

## SECTION 33 34 00

### SANITARY SEWER FORCEMAINS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes
  - 1. Pressure Sewer Lines.
- B. Related Sections
  - 1. Section 33 05 05 - Trenching and Backfilling.
  - 2. Section 33 05 23.16 - Utility Pipe Jacking.
  - 3. Section 33 05 23.13 - Utility Horizontal Directional Drilling.
  - 4. Section 33 31 00 - Sanitary Utility Sewer Piping.

##### 1.02 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
  - 1. Force Main Pipe. Measurement will be by lineal feet along the centerline of pipe from center of structure to center of structure or from center of MH to end of pipe for the type and size of pipe specified. Payment will constitute compensation in full for all Work and cost to furnish and install pipe, excavation, backfill and compaction, pipe encasement, testing, and surface restoration.
  - 2. Fittings shall be addressed per Section 33 10 00.
  - 3. Locate Lead Box: Measurement shall be based on each locate lead box installed. Payment at the Bid Unit Price shall include all items and labor required to complete the Work.
  - 4. All other Work and costs of this Section shall be incidental to the Project included in the Total Base Bid.

##### 1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
  - 1. D16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
  - 2. D1248 - Polyethylene Plastics Extrusion Materials for Wire and Cable.
  - 3. D2321 - Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity – Flow Applications.
  - 4. D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
  - 5. D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
  - 6. F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
  - 7. F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  - 8. G8 - Test Method for Cathodic Disbonding of Pipeline Coatings.
- B. American Water Works Association (AWWA)
  - 1. C104 - Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
  - 2. C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
  - 3. C110 - Standard for Ductile Iron and Gray Iron Fittings, 3 Inches through 48 Inches.
  - 4. C111 - Rubber-Gasketed Joints for Ductile Iron Pressure Pipe and Fittings.

5. C151 - Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
6. C153 - Standard for Ductile Iron Compact Fittings, 3 Inches through 12 Inches, for Water and Other Liquids.
7. C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inches through 12 Inches (100 mm to 300 mm), for Water Distribution.
8. C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 Inches through 63 Inches (100 mm to 1,575 mm), for Water Distribution and Transport.

#### 1.04 SUBMITTALS

- A. Submit the following items consistent with Section 01 33 00:
  1. Product Data and Certificates of Compliance for each diameter of pipe and fittings to be installed.
  2. Manufacturer's recommendations for installation of pipe.

## **PART 2 PRODUCTS**

#### 2.01 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

- A. The polyvinyl chloride pressure pipe (P.V.C. pressure pipe) covered by this specification shall conform to ASTM D-1784, Type I, Grade I, and A.S.T.M. D-2241 SDR-PR 26 100 psi, latest revision, and shall have a minimum working pressure of 100 psi.
- B. All pipes shall be marked P.V.C. ASTM D-1120 and ASTH D-2241. The class pressure rating or SDR shall be plainly marked on the pipe.
- C. Rubber Gasket Joints
  1. All P.V.C. pressure pipe shall have rubber gasket joints in accordance with ASTM D-1869. Joints shall be kept clean and properly lubricated prior to installation.
- D. Fittings
  1. All fittings shall be compatible with the pipe supplied and shall have a minimum working pressure of 100 psi (SDR-PR 26).

#### 2.02 AIR AND VACUUM VALVES

- A. Sewage air and vacuum valves shall be Apco sewage valves, Model Number 401, as manufactured by Valve and Primer Corporation, or approved equal.
- B. The valve shall be furnished with a 2" inlet, a 2" shut off valve and all other accessories needed for back flushing such as a 1" blow off valve, a 1/2" shut off valve and a quick disconnect coupling with back flushing hose.
- C. An operating and maintenance instruction manual shall be included with the valve.

#### 2.03 AIR RELIEF MANHOLE

- A. Air relief manholes shall be constructed of precast concrete sections with R-4 joints as designed on the plans and shown on the standard plate in accordance with A.S.T.M. designations C-139.

#### 2.04 UTILITY STRUCTURES

- A. Conform to the requirements of Section 33 39 00.

2.05 TRACER WIRE FOR FORCEMAIN

- A. 1/8" galvanized aircraft wire clear PVC coated to 3/16".
- B. 1/8" 304 stainless steel wire clear PVC coated to 3/16".
- C. #12AWG solid copper or copper clad steel (CCS) wire with 30mil high density polyethylene (HDPE) insulating jacket.
- D. Connectors shall be "wire nut" or "twist on" type connectors filled with silicone waterproofing sealant suitable for direct bury applications according to UL 486D test standard. Connectors shall be DryConn™ connectors as manufactured by King Innovation or approved equal

**PART 3 EXECUTION**

3.01 PIPE INSTALLATION

- A. All pipes shall be laid to the depth shown on the contract drawings.
- B. The Contractor shall satisfactorily maintain the specified cover by the use of grade boards or lasers.
- C. If additional bends are required, where not shown on the drawings to maintain alignment around curves, the Contractor shall provide the required number and be compensated at the unit price as proposed on the bid form.
- D. The following is the maximum allowable joint deflection for the ductile iron pipe.

4 inch	4° 25'	5°
6 inch	4° 25'	5°
8 inch	3° 51'	5°
10 inch	3° 42'	5°
12 inch	3° 8'	5°
14 inch	2° 39'	3°
16 inch	2° 21'	3°
18 inch	2° 7'	3°

3.02 LAYING PIPE

- A. Handling of Forcemain Material into Trench
  1. Proper implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work.
  2. All pipe, fittings and valves shall be carefully lowered into the trench in such a manner as to prevent damage to forcemain materials and protective coatings and linings.

3. Under no circumstances shall forcemain materials be dropped or dumped into the trench.
- B. Jointing:
1. All types of joints shall be made in strict accordance with manufacturer's specifications.
  2. All pipe ends shall be wire brushed, wiped clean, and kept clean until joints are made.
  3. For the assembly of the push-on type of joint, additional cleaning shall be required with a power driven wire brush or other means just prior to assembly until clean, bright, metallic surface shows in the locations where the metal inserts of the gasket will contact the socket and spigot after assembly.
- C. Cutting Pipe
1. Untapered spigot ends may be encountered when pipes are cut in the field
  2. The cut end should be beveled with a heavy file or other suitable apparatus, removing any sharp or rough edges to protect the gasket from injury and ensure ease of assembly.
- D. Blocking
1. All fittings, at points of bends in the line, shall be solidly braced against the end or sides of the trench. All fittings shall be blocked with concrete.
  2. The concrete to have a minimum compressive strength of 2000 psi and the block to be of sufficient size so as not to exert more than 2000 lbs. per square foot pressure against the soil.

### 3.03 FIELD QUALITY CONTROL

- A. Hydrostatic Tests Required
1. The pressure test shall be held at a hydrostatic pressure equal to twice the maximum design pressure or a minimum hydrostatic pressure of 70 pounds per square inch for a period of one hour in the presence of the Engineer.
    - a. At the end of the one hour period, the pressure drop shall be read.
    - b. Next, the Contractor shall add water to the system through a water meter capable of measuring increments to a tenth of a gallon until the water system has been restored to the original hydrostatic pressure as stated above.
    - c. The quantity of water added to the system shall then be read to the nearest tenth of a gallon.
    - d. The maximum allowable quantity of water which may be added to the water system is one pint per hour for each section of force main tested between consecutive valves or plugs.
    - e. A suitable container graduated in increments of one pint shall be used as the source of water.
  2. Procedure
    - a. Each valved section of pipe shall be slowly filled with water from a safe source, and the specified test pressure, measured at the lowest point of elevation, shall be applied by means of a water pump connected to the pipe in a manner satisfactory to the Engineer.
    - b. The pump, pipe connections, gauge and all necessary apparatus shall be furnished by the Contractor and shall be approved by the Engineer before any test is made.
    - c. All necessary pipe taps shall be made by the Contractor as may be directed by the Engineer.
  3. Expelling Air Before Test
    - a. Before applying the specified test pressure, all air shall be expelled from the pipe.
    - b. In the instances where air relief manholes exist, the pipe shall be filled with water until all air has been expelled through the air relief valve.
    - c. The shut off valve between the force main and air relief valve shall be closed and the air relief valve disconnected from the system
  4. Examination Under Pressure

- a. Any cracked or defective pipes, valves and fittings discovered in consequence of the pressure test shall be removed and replaced by the Contractor with sound material and the test shall be repeated until satisfactory to the Engineer.
  - b. The pressure test shall be performed in a manner approved by the Engineer
  - c. The Contractor shall correct all faulty materials or workmanship discovered during the tests and all such corrections shall be made to the satisfaction of the Engineer at the Contractor's expense.
- B. Electrical Conductivity Test
1. After the backfilling operation has been completed, the Contractor will be required to conduct an electrical conductivity test in the presence of the Engineer.
  2. The test shall be run after complete backfilling to assure that no electrical connections have broken loose in the joints during the backfilling operation.
  3. Direct current of 350 amperes, plus or minus 10 percent, shall be passed through the pipe line for 5 minutes. Current flow through the pipe shall be measured continuously on a suitable ammeter and shall remain steady without interruption or excessive fluctuation throughout the 5 minute test period.
  4. Insufficient current or intermittent current or arcing, indicated by large fluctuations of the ammeter needle, shall be evidence of defective electrical contact in the pipeline. The cause shall be isolated and corrected, and the section retested to meet the requirements.
  5. Cables from the power source to the ends of the section of pipe under test should be of sufficient size to carry the test current without over heating or excessive voltage drop. Usable size will be in the range of 2/0 to 4/0 A.W.G.
  6. Connections to the pipe or appurtenances should be of a type that will not cause arcing or welding action. Any pipe coating or paint that may be removed for the test, shall be replaced when the test is completed.
  7. Caution shall be exercised at all times, when the electrical conductivity test is conducted.
  8. The electrical conductivity test shall not be required for P.V.C. forcemain.

**END OF SECTION**