

SECTION 02510 - WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

- 1.1 **Section Includes:** Furnishing and installing water distribution piping, valves, fittings, and other appurtenances, including reaction blocking, flushing, testing, and disinfection.
- 1.2 **Related Work:**
- A. SECTION 02316 - TRENCHING, BACKFILLING AND COMPACTION
 - B. SECTION 02370 - EROSION CONTROL
 - C. SECTION 02920 - GRASSING AND LANDSCAPING
- 1.3 **Reference Standards:**
- A. All materials and installation shall conform to requirements of Georgia Rules for Safe Drinking Water Chapter 391-3-5, latest revisions, and Environmental Protection Division's *Minimum Standards for Public Water Systems*, latest edition.
 - B. Drinking Water System Components-Health Effects (NSF ANSI Standard 61).
 - C. Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water (AWWA C104-03).
 - D. Polyethylene Encasement for Ductile Iron Pipe Systems (AWWA C105-05)
 - E. Ductile-Iron and Gray-Iron Fittings, 3 Through 48 In., for Water (AWWA C110-03).
 - F. Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings (AWWA C111-07).
 - G. Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges (AWWA C115-05).
 - H. Protective Fusion-Bonded Epoxy Coatings for Interior or Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service (AWWA C116-03).
 - I. Ductile-Iron Pipe, Centrifugally Cast, for Water (AWWA C151-02).
 - J. Ductile-Iron Compact Fittings for Water Service (AWWA C153-06)
 - K. Poly (Vinyl Chloride)(PVC) Pressure-Rated Pipe (SDR Series) (ASTM D2241-04a).
 - L. Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds (ASTM D1784-03).
 - M. Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. for Water Distribution (AWWA C900-97).
 - N. Metal-Seated Gate Valves for Water Supply Service (AWWA C500-02).
 - O. Dry-Barrel Fire Hydrants (AWWA C502-05).
 - P. Rubber-Seated Butterfly Valves (AWWA C504-06).
 - Q. Swing-Check Valves for Waterworks Service, 2 In. - 4 In. NPS (AWWA C508-01).

- R. Resilient-Seated Gate Valves for Water Supply Service (AWWA C509-01).
- S. Double Check Valve Backflow-Prevention Assembly (AWWA C510-97).
- T. Air Release, Air/Vacuum, and Combination Air Valves for Water Works Service (AWWA C512-04)
- U. Protective Interior Coatings for Valves and Hydrants (AWWA C550-05).
- V. Installation of Ductile-Iron Water Mains and Their Appurtenances (AWWA C600-05).
- W. Underground Installation of PVC Pressure Pipe and Fittings for Water (AWWA C605-05).
- X. Disinfecting Water Mains (AWWA C651-05).
- Y. Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals (ASTM D3139-98).
- Z. Elastomeric Seals (Gaskets) for Joining Plastic Pipe (ASTM F477-02e1).
- AA. City of Emerson Water & Sewer Standard Detail Drawings, latest edition.

1.4 Submittals: Submit under provisions of Section 01000.

- A. Submit complete descriptions, including manufacturer's catalog data and operation and maintenance instructions, for all products for approval prior to shipment.
- B. Submit manufacturer's certification for all pipe, valves, hydrants, and fittings shipped to the job stating that specified tests have been made and the results thereof comply with applicable specifications.

1.5 Delivery, Storage, and Handling:

- A. Properly and safely unload, and store all material furnished until incorporated into the Work and accepted.
- B. Unload pipe, fittings, valves, and hydrants by lifting with hoists or skidding to avoid damage. Do not roll or drop off trucks. Do not skid or roll against pipe already on the ground.
- C. Unload material at the site of the Work near the place where it will be installed. Do not interfere with traffic or create safety hazard. Provide signs, lights, and barricades as necessary to protect the public.
- D. Keep interior of pipe, fittings, valves, hydrants, etc. free of all dirt or foreign matter at all times. Do not store materials in drainage ways or ditches.
- E. When materials cannot be placed near the Work site, store in protected area at no expense to the Owner.

1.6 Site Conditions: Contractor shall be responsible for obtaining potable water needed for construction, testing, flushing, and disinfection.

PART 2 - PRODUCTS

- 2.1 General: All products shall be new and unused. All materials that come into contact with the drinking water shall be certified for conformance with ANSI/NSF Standard 61.
- 2.2 Ductile Iron Pipe (DIP): Manufactured in USA in conformance with AWWA C151 and cement mortar lined in accordance with AWWA C104, standard thickness, with seal coat.
- A. Unless otherwise specified, Pressure Class 350 for 4-in to 12-in. dia. pipe, Pressure Class 300 for 14-in to 20-in. pipe and Pressure Class 250 for all larger diameters.
 - B. Unless otherwise specified, the pipe shall have push-on (P-O) compression type joints conforming to AWWA C111.
 - C. Restrained joint (RJ) pipe, where specified or indicated on drawings, shall consist of push-on compression type joint with a locking gasket with stainless steel locking segments vulcanized into the gasket to grip the pipe to prevent joint separation. Restrained joints shall be Fast Grip Gasket by American Cast Iron Pipe Co. or Field-Lok Gasket by U.S. Pipe Co., or equal approved by the City Engineer. Retainer glands with set screws are not acceptable.
- 2.3 Plastic Pipe (PVC): Polyvinyl Chloride (PVC) pipe conforming to all requirements of ASTM D2241. PVC plastic extrusion compound shall meet the requirements of ASTM D1784-03 for Class 12454-B (PVC 1120).
- A. Pipe and fittings shall be Standard Dimension Ratio 21 (SDR 21), unless otherwise specified on the Drawings. C900 pipe, if specified, shall be pressure Class 200, DR14, CI pipe equivalent OD, conforming to AWWA C900.
 - B. Pipe, couplings, and fittings shall bear the National Sanitation Foundation Testing Laboratories, Inc. (NSF) seal of approval for potable water use.
 - C. Pipe joints: Integral push-on type complying with ASTM D3139, designed to provide for thermal expansion or contraction experienced with a total temperature change of at least 75°F. in each length of pipe. Gaskets shall be vulcanized natural or synthetic rubber conforming to AWWA C111 and ASTM F477.
- 2.4 Ductile Iron Fittings and Accessories: Manufactured in USA in conformance with AWWA C153 for diameters through 24 inches and AWWA C110 for diameters larger than 24 inches. Fittings shall be pressure rated 350 psi for diameters through 24 inches and 250 psi for diameters larger than 24 inches. ***Fittings will be paid at AWWA C110 weights (body weights only), regardless of actual weight of fitting used.***
- A. Cement mortar lined in accordance with AWWA C104, standard thickness, with seal coat. *Interior walls shall be smooth and free of defects.*
 - B. Mechanical joint (MJ) unless otherwise specified on the Drawings.
 - C. Fittings used on restrained joint (RJ) fittings shall be restrained joint, push-on compression type joints equal to those specified for restrained joint DI pipe.
 - D. Rubber gasket joints: AWWA C111.
 - E. Gaskets for PVC pipe shall be plain rubber transition type compatible with the type of pipe and fittings used.

2.5 Joint Restraint Devices:

- A. DIP with Push-on Joints: Wedge action restraint ring on the spigot end joined by tie rods to a ductile iron follower gland behind the bell. Rated for 350 psi for 16-in. and smaller and 250 psi for 18-in and larger. Series 1700 Megalug restraint harness as manufactured by EBAA Iron, Inc., or equal specifically approved by the City Engineer.
- B. DIP and Fittings with Mechanical Joints: Follower gland with individually actuated wedges. Rated for 350 psi for 16-in. and smaller and 250 psi for 18-inch and larger. Series 1100 Megalug restraint as manufactured by EBAA Iron, Inc., Ford Uni-Flange Series 1400, or equal specifically approved by the City Engineer.

2.6 Butterfly Valves (BFV): All valves larger than 16-inch shall be butterfly valves conforming to AWWA C504.

2.7 Gate Valves, Metal-Seated: (Acceptable only for 8-inch and smaller mains.) Shall conform to AWWA C500 for double-disc type, iron body, bronze mounted valves for buried, vertical installation, except that valves shall be rated for 200 psi working pressure.

- A. Valve Ends: Mechanical joint unless shown otherwise on the Drawings.
- B. Valve Discs: Double-disc type, parallel seat.
- C. Stem and Seal: Bronze, non-rising stem (NRS), unless shown otherwise on the Drawings; O-ring seals.
- D. Epoxy Coating: Interior and exterior, in accordance with AWWA C550.
- E. Operator: Manual operating nut, 2 inches square, unless shown otherwise on the Drawings; valve to open when turned to the left (counter-clockwise).

2.8 Gate Valves, Resilient Seat: Shall conform to AWWA C515 for reduced-wall, resilient-seated, iron body, bronze mounted gate valves, except that all cast ferrous valve components shall be ductile iron.

- A. Valve Ends: Mechanical joint unless shown otherwise on the Drawings.
- B. Seat: Resilient rubber seat ring.
- C. Stem and Seal: Bronze, non-rising stem (NRS), unless shown otherwise on the Drawings; O-ring seals.
- D. Coating: Interior and exterior, shall conform to AWWA C550.
- E. Operator: Manual operating nut, 2 inches square, unless shown otherwise on the Drawings, valve to open when turned to the left (counter-clockwise).

2.9 Small Gate Valves: Gate valves smaller than 3 inches shall conform to the level of quality and manufacturing standards established for valves 3 inches and larger by the respective AWWA Standards. *All small gate valves shall be rated for 200 psi working pressure.*

- A. Valves for non-buried service shall be bronze body, rising stem, solid wedge disc, with handwheel, Crane 428, Jenkins 47, or equal specifically approved by the City Engineer.

- B. Valves for buried service shall be 200 psi iron body, non-rising stem, bronze mounted, metal seated, Mueller A-2360, Kennedy 1571X, 1579X, or an equivalent resilient seat type specifically approved by the City Engineer. Provide standard 2-inch square operating nut on all valves for buried service.
- 2.10 Ball Valves 4" and Smaller: Two-way, lever-operated bronze body Ball Valve, Standard Port size, Pittsburgh Brass Manufacturing Co., Watts, Milwaukee Valve, or equal specifically approved by the City Engineer. All ball valves shall be rated for 200 psi working pressure. PVC ball valves, if specified, shall be Full-Flo True Union Ball Valve as manufactured by Hayward Manufacturing Co., Inc., or equal specifically approved by the City Engineer.
- 2.11 Check Valves: In-line swing check style conforming to AWWA C508, ductile iron body, mechanical joint ends, resilient material-to-metal type seat. Check valves shall be rated for 200 psi working pressure. Provide outside spring and lever unless shown otherwise on the Drawings. Epoxy coating, interior and exterior, shall conform to AWWA C550.
- 2.12 Backflow Preventer for Fill Valve Assembly: Double check valve assembly conforming to AWWA C510, bronze body, ball type test cock, ball valve shut offs with Tee handles. Watts Series 007, Hersey Model No. FDC, Conbraco Series 40-100, or equal specifically approved by the City Engineer.
- 2.13 Air Release Valves: Air valves for release of air under pressure shall conform to AWWA C512 for Air Release Valves rated to withstand 300 psi working pressure. Provide ductile iron body, threaded connections, stainless steel float and compound lever system, Buna N seat; with all internal trim stainless steel or bronze. Valve size shall be 1" inlet 1/2" outlet unless otherwise specified; *orifice size to be determined by working pressure*. Provide Crispin Model PL10-H, APCO Model 200A, or ValMatic Model 38.
- 2.14 Combination Air Valves: Shall conform to AWWA C512 for Combination Air Valves rated to withstand 300 psi working pressure. Provide ductile iron body, threaded connections, stainless steel floats and compound lever system, Buna N seat; with all internal trim stainless steel or bronze. Valve shall have 1-in. inlet and outlet, unless larger size is indicated on the Drawings. Provide Crispin Model UL10-H, APCO Model 143C, or ValMatic Model 201C.
- 2.15 Fire Hydrants: Shall conform to AWWA C502 for dry-barrel fire hydrants, traffic type, with safety flange which allows the valve to remain closed when the hydrant is broken or damaged above or near the grade level. Hydrants shall be Mueller Super Centurion A-423, with tamper-proof option 114.
- A. Size: Hydrant main valve opening 5-1/4 inches. Inlet shall be 6 inch, mechanical joint, with strapping lugs.
- B. Bury: Unless otherwise specified, with bury required by water main diameter, and to provide 18 inches from centerline of nozzles to the bury line of installed hydrant. However, vertical extensions shall be provided as required to bring the hydrant to its proper finished grade.
- C. Outlet Nozzles: Two 2-1/2 inch dia.; one 4-1/2 inch dia. Nozzle threads shall conform to those in service where the hydrant is to be installed unless otherwise specified. Provide field replaceable nozzle threads.
- D. Stem Seals: O-ring.

- E. Valve: Compression type closing with pressure. Facings shall be rubber.
 - F. Color: Top bonnet: Silver; Barrel: Yellow
 - G. Barrel Drain: Provide integral drain outlet.
 - H. Anchoring: Provide harnessing lugs. Use mechanical joint anchoring coupling (up to 36" in length) or 3/4 inch galvanized, threaded rods, with galvanized bolts and washers.
- 2.16 Piping Accessories: Any accessories required shall be compatible with pipe and fittings used. Small valves, pipe, and fittings shall conform to AWWA Standard C800.
- A. Tapping saddle for pipe 6 inches and smaller: Dresser Style 91, double strap, JCM Model 402, Smith-Blair No. 313, or equal specifically approved by the City Engineer. (For tapping pipe larger than 6 inches in diameter use a DI tapping saddle or tee)
 - B. Couplings for 3-in. and smaller pipe: Dresser Style 38.
- 2.17 Manhole for Air Valves or Check Valves: Precast concrete conforming to ASTM C478-03a, with cast iron cover, NEENAH R-6041-A for cast-in-slab, or R-1776 if not cast-in-slab type. Cover shall read, "CITY OF EMERSON WATER."
- 2.18 Vault for Air Valves: For air valves installed in vault in non-vehicular traffic areas only, use Carson Industries L Series 24 light duty HDPE vault, with extension for 24" minimum depth, with 24" sq. x 3" thick polymer concrete lid.
- 2.19 Valve Boxes: Cast iron, 5-1/4 inch diameter, suitable for the valve installed; two piece screw type adjustable to suit the depth of bury. Provide extension stem as required for deep valves so that no operating nut is deeper than 1.5 feet below the cover. Cover shall be cast iron, marked "WATER."
- 2.20 Valve Collars: Reinforced Concrete. Provide pre-cast 24-inch diameter x 6-inch thick pad for non-traffic areas. For valve boxes located in traffic and/or paved areas, provide poured-in-place, 24-inch square or round x 6-inch thick pad.

PART 3 - EXECUTION

3.1 Preparation:

- A. Perform demolition, clearing and grubbing as required.
- B. Install erosion and sediment control measures as required.
- C. Strip and stockpile all sod topsoil suitable for reuse in restoration.
- D. Remove pavement only as necessary for excavating the trench and installing the pipeline and appurtenances. Cut asphalt pavement in straight, uniform lines by means of a suitable pavement saw. Cut concrete pavements to a depth of at least 2 inches along the cut line with a rotary saw, after which the pavement may be broken with a jack hammer.
- E. Provide protection of utilities by notifying all local utility owners and, with an electronic

pipe locator and their assistance, locate underground structures, pipes and utility lines, and mark them in advance of trenching operation. Excavate and expose underground utilities in test pits to verify locations and depths. As excavation approaches the marked areas, dig with extreme care if using conventional trenching machines. Promptly restore utilities or structures damaged by construction activities to their original condition before the damage occurred. Upon Contractor's failure to promptly correct such damage, Owner may correct the damage and back-charge the Contractor for costs incurred.

- F. As part of the trenching operations, perform removal, relocation, or relaying of pipes, utility lines, and appurtenances which will obstruct the completed water mains or appurtenances.

3.2 Trenching, Backfilling and Compaction: Conform to Specification Section 02316.

3.3 Bedding: Bedding shall conform to the individual requirements for the pipe or conduit material being used. Unless otherwise specified or shown on the Drawings, bedding shall be Class C for Plastic Pipe (4 inches of stone under pipe) and Class D for ductile iron pipe.

3.4 Alignment, Grade, and Cover:

- A. Install pipe and appurtenances at the locations, positions, alignments, and grades shown on the Drawings. In the event of conflict, install as directed by the City Engineer.
- B. Provide **36 inch depth of cover** measured from finished grade to top of pipe barrel unless otherwise shown on the Drawings. Where obstruction are encountered, the depth of cover may be more or less than 36 inches, provided that the greater or lesser depths are approved by the City Engineer.
- C. For pipelines parallel to existing public roads and highways, provide minimum 48 inch depth of cover below the finished grade **OR** 48 inch depth measured below the centerline elevation of the road or highway, **whichever depth is at lowest elevation.**
- D. Limit pipe curvature to the horizontal or vertical joint deflection specified by the pipe manufacturer or AWWA Standard C600. Use fittings if required curvature cannot be maintained by allowable joint deflection. Do not bend PVC pipe.

3.5 Installing Pipe: Install pipe and appurtenances only when trench conditions are suitable. Trenches must not contain water that can enter open end of pipe. Provide proper implements, tools, and facilities for the safe and convenient performance of the Work.

- A. Lower all pipe, fittings, valves, and hydrants carefully into the trench piece by piece by means of a derrick, ropes, or other suitable tools or equipment. Prevent damage to water main materials and protective coatings and linings. Do not drop or dump water line materials into the trench.
- B. Carefully examine all pipe and fittings for cracks and other defects while suspended above the trench immediately before installation in final position. Defective pipe or fittings shall be clearly marked and shall be removed from the site.
- C. Clean the interior and bell and spigot ends of each piece of pipe thoroughly before the pipe is laid.
- D. Prevent foreign material from entering the pipe while it is being placed in the line. if

necessary, provide protective covering for the ends of the pipe until the connection is to be made to the adjacent pipe. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

- E. As each length of pipe is placed in the trench, center the spigot end in the bell, force the pipe home and bring to correct line and grade. Secure the pipe in place with approved backfill material tamped around it. Take precautions to prevent dirt from entering the joint space.
 - F. At times when pipe laying is not in progress, close the open ends of pipe with a watertight plug. Maintain plug in place until the trench is pumped completely dry.
 - G. Lay pipe with bell ends facing in the direction of laying, unless directed otherwise by the City Engineer. Where pipe is laid on a grade of 10 percent or greater, start the laying at the bottom and shall proceed upward with the bell ends of the pipe upgrade.
- 3.6 Cutting Pipe: Use pipe-cutter for inserting valves, fittings, or closure pieces in a neat and workmanlike manner without damage to the pipe or lining. Cut at right angles to the axis of the pipe.
- 3.7 Detection of Non-ferrous Pipe: Install one continuous strand of approved detection tape directly over all non-ferrous pipe, approximately 18 inches above the pipe and one continuous strand of No. 12 solid copper wire in blue insulation directly under the pipe. Pull wire up into valve boxes to within 2 inches of top of valve box. Installed detection device shall be such that Owner can locate installed pipe using a standard electronic detector.
- 3.8 Jointing: Provide jointing of all pipe, fittings, valves, and hydrants in strict compliance with manufacturer's instructions.
- A. Mechanical Joints (MJ): Tighten all nuts with torque limiting wrench. Nuts spaced 180 degrees apart shall be tightened alternately in order to produce equal pressure.
 - B. Push-on Joints (P-O): Furnish and install adaptor as required to join bells and spigots of different sizes. Complete joint by forcing the plain end to the bottom of the socket with a forked tool or jack-type tool.
 - C. Restrained Joints (RJ): Follow same procedure as for push-on joints and manufacturer's procedure for type of restrained joint installed.
- 3.9 Setting of Valves and Fittings:
- A. Set valves plumb. (No exceptions will be allowed.) Tamp backfill around valves and boxes carefully in 6 inch layers for the full depth of trench.
 - B. Provide a valve box, cast iron lid, and concrete collar for every valve. For valves in areas that will not be paved, 6" PVC pipe riser may be used in lieu of C.I. box. The valve box or riser shall not transmit shock or stress to the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed.
 - C. Provide an extension stem on any operating nut that is greater than 5 feet below the valve box lid. If used, extension shall terminate 18 inches below grade.
 - D. Upon final completion of valve and valve box, including surface restoration, operate

each valve in presence of City Engineer to demonstrate proper valve operation.

- E. Provide and install concrete valve marker ***only for valves specifically designated by Owner's Representative***. Install markers after final grading of the site.
 - G. Provide accurate and complete sketch for each valve showing measured distances to at least three permanent points. Measure for valve sketches upon job completion and submit to Engineer when application is made for final payment.
- 3.10 Setting of Hydrants: Set all hydrants plumb with nozzles parallel with, or at right angles to, the street with the pumper nozzle facing the street unless otherwise specified.
- A. Provide and install vertical extensions if required to match the "bury line" with finished grade after backfill. Do not bury the break-away flanges under any conditions.
 - B. Immediately upon installation, install black polyethylene bag (or other approved cover) over all inoperable fire hydrants, new or existing.
 - C. Upon final completion of fire hydrants ready for service, demonstrate proper installation and operation by: (1) operating each hydrant under flowing conditions and (2) closing and opening the hydrant isolation valve.
- 3.11 Thrust (Reaction) Blocking: Provide blocking for all plugs, caps, tees, bends, valves, hydrants, etc. unless otherwise specified. Generally, concrete thrust blocking is required whether or not restrained joints are used.
- A. Blocking shall be purchased Ready-Mix concrete having a compressive strength of not less than 3,000 psi at 28 days. Place blocking between solid, unexcavated earth and the fitting to be anchored. The area of bearing on the pipe and on the ground in each instance shall withstand thrust forces created by the specified test pressure. In no instance shall the bearing area be smaller than shown on the Drawings for firm, dry clay (3000 lb. per sq. ft.). Where soils are encountered with less than 3000 lb. per sq. ft. bearing capacity are encountered, increase bearing area dimensions as necessary. All blocking shall be placed such that the joints will be accessible for repair, unless otherwise shown or directed.
 - B. Metal harnesses, tie rods, or clamps may not be used except in special situations specifically approved by the City Engineer. Steel rods or clamps, if their use is approved, shall be galvanized.
- 3.12 Utility Crossings: Use extreme caution to avoid damage or disruption where crossings are necessary over or under other utility pipes or structures, such as sanitary sewers, storm sewers, culverts, gas mains, telephone ducts, buried cables, other water mains, or other structures.
- A. Do not pass water pipe through any drainage pipe, culvert, sanitary or storm sewer, or manhole, or any other structure.
 - B. Provide minimum of 6 inch cushion of earth or sand between water pipe and any other utility or structure.
 - C. If practical, provide at least 10 feet horizontal and 18 inches clear vertical separation at all structures and other pipelines or utilities.

- D. See additional requirements herein for separation water main from storm or sanitary sewers and natural gas mains.

3.13 Stream and River Crossings:

- A. For open-cut stream crossings, install water pipe as indicated on the Stream Crossing Detail Drawing. Provide minimum cover of 24 inches under bottom of stream beds or ditches.
- B. Where indicated on the Drawings and for streams greater than 15 ft. wide, place ball joint river crossing pipe beneath the river bed to maintain minimum 24 inches of cover. Install river crossing pipe by means and methods of Contractor's choice while ensuring that all conditions of applicable permits are complied with. Handle, install, and join ball joint pipe strictly in accordance with manufacturer's written instructions. Use extreme care to avoid flotation of pipe under all conditions.

3.14 Sewer Separation: Use special precautions to maintain minimum separation distances between water main and any existing or proposed sanitary sewer, storm sewer, or manhole.

- A. To the maximum extent practical, maintain at least 10 feet of horizontal separation between the water main and any existing or proposed sewer. Under no circumstances shall a sewer and a water main be laid in the same trench.
- B. Maintain a minimum vertical separation of 18 inches between the outside of the water main and the outside of any sewer or forcemain. Arrange the crossing so that the water main joints will be equidistant and as far as possible from the sewer joints. **Install water pipe above (over) sanitary sewers.** Where local conditions prohibit laying water pipe above (over) a sewer, maintain 18 inches minimum vertical separation and provide adequate structural support and protection for the sewer to prevent damage during pipe laying and backfilling operations. Insure that any sewer or forcemain crossing over a water main is constructed of materials and with joints that are equivalent to water main standards and tested to assure water-tightness.
- C. Notify City Engineer immediately upon encountering field conditions that do not allow If at least 18 inch vertical between the water pipe and existing or proposed sewer is not possible, notify City Engineer and use 18 ft. length of ductile iron pipe for the water main, centered on the sewer at the point of crossing.

3.15 Gas Main Separation: Use special precautions to maintain minimum separation distances between water main and any existing or proposed natural gas mains.

- A. Where practical, maintain a minimum 5 ft. clear vertical separation and minimum horizontal separation of 10 ft. between the water main and any steel gas main. Notify City Engineer immediately upon encountering field conditions that do not allow the specified minimum distances.
- B. Pipe wrapping or encasement of DI water pipe, where specified or directed, shall be performed in accordance with requirements of AWWA Standard C105.

3.16 Connection to Existing Mains:

- A. Coordinate connections to existing water facilities with Utility Owner and do not make connections to existing mains without specific approval of time of day and allowable

duration of service disruption.

- B. Ascertain the exact locations and depths of existing mains prior to connection. Locations of required connections to existing mains shown on Drawings may be approximate only.
 - C. Make connections to existing mains in a complete and workmanlike manner using only approved fittings and specials to suit conditions encountered.
 - D. Repair, reconnect, and return to service in equal or better condition all existing pipes which are cut or damaged.
- 3.17 **Filling for Testing:** Connect temporary fill valve assembly to existing water main or hydrant as shown on the Drawings. Coordinate with Utility Owner's forces for filling and testing. Provide adequate backflow protection on fill line between potable water supply source and new water main. Fill slowly, as directed by the Utility Owner.
- 3.18 **Hydrostatic Test:** Perform pressure and leakage tests on ***each section of the pipe between valves*** in accordance with AWWA C600, except as otherwise specified herein. All thrust blocking shall be in place and properly cured prior to start of hydrostatic testing. If directed by the City Engineer, pipelines may be tested before the trench is completely backfilled.
- A. Furnish and install corporation stops at high points on the pipe to release air as pipe is slowly filled with test water. When a segment of pipe between two valves is filled and ready for testing, the segment of pipe shall be thoroughly blown free of air and prepared for testing. Air must be removed prior to testing.
 - B. Furnish suitable test pump, meters, connections, pressure gages approved by the City Engineer, and all necessary apparatus including means for accurately measuring water introduced into the pipe during testing.
 - C. Maintain full test pressure for a **minimum of 8 hours**. Maintain **200 pounds per square inch (psi)** for pipe 16-in. and smaller; maintain 150 psi for pipe larger than 16-in. Pressure shall not vary by more than 5 psi during the test.
 - D. The length of pipe included in each pressure test shall be limited to the segment between two valves, unless otherwise directed by the City Engineer because of topography or other conditions which might prevent a valid test.
 - E. Concurrently with the pressure tests, conduct leakage tests on all pipe. Maximum allowable leakage shall be **six (6) gallons per mile of pipe per inch of nominal diameter per day**.
 - F. Locate, remove, and replace all defective pipe, valves, fittings, or hydrants. Clamps or other repair devices shall not be used for repair.
 - G. Repeat pressure and leakage tests until results are satisfactory to the City Engineer.
- 3.19 **Initial Flushing:** **After completion of hydrostatic testing, and prior to disinfection**, thoroughly flush the pipelines, in presence of City Engineer's Representative. Provide adequate backflow protection for the flushing water source, to be approved by the City Engineer prior to flushing.
- A. Produce a minimum velocity of 3.0 feet per second in pipe for as long as necessary to

clean out silt and debris, unless Owner determines otherwise.

- B. Provide adequate outlet piping and/or diffuser nozzle for proper disposal of flush water without causing erosion or other damage.

3.20 **Disinfection:** After initial flushing, disinfect all installed pipe, fittings, valves, and appurtenances or other facilities exposed to contamination by the construction. Disinfect strictly in accordance with AWWA Standard C651, **using the continuous-feed method**, except as otherwise specified. Use of the slug method may be directed by the City Engineer for larger pipelines to reduce volume of heavily chlorinated water to be flushed to waste. **Use of the tablet method is not acceptable.**

- A. Disinfect all pipe and appurtenances using calcium or sodium hypochlorite solution. Do not use calcium hypochlorite intended for swimming pool disinfection.
- B. Provide constant feed of chlorine such that the main will have not less than 25 mg/L free chlorine. After 24 hour retention period, all portions of the main shall have a residual of not less than 10 mg/L of free chlorine.
- C. **Final Flushing:** After 24 hrs. flush chlorinated water from the line until chlorine concentration of water leaving the main is no higher than that generally prevailing in the existing system, or less than 1.0 mg/l. Provide proper treatment and disposal of chlorinated water in accordance with federal, state, and local law.
- D. Repeat disinfection procedure until bacteriological analysis results are acceptable to the Owner and the local regulatory agencies.

END OF SECTION