakage, in gallons per hour

S = length of pipe, feet

D = pipe diameter, inches

P = test pressure, psi

- I. Acceptance. Acceptance shall be determined on the basis of allowable leakage. If any test of laid pipe discloses leakage greater than specified in Section 3.07.H, repairs or replacements shall be made by the Contractor's at his own expense.

END OF SECTION