

**SECTION 02551
WATER MAIN INSTALLATION AND CHLORINATION**

1.0 GENERAL

A. Description

Water main installation shall include, but not necessarily be limited to, furnishing and installing water pipe, fittings, and appurtenances of the size and type shown on the Plans, installed on a firm foundation true to line and grade in accordance with the Contract Documents.

B. Related Work Specified Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Valves and Appurtenances: Section 02552
3. Water Services, Water Meter Settings, and Vaults: Section 02553
4. Fire Hydrants: Section 02554
5. Cast-In-Place Concrete: Section 03300
6. Miscellaneous Metals: Section 05500

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Manufacturers and Materials for Water and Sewer Main Construction.
2. The Commission will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents. When specific tests of materials are called for in the referenced standards and specifications, the Commission has the option of requiring that any or all of these tests be performed at the Contractor's expense.
3. To minimize the number of joints, only standard manufacturers' length of pipe shall be furnished and installed for all water mains unless otherwise indicated on the Plans, or as approved by the Chief Engineer.

B. Pipe Symbols

For convenience and standardization, the various types of pipe are designated on the plans by the following symbols:

DIP	-	Ductile Iron Pipe
PVC	-	Polyvinyl Chloride Pipe
HDPE	-	High Density Polyethylene Pipe

C. Materials Furnished by the Commission

1. The Commission will not furnish any materials for water main construction.
2. Unless otherwise noted in the "Special Provisions," the Contractor shall pay for all water used for testing. The Contractor shall contact the Commission to coordinate its use.

D. Contractor's Options

1. The Contractor may furnish polyvinyl chloride pressure water pipe (PVC) and compatible specified fittings for water mains equal to or small than 12-inches in diameter unless specified otherwise by the Commission.
2. The Contractor may furnish ductile iron pipe (DIP) and compatible specified fittings for water mains 4-inches in diameter and greater unless specified otherwise by the Commission.

E. Detailed Material Requirements

1. Portland cement concrete for pipe fitting buttresses and anchorages shall be as specified in Section 03300.
2. Polyvinyl chloride (PVC) pipe and fittings shall be homogeneous throughout and free from visible discoloration cracks, bubbles, blisters, holes, foreign inclusions, cuts, or scrapes on inside or outside surfaces, or other imperfections which may impair the performance or life of the pipe. Polyvinyl Chloride Plastic Water Pipe 4 inch through 12 inch shall be Class 150 (DR18) and shall meet the requirements of AWWA C900. PVC Water Pipe smaller than 4 inches shall be PVC 1120 (SDR21) and shall meet the requirements of ASTM D 2241. The outside diameters of DR18 shall be equivalent to cast-iron pipe. PVC Water Pipe shall have an integral bell with a rubber gasketed joint as listed in the AWWA C900 standard. Pipe and couplings shall be marked and factory tested in accordance with AWWA C900. Water mains in State rights of way and major County roadways, and water mains larger than 12 inch diameter shall be Class 52 ductile iron.
3. Ductile Iron Pipe and Fittings
 - a. Pipe
 - 1) Pipe shall be designed and manufactured in accordance with ANSI/AWWA C151/A21.51 unless otherwise directed in writing by the Commission.
 - 2) All pipe and fittings shall be designed and constructed to withstand all external pressure caused by overburden as indicated on the profile and traffic loads to which the pipe may be subjected.
 - 3) Pipe shall be double thickness cement mortar lined in accordance with AWWA C104 with an interior seal coat of

bituminous material. The outside surface shall also be bituminous coated.

- 4) The minimum special standard thickness class shall be Class 52 or as shown on the plans or specified in the "Special Provisions".
- 5) Ductile iron pipe (DIP) and fittings shall be sound and without defects that might impair its service.

b. Joints

Joints may be mechanical or rubber gasketed push-on type. Unless otherwise noted, all joints shall be in accordance with ANSI/AWWA C111/A21.11 Standard.

c. Fittings

- 1) All fittings shall have mechanical joints.
- 2) All fittings 3-inches through 24-inches shall be manufactured in accordance with the ANSI/AWWA C153/A21.53 Standard. All fittings 30- inches through 48-inches shall be manufactured in accordance with the ANSI/AWWA C110/A21.10 standard for a working pressure of 250 psi unless specified or directed otherwise by the Commission.

- d. Joint restraint for pipe and fittings shall be specified in the Approved Materials and Manufacturers List or approved equal.

4. Joint Restraint

- a. Restrained joint pipe and fittings shall be of the pipe manufacturer's standard design for ductile iron, and fittings.
- b. Mechanical joint restraining systems for ductile iron pipe may be used at fittings, valves, fire hydrant leads, vault bypasses and when connecting to existing utilities unless noted otherwise by the Commission. The mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which when actuated imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153/A21.53 of the latest revision. Twist-off nuts shall be used to ensure proper actuating of the restraining devices. The 3 inch through 16 inch mechanical joint restraining device shall have a working pressure of at least 350 psi with a minimum safety factor of 2. The 18 inch through 48 inch mechanical joint restraining device shall have a working pressure of at least 250 psi with a minimum safety factor of 2. Restrained joints on straight lengths of pipe shall be as manufactured by the pipe manufacturer and the restraining mechanisms shall be an integral part of the bell and spigot.

- c. Rod for tie rod assemblies shall be stainless steel, and shall be threaded for at least 4 inches on both ends. Rod shall be 3/4 inch diameter unless otherwise noted. Nuts shall meet the requirements of ASTM A 194. Manufactured tie rod and accessories shall result in the completed restrained joint assembly having a minimum working pressure rating of 200 psi.

5. Detector Tape

Visual Detection Tape shall be 3 inches wide (minimum) nonmetallic blue plastic tape lettered "water" in yellow graphics.

6. Tracer Wire for Pipelines

Tracer wire shall be #12 AWG, solid continuous copper wire with a 45 mil polyethylene insulation. The wire shall be blue, have UL markings and suitable for direct bury applications. All underground splicing shall be with butt splice connectors and shrink tubing or split bolt connections with a water proof binder and underground electrical tape.

- F. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Preparation

1. Trench excavation, backfill, and compaction, and pipe bedding and haunching shall be as specified in Section 02250.
2. Prior to start of utility installation, all rights-of-way shall be graded to within ± 0.2 feet of the proposed subgrade in paved areas and finished grade in unpaved areas.
3. Trench Water: The pipeline trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joint shall be made under water.
4. Laying Pipe in Freezing Weather: No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the pipe has been installed.
5. Pipe Bedding: Each pipe shall be bedded on a solid foundation acceptable to the Commission and in accordance with the Standard Details. Bedding shall be installed to insure that joints are properly made and the pipe is firmly supported the full length of the barrel.

Aggregate bedding shall be installed to grade prior to laying pipe.

B. Pipe Installation

1. All pipe shall be installed in accordance with the approved manufacturers' written recommendations and as specified herein. These recommendations shall include: maximum trench width, bedding requirements, backfill material, and compaction, where applicable. In addition, the following shall apply unless otherwise noted:
 - a. Polyvinyl chloride water pipe (PVC) shall be installed in accordance with the Standard Details and the manufacturer's recommendations.
 - b. Ductile iron pipe (DIP) shall be installed in accordance with the Standard Details and the recommendations of the Ductile Iron Pipe Research Association.
2. Equipment for Handling Pipe: Proper and suitable tools and appliances as approved for safe and convenient handling and joining of pipes shall be used.
3. Pipe Installation: Pipe shall be carefully handled and lowered into the trench. Pipe shall be installed with special care to ensure that each joint is watertight, has met the required manufacturer's insertion depth, and has no shoulder or unevenness of any kind along the inside of the pipeline. No wedging or blocking will be permitted in installing any pipe unless directed by written order or permission in writing is obtained from the Commission.
4. Pipe Setting and Protection: No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Care shall be used to assure water tightness and prevent damage to, or disturbing of, the joints during the refilling process. After pipes have been installed and joints have been made, there shall be no walking on or working over the pipe, except as may be necessary in tamping the backfill material, until the backfill is at least 2 feet over the top of the pipe.
5. Cleaning Pipe: The pipes shall be thoroughly cleaned before being installed and shall be kept clean until acceptance of the completed work. Open ends of all pipelines shall be provided with a stopper carefully fitted to keep dirt and other substances from entering. This stopper shall remain in place at all times when installation is not in progress.
6. Cutting Pipe: Whenever a pipe requires cutting, to fit into the line or bring it to the required location, the work shall be performed by an approved method that leaves a smooth, square end. Cut PVC pipe ends shall have burrs removed and the end beveled to match factory bevel. Field spigots shall be stop-marked with a felt tip marker or wax crayon for the proper length of assembly insertion.
7. Jointing Pipe
 - a. General

Before any joints are made in the trench, the Contractor shall demonstrate to the Commission by making a sample joint that methods he will employ conform with the Specifications, will secure a watertight joint, and that the workmen whom he intends to use for this work are familiar with the requirements for making proper joints.

- b. Push-On Gasketed Joints

Prior to making gasketed joints, both mating pipe ends and the gasket shall be cleaned of all foreign material. The gasket shall then be inserted in or stretched over the cleaned gasket seat and lubricant applied as recommended by the manufacturer and approved by the Commission. The pipe ends shall be carefully aligned and pushed together to meet the required manufacturer's insertion depth. There shall be no shoulder or unevenness of any kind along the inside of the pipeline. The method of inserting the spigot into the bell shall be as recommended by the manufacturer and approved by the Commission.
 - c. Mechanical Joints

Mechanical joints shall be joined in accordance with the manufacturer's recommendations as approved by the Commission. All nuts shall be tightened uniformly with a torque of not less than 75 or more than 90 foot-pounds.
 - d. Other methods of jointing pipe will be given consideration by the Commission, provided the Contractor furnishes evidence that the proposed method is equal to or better than the specified methods, and further, provided that the proposed method has been successfully used and that the joint has previously been manufactured by the company from whom the Contractor proposes to purchase pipe.
 - e. All jointing material and workmanship shall be in accordance with the manufacturer's recommendations as approved by the Commission.
- 7. Tracer Wire: All water mains shall have tracer wire secured with duct tape to the top of the pipe at ten (10) foot centers. The tracer wire shall be continuous for the full length of the pipeline. Continuous conductivity shall be maintained and tested. Underground splice connections shall be made with solderless split bolt connectors and taped to pipe.
 - 8. Detector Tape: Install visual detection tape 12 inches below the surface at final grade.
 - 9. Restrained joints and joint restraint systems shall be assembled in accordance with the manufacturer's recommendations. Tie rod nuts shall be uniformly tightened and double nutted to prevent movement. Joint restraint systems shall be field protective coated with two coats of a bituminous coating after assembly.
 - 10. Connections to existing work shall be made by the Contractor in the presence of the Commission at such a time and in such manner as directed and approved by the Commission. The Contractor shall notify the consumers in the area to be affected by the shut-off. All valves necessary for making connections will be operated by the Commission. The Contractor shall complete the connections with the greatest possible speed and all work shall proceed without interruption until the existing system is returned to operation, so that the public will be inconvenienced as little as possible.
 - 11. Buttresses and anchors shall be installed at all caps, horizontal bends, tees, branches and vertical bends as required in the Contract Documents, Standard Details, and as directed by the Commission.

C. Field Tests

1. General

- a. All portions of water mains and appurtenances shall be tested. The Commission shall have the final decision as to the methods used.
- b. During installation water mains will be visually inspected for compliance with these specifications and the contract documents by the Commission with the assistance of the Contractor. Further inspections and tests will be conducted by both parties after the section of pipeline being inspected and tested has been backfilled and has had ample time for the curing of buttresses.
- c. The Contractor shall schedule all tests with the Commission at least 48 hours in advance of the test, and shall conduct all tests in the presence of the Commission. On Commission Capital Projects, the Commission will witness one test at no cost to the Contractor. Should the pipeline fail the first Commission witnessed test, the Contractor shall reimburse the Commission for all costs resulting from such additional tests so required until the pipeline passes the test(s). The Contractor shall also reimburse the Commission for the cost of inspection if the Contractor is not prepared for any test, or for additional tests required.
- d. The pipeline shall be flushed free of all debris, silt, earth, gravel, rock or other foreign material. It shall be done in a manner to prevent debris or flushing water from entering the existing water mains.
- e. Control and/or treatment of the discharge of chlorinated water used for flushing, cleaning, or testing operations shall comply with all current applicable local, state, and federal regulations. Costs associated with the control or treatment procedures shall be the Contractor's responsibility.
- f. Any defective work which shows up while conducting tests shall be replaced or repaired as approved by the Commission by the Contractor at his expense.
- g. Water mains shall be tested in sections dictated by the operational breaks noted on the Contract Documents or as approved by the Commission.
- h. No water mains shall be connected to existing mains, except through 3/4" loading line, at any point until they have been tested and chlorinated.
- i. All stub valves shall be open and testing will be through caps or blow-offs at buttress.
- j. After approval of test results by the Commission, the Contractor shall drain the line and connect to existing mains.
- k. After connection to existing mains the Contractor shall refill and flush the lines and the Commission Inspector will check to see that the chlorine residual is back to acceptable levels before any water services are installed.

- I. Once the line is permanently tied into the Commission system the line shall remain charged unless directed otherwise by the Commission.
- 2. Chlorination and Field Tests
 - a. General
 - 1) When mains are completed, they shall be flushed, chlorinated, and tested. The Contractor shall furnish all labor, tools, materials, and equipment necessary to perform the tests specified and to chlorinate the water mains.
 - 2) Testing and tying in will be coordinated through the Commission. Under no circumstances shall any existing valves or fire hydrants be operated by the Contractor without prior approval of the Commission.
 - 3) The section of water main being tested shall be filled from an existing fire hydrant or main as designated by the Commission. The Contractor shall furnish an approved backflow preventer at the point of supply. When charging and testing water mains which are not sufficiently close to existing water mains, the Contractor may use an approved potable water truck to haul water from an approved source.
 - b. Chlorination, Dechlorination, Flushing, and Bacteriological Testing
 - 8/9/10 1) When the water mains are completed, each section (between operational breaks) shall be flushed, chlorinated and sampled in accordance with AWWA C651 "Disinfecting Water Mains" standard. Calcium Hypochlorite or approved equal shall be discharged into the water main near the point where the water main is being charged. This solution shall be of such strength and quantity as may be necessary to provide 25 parts per million residual chlorine after 24 hours, in the section of water main being charged.
 - 8/9/10 2) After the 24 hour (minimum) disinfection period and final flushing, the water mains shall be tested for bacteriological contamination. Two (2) samples shall be taken 24 hours apart for each section of main completed by a State Certified sampler and tested by a State Certified Laboratory at the expense of the Contractor. Sampling locations will be designated by the Commission Inspector and shall be taken in the presence of that Inspector. Samples not taken in the presence of the inspector shall be repeated at no additional cost to the Commission. Should the chlorine residual or bacteriological results not be satisfactory, the Contractor shall flush and re-chlorinate the water main until satisfactory results are obtained.
 - 3) The discharge of chlorinated water into a sanitary sewer without permission from the Commission Inspector is prohibited. Permission will be granted on a case by case basis depending on chlorine content, geographic location and quantity.

- 4) The discharge of all water on the ground surface shall be in accordance with all applicable federal, state and local requirements.
- 8/9/10 5) Water main dechlorination shall be performed by a professional dechlorination company or by a utility contractor that has received approval by the Commission. Dechlorination approval will only be granted to a contractor that has successfully demonstrated the proper use of approved dechlorination equipment. Contractor dechlorination approval will have a three month duration.
- c. Hydrostatic Testing
 - 1) Water mains and appurtenances shall be hydrostatically tested between operational breaks by the Contractor, in the presence of the Commission, in accordance with AWWA C600 and as specified herein.
 - 2) The pressure in the main shall be increased to 200 psi at the highest point of the section of main under test, provided the design static pressure is under 150 psi. Where the design static pressure is over 150 psi, the test pressure shall be 50 psi above static pressure. This test pressure shall be maintained, without pumping for at least two (2) hours. Should this test show the main to be defective, the Contractor shall remedy such defects and retest the main as specified above. This procedure shall be repeated until the test requirements are met.
 - 3) In the event that air is trapped within the main to be tested, the Contractor, with Commission approval, shall make additional taps at his expense to release the trapped air. Locate these taps at proposed service locations whenever possible.
 - 5) Hydrostatic testing against a closed valve shall not be permitted.
- d. Continuity Testing for Non-Metallic Pipe
 - 1) After backfilling, the Contractor shall test the tracer wire to demonstrate electrical continuity between valve boxes and through the length of the non-metallic pipeline installed. The Contractor shall schedule all tests with the Commission at least 48 hours in advance. Any discontinuity shall be located, repaired, and retested at the Contractor's expense until continuity is demonstrated.

4.0 METHOD OF MEASUREMENT

A. Water Mains

Measurement for furnishing and installing water mains will be made horizontally along the center line of the pipe for each size and type of pipe without deduction for fitting or valves less than 4 inches in diameter.

B. Fire Hydrant Leads

Measurement for furnishing and installing fire hydrant leads will be made along the centerline of the pipe from the valve to the hydrant

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
2. The prices bid for furnishing and installing water mains shall include the following:
 - a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250.
 - b. Furnishing and installing granular pipe bedding materials and concrete for pipe fitting anchorages and buttresses as shown on the Standard Details and as required elsewhere in the Contract Documents.
 - c. Furnishing and installing restrained joints and/or joint restraint systems where required by the Contract Documents.
 - d. Abandonment of existing water mains and appurtenances.
3. Payment will be made for contingent items when approved by the Commission.

B. Water Mains and Fire Hydrants

Payment for furnishing and installing water mains and fire hydrant leads, complete and in place, will be made per linear foot of the size and type of pipe installed at the unit price bid. The price(s) bid shall include traffic control, furnishing and installing all pipe, fittings, jointing and restraining materials, tracer wire and test stations where required, buttresses, strapping, cradling, testing of the installation, removal and disposal of pavement, removal and disposal of sidewalk, removal and disposal of paved ditches, removal and disposal of curb and gutter, providing an approved spoil site, and disposing of all spoil or excess materials; backfilling, suitable bedding and backfill materials, all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, milling, paving, pavement materials, removing existing buttresses when necessary, connecting to existing pipelines, structures; testing, temporary bracing and protection of the utility poles and obtaining authorization from the utility companies, and all incidentals required to complete the work.

****END OF SECTION 02551****