

SECTION 02731

SANITARY SEWER FORCE MAINS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewage force mains.

1.02 UNIT PRICES

- A. Measurement for payment for pipe is on a unit price per linear foot basis. Measurement will be taken along the centerline of the pipe from end to end. Payment will be made per foot of force main installed, complete in place including pipe, fittings, excavation, bedding, backfill and special backfill, shoring, earthwork, connections to existing manholes and pipe, accessories, inspection and testing.

1.03 SUBMITTALS

- A. Conform to requirements of all provisions and section of these specifications.
- B. Submit proposed methods, equipment, materials, and sequence of operations for force main construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.
- C. Submit shop drawings and design calculations for joint restraint systems using reinforced concrete encasement of pressure pipe and fittings.
- D. Submit test reports as specified in Part 3 of this Section.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE AND FITTINGS

- A. Conform to requirements of Section 02610 - Ductile Iron Pipe and Fittings.

2.02 PVC PIPE

- A. Conform to requirements of Section 02620 - PVC Pipe.
- B. Provide lined ductile iron fittings conforming to Section 02610 - Ductile Iron Pipe and Fittings.

### 2.03 POLYETHYLENE PIPE AND FITTINGS

- A. Conform to requirements of Section 02619 - High Density Polyethylene (HDPE) Solid all Pipe

### 2.04 CENTRIFUGALLY CAST FIBERGLASS PIPE AND FITTINGS

- A. Conform to requirements of Section 02618 - Centrifugally Cast Fiberglass Pipe.

### 2.05 THRUST RESTRAINT

- A. Unless otherwise shown on the Drawings, provide concrete thrust blocking for force mains up to 12-inches in diameter, to prevent movement of buried lines under pressure at bends. Blocking shall be Portland cement concrete, as specified in Section 03305 - Concrete for Utility Construction. Place concrete in accordance with details on the Drawings. Place thrust blocks between undisturbed ground and the fittings. Anchor fittings to thrust blocks so that pipe and fitting joints are accessible for repairs. Concrete shall extend from 6 inches below the pipe or fitting to 12 inches above.
- B. For all force mains larger than 12 inches in diameter, and where indicated on the Drawings, provide restrained joints conforming to the requirements of the force main pipe material specifications. Restrained joints shall be installed for the length of pipe on both sides of each bend or fitting for the full length shown on the Drawings.
- C. Horizontal and vertical bends between zero and 10 degrees deflection angle will not require thrust blocks or harnessed or restrained joints.
- D. Horizontal and vertical bends greater than 10 degrees deflection angle shall have thrust restraint as shown on the Drawings.
- E. Reinforced concrete encasement of force main pipe and fittings may be used in lieu of manufactured joint restraint systems. Alternate joint restraint systems using reinforced concrete encasement shall conform to the following design requirements.
  - 1. Design calculations shall be performed and sealed by a Professional Engineer licensed in the State of Texas.
  - 2. Design calculations shall be based upon soil parameters quantified in the geotechnical report for the site where the alternative thrust restraint system is to be installed. If data is not available for the site, use parameters recommended by the geotechnical engineer.
  - 3. The design system pressure shall be the specified test pressure.

4. The following safety factors shall be used in sizing the restraint system:
  - a. Apply a factor of safety equal to 1.5 for passive soil resistance.
  - b. Apply a factor of safety equal to 2.0 for soil friction.
5. The encasement shall be contained entirely within the standard trench width and terminate on both ends at a pipe bell or coupling.
6. Concrete encasement reinforcement steel shall be designed for all loads including internal pressure and longitudinal forces. Concrete design shall be in accordance with ACI 318.

### PART 3 EXECUTION

#### 3.01 PIPE INSTALLATION BY OPEN-CUT

- A. Perform excavation, bedding, and backfill in accordance with Section 02227 - Excavation and Backfill for Utilities.
- B. Wrap ductile-iron pipe and fittings with polyethylene wrap in accordance with requirements of Section 02630 - Polyethylene Wrap. Polyethylene wrap shall not be installed on ductile iron pipe protected by a cathodic protection system.
- C. Install pipe in accordance with the pipe manufacturer's recommendations and as specified in the following paragraphs.
- D. Install pipe only after excavation is completed, the bottom of the trench is fine graded, bedding material is installed, and the trench has been approved by the Owner's Representative.
- E. Install pipe to the line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in the trench so the interior surfaces of the pipe follow the grades and alignment indicated. Provide bell holes where necessary.
- F. Install pipe with the spigot ends toward the direction of flow. Form a concentric joint with each section of adjoining pipe so as to prevent offsets.
- G. Keep the interior of pipe clean as the installation progresses. Where cleaning after laying the pipe is difficult because of small pipe size, use a suitable swab or drag in the pipe and pull it forward past each joint immediately after the joint has been completed. Remove foreign material and debris from the pipe.
- H. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where

provided. Use of backhoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by the Owner's Representative.

- I. Keep excavations free of water during construction and until final inspection.
- J. When work is not in progress, cover the exposed ends of pipes with an approved plug to prevent foreign material from entering the pipe.
- K. Where sanitary sewer force main is to be installed under an existing waterline with a separation distance of less than 2 feet, install one full joint length of pipe centered on the waterline and maintain a minimum 6-inch separation distance.

3.02 PIPE INSTALLATION OTHER THAN OPEN-CUT

- A. For installation of pipe by augering or jacking conform to requirements of specification sections for augering or jacking work.

3.03 HYDROSTATIC TESTING

- A. After the pipe and appurtenance have been installed, test line and drain. Prevent damage to the Work or adjacent areas. Use clean water to perform tests.
- B. The Owner's Representative may direct tests of relatively short sections of completed lines to minimize traffic problems or potential public hazards.
- C. Test pipe in the presence of the Owner's Representative.
- D. Test pipe at 150 psig or 1.5 times design pressure of the pipe, whichever is greater. Design pressure of the force main shall be the rated total dynamic head of the lift station pump.
- E. Test pipe at the required pressure for a minimum of 2 hours according to requirements of UNI-B-3.
- F. Maximum allowable leakage shall be as calculated by the following formula:

$$L = (S) (D) (P^{0.5}) / 133,200$$

Where:        L        Leakage in gallons per hour.  
                  S        Length of pipe in feet.

- D Inside diameter of pipe in inches.
- P Pressure in pounds per square inch.

- G. Correct defects, cracks, or leakage by replacement of defective items or by repairs as approved by the Owner's Representative.
- H. Plug openings in the force main after testing and flushing. Use cast iron plugs or blind flanges to prevent debris from entering the tested pipeline.

### 3.04 PIGGING TEST

- A. After completion of hydrostatic testing and prior to final acceptance, test force mains longer than 200 feet by pigging to ensure piping is free of obstructions.
- B. Pigs: Provide proving pigs manufactured of an open-cell polyurethane foam body, without any coating or abrasives which would scratch or otherwise damage interior pipe wall surface or lining. Pigs shall be able to pass through reductions of up to 65 percent of the nominal cross-sectional area of the pipe. Pigs shall be able to pass through standard fittings such as 45-degree and 90-degree elbows, crosses, tees, wyes, gate valves, or plug valves, as applicable to the force main being tested.
- C. Test Execution: Pigging test shall be conducted in the presence of the Owner's Representative. Provide at least 48-hours notice of scheduled pigging of the force main prior to commencing the test.

END OF SECTION