

## SECTION 33 31 23

### SANITARY SEWERAGE

#### FORCE MAIN PIPING

#### PART 1: GENERAL

##### 1.1 SCOPE

- A. The work covered by this section relates to sanitary sewer force mains including materials permitted, installation, and testing.

##### 1.2 SUBMITTALS

- A. Conform to requirements of Section 01 00 04 - Submittals.
- 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. Force mains 12 inches in diameter and larger: Submit shop drawings and design calculations for joint restraint systems using restrained joint pipe and fittings or reinforced concrete encasement of pressure pipe and fittings.
- D. Submit qualifications, proposed methods, equipment, materials, and sequence for acceptance testing of pipeline.
- E. Submit test reports as specified in Part 3 of this Section.

##### 1.3 QUALITY ASSURANCE

- A. Qualifications. Install sanitary sewer force main that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections. Perform testing in accordance with Section 33 01 10.13 - Pressure and Leakage Tests.
- B. Regulatory Requirements.
  - 1. Install pressurized sewer lines to meet minimum State mandated separation distance from potable water line. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. Install new sanitary sewers no closer to water lines than 10 feet in all horizontal directions. Where water and pressurized sanitary sewer lines cross, a minimum vertical separation in accordance with state and/or local standards is required when the water line passes above the sanitary sewer main. Where separation distance cannot be achieved, sanitary sewers shall be constructed of ductile iron piping or encased in reinforced concrete encasement (as detailed on the Drawings) for a minimum distance of 10 feet either side of the crossing.

## PART 2: PRODUCTS

### 2.1 PIPE AND FITTING MATERIAL SCHEDULE

- A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified in one or more of the following Sections:
  - 1. Section 33 05 19.02 - Ductile-Iron Utility Pipe Water (Contractor Furnished). Provide linings in accordance with this Section.
  - 2. Section 33 05 33.13 – Polyethylene Utility Pipe (Wastewater).
  - 3. Section 33 05 31.11 - Polyvinyl Chloride (PVC) Gravity Sewer Pipe.
- B. A force main must be a minimum of 4 inches in diameter, unless it is used in conjunction with a grinder pump station.

### 2.2 THRUST RESTRAINT

- A. Unless otherwise shown on Drawings, provide concrete thrust blocking for force mains up to 12-inches in diameter, to prevent movement of buried lines under pressure at bends, tees, caps, valves and hydrants. Blocking shall be Portland cement concrete. Place concrete in accordance with details on Drawings. Place thrust blocks between undisturbed ground and fittings. Anchor fittings to thrust blocks so that pipe and fitting joints are accessible for repairs.
- B. For force mains larger than 12 inches in diameter, and where indicated on Drawings, provide restrained joints conforming to requirements of force main pipe material specifications. Install restrained joints for length of pipe on both sides of each bend or fitting for full length where shown on Drawings.
- C. Horizontal and vertical bends between zero degrees and the maximum allowable deflection angle will not require thrust blocks or harnessed or restrained joints.
- D. Horizontal and vertical bends between the maximum allowable deflection angle and 90 degrees deflection angle shall have thrust restraint as shown on Drawings, or specified herein
- E. Provide thrust restraint at tees, plugs, blowoff drains, valves, hydrants, and caps, as indicated.
- F. 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 following design requirements.
  - 1. Design calculations shall be performed and sealed by Professional Engineer licensed in the State in which the project is being completed.
  - 2. Base design calculations upon soil parameters quantified in geotechnical report for site where alternative thrust restraint system is to be installed. When data is not available for site, use parameters recommended by geotechnical engineer.
  - 3. The design system pressure shall be specified test pressure.

4. The following safety factors shall be used in sizing restraint system:
  - a. Apply factor of safety equal to 1.5 for passive soil resistance.
  - b. Apply factor of safety equal to 2.0 for soil friction.
5. Contain concrete encasement entirely within standard trench width and terminate on both ends at pipe bell or coupling.
6. Concrete encasement reinforcing 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**

#### **3.1 PIPE INSTALLATION BY OPEN-CUT**

- A. Perform excavation, bedding, and backfill in accordance with Section 31 23 33 - Excavation and Backfill for Utilities.
- B. Wrap ductile-iron pipe and fittings with polyethylene wrap in accordance with requirements of Section 33 06 00 - Polyethylene Wrap (Wastewater) where soil conditions require installation. Do not install polyethylene wrap on ductile iron pipe protected by cathodic protection system or fusion bonded or polyurethane coated fittings.
- C. Tracer wire shall be installed with pipe in accordance with the requirements of Section 33 05 97.16 – Markers for Utility Identification.
- D. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.
- E. Install pipe only after excavation is completed, bottom of trench is fine graded, bedding material is installed, and trench has been approved by Owner.
- F. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.
- G. Install pipe with spigot ends toward direction of flow. Form concentric joint with each section of adjoining pipe so as to prevent offsets.
- H. Keep interior of pipe clean as installation progresses. Where cleaning after laying pipe is difficult because of small pipe size, use suitable swab or drag in pipe and pull it forward past each joint immediately after joint has been completed. Remove foreign material and debris from pipe.
- I. 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 back-hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Owner.
- J. Keep excavations free of water during construction and until final inspection.
- K. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.

- L. Where sanitary sewer force main is to be installed under existing water line with separation distance of less than 2 feet, install one full joint length of pipe, minimum 18 foot length, centered on water line and maintain minimum 6-inch separation distance.
- M. A force main must terminate below a manhole invert with the top of the pipe matching the water level in the manhole at design flow.
- N. Any high point must include a sewage type air release valve.

### 3.2 PIPE INSTALLATION OTHER THAN OPEN-CUT

- A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification section 33 04 07.13 – Utility Directional Drilling.

### 3.3 HYDROSTATIC TESTING

- A. After pipe and appurtenance have been installed, test line and drain. Prevent damage to Work or adjacent areas. Use clean water to perform tests.
- B. Owner may direct tests of relatively short sections of completed lines to minimize traffic problems or potential public hazards.
- C. Test pipe in presence of Owner.
- D. Test pipe at 150 psig or 1.5 times design pressure of pipe, whichever is greater. Design pressure of force main shall be rated total dynamic head of lift station pump, but never exceed the ultimate design pressure of the pipe.
- E. Maximum allowable leakage shall be as calculated by following formula:

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

- Where:
- L = Leakage in gallons per hour.
  - S = Length of pipe in feet.
  - P = Inside diameter of pipe in inches.
  - D = Pressure in pounds per square inch.

- F. No leakage permitted on exposed pipes and fittings.
- G. Correct defects, cracks, or leakage by replacement of defective items or by repairs as approved by MOAW.
- H. Plug openings in force main after testing and flushing. Use cast iron plugs or blind flanges to prevent debris from entering tested pipeline.

**END OF SECTION 33 31 23**