

SECTION 02535
PIPE INSTALLATION

PART 1 - GENERAL

1.1 Summary

A. Description of Work

This Section includes handling, installation and testing of pipe, fittings, specials, and appurtenances as indicated or specified.

B. Related Work Specified Elsewhere

Excavation, Filling, and Backfilling for Structures.....Section 02321
Utility StructuresSection 02532
Sewer Line ConstructionSection 02560

1.2 Quality Assurance

A. Applicable Standards and Specifications

1. American Society for Testing and Materials (ASTM):

ASTM D2321 - Underground Installation of Flexible Thermoplastic Sewer Pipe.

ASTM F1417 - Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

2. Federal Specifications (FS):

SS-S-00210 - Sealing Compound, Preformed Plastic, For Expansion Joints and Pipe Joints.

1.3 Delivery, Storage and Handling

A. Handle in a manner to ensure installation in sound and undamaged condition.

1. Do not drop or bump.

2. Use slings, lifting lugs, hooks, and other devices designed to protect pipe, joint elements, linings, and coatings.
- B. Ship, move, and store with provisions to prevent movement or shock contact with adjacent units.
 - C. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

PART 2 - MATERIALS

Specified in Section 02560.

PART 3 - EXECUTION

3.1 Installation

- A. Verify all preliminary work has been completed prior to any sewer line construction.
- B. Use equipment, methods, and materials ensuring installation to lines and grades indicated.
 1. Maintain within tolerances specified or acceptable laying schedule.
 - a. **Alignment:** +1 inch per 100 feet in open cut or tunnel.
 - b. **Grade:** +1 inch per 100 feet.
 2. Do not lay on blocks unless pipe is to receive total concrete encasement.
 3. Obtain acceptance of method proposed for transfer of line and grade from control to the Work.
- C. Install pipe of size, materials, strength class, and joint type with embedment indicated.
- D. Install pipe with spigot or tongue ends in direction of flow. Obtain Engineer approval for deviations there from.

- E.** Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during installation and at discontinuance of installation.
 - 1.** Close open ends of pipe with snug-fitting closures.
 - 2.** Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.
 - 3.** Remove water, sand, mud, and other undesirable materials from trench before removal of end cap.
- F.** Brace or anchor as required to prevent displacement after establishing final position.
- G.** Perform only when weather and trench conditions are suitable. Do not lay in water.
- H.** Observe extra precaution when hazardous atmospheres might be encountered.

3.2 Jointing

A. General Requirements

- 1.** Locate joint to provide for differential movement at changes in type of pipe embedment, impervious trench checks, and structures.
 - a.** Not more than 8 inches from structure wall, or
 - b.** Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or pipe bedding material.
 - c.** As indicated.
- 2.** Perform conforming to manufacturer's recommendations.
- 3.** Clean and lubricate all joint and gasket surfaces with lubricant recommended.

4. Use methods and equipment capable of fully seating or making up joints without damage.
5. Check joint opening and deflection for specification limits.

3.3 Temporary Plugs:

- A. Furnish and install temporary plugs. Temporary plugs are to be installed
In the pipe at the end of each workday and the trench is to be completely backfilled.

3.4 Field Testing:

1. Acceptance Tests for Gravity and Low-Pressure Pipelines:

a. Alignment:

- (1) Sewer shall be inspected by flashing a light between manholes or by physical passage where space permits.
- (2) Sewer shall be inspected by videotaping entire line, from first to last manhole. During entire video recording, water must be flowing in the invert at a rate of at least one gallon per minute. The footage from the starting manhole must be recorded on the video screen, as well as the pipe run identification.
- (3) Contractor shall clean pipe of excess mortar, joint sealant, and other dirt and debris prior to inspection.
- (4) Determine from Videotaping or Physical Inspection:
Presence of any misaligned, displaced, or broken pipe.
Presence of visible infiltration or other defects.
- (5) Correct defects as required prior to conducting leakage tests.

b. Air Testing: Perform air tests per ASTM C828 for clay or F1417 for plastic pipe at Contractor's option in lieu of exfiltration test for pipe sizes up to and including 42 inches in diameter and will include all lateral pipes to the property lines where applicable.

(1) Furnish all facilities required including:

Necessary piping connections.
Test pumping equipment.
Pressure gauges or manometers.
Bulkheads.
All miscellaneous items required.

(2) Obtain approval of equipment and acceptance of methods proposed for use.

(3) Conduct initial test on first run of pipe laid by each crew.

(a) Include a minimum of 10 lengths of pipe but not to exceed 500 feet.

(b) Perform before backfilling.

(c) Satisfactorily complete test before crew is permitted to continue pipe installation.

(4) Test remaining pipe in sections determined by Contractor and approved by Engineer.

(5) A wetted interior pipe surface on clay pipe is desirable and will produce more consistent test results.

(6) Plug ends of line and cap or plug all connections to withstand internal test pressures. Test plugs must be securely braced within the manholes.

(7) Introduce low-pressure air until internal air pressure is 4.0 psi greater than the average back pressure of ground water above the pipe invert.

- (8) Allow two to five minutes for internal air pressure and temperature to stabilize. Adjust pressure to 3.5 psi and start test.
- (9) Time required for pressure to decrease 1.0 psi from 3.5 to 2.5 psig greater than the average back pressure of any ground water above the pipe invert shall not be less than the minimum test time in the following table for the given diameters:

Minimum Test Times (Minutes) in Plastic Pipe			
<u>Nominal Pipe Diameter</u>	<u>Minimum Time (min.)*</u>	<u>Length for Min. Time</u>	<u>Time for Longer Length(s)*</u>
4 in.	3:46	597 ft.	0.380 L
6 in.	5:40	398 ft.	0.854 L
8 in.	7:34	298 ft.	1.520 L
10 in.	9:26	239 ft.	2.374 L
12 in.	11:20	199 ft.	3.418 L
15 in.	14:10	159 ft.	5.342 L
18 in.	17:00	133 ft.	7.692 L
21 in.	19:50	114 ft.	10.470 L
24 in.	22:40	99 ft.	13.674 L
27 in.	25:30	88 ft.	17.306 L
30 in.	28:20	80 ft.	21.366 L
33 in.	31:10	72 ft.	25.852 L
36 in.	34:00	66 ft.	30.768 L

* For 3.5 kPa (0.5 psi) pressure test drop, required test times shall be exactly one-half the values shown.

- (10) If the section of line to be tested includes more than one pipe size, calculate the test duration for the length of each size and add the test durations to arrive at the total duration of the testing period for the section.
- (11) Repeat test as necessary after all leaks and defects have been repaired.

2. Acceptance Tests for Pressure Pipelines:

- a. Perform hydrostatic pressure and leakage tests.
 - (1) Conform to AWWA C600 procedures. As modified herein.
 - (2) Perform after backfilling.
- b. Test separately in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs.
 - (1) Select test segments such that adjustable seated valves are isolated for individual checking.
 - (2) Contractor shall furnish and install test plugs.
 - (a) Including all anchors, braces, and other devices to withstand hydrostatic pressure on plugs.
 - (b) Be responsible for any damage to public or private property caused by failure of plugs
- c. Limit fill rate of line to available venting capacity. Fill rate shall be regulated to limit velocity in lines when flowing full to not more than 0.05 to 1 fps.
- d. Owner shall make water for testing available to Contractor at nearest source.
- e. Pressure and Leakage Test:
 - (1) Test pressure shall not exceed 1.25 times the working pressure at the highest point along the test section.
 - (2) Test shall be at least 2-hour duration. Maintain pressure throughout test within 5 PSI of the test pressure.
 - (3) Leakage test shall be conducted concurrently with the pressure test.
 - (4) Acceptable when leakage does not exceed that determined by the following formula (in English Units):
 - L = 0.0000075SD(P)^{1/2}, in which
 - L = allowable leakage, in gallons per hour
 - S = length of pipe tested, in feet
 - D = nominal diameter of the pipe, in inches
 - P = average actual leakage test pressure in psig.

- (5) These formulas are based on an allowable leakage of 11.65 gpd/mile/in of nominal diameter at a pressure of 150 psi.
- (6) When testing against a closed metal-seated valve, an additional leakage per closed valve of 0.0078 gal/hr/in of nominal valve size shall be allowed.
- (7) Repeat test as necessary.
 - (a) After location of leaks and repair or replacement of defective joints, pipe, fittings, valves or hydrants. All visible leaks are to be repaired regardless of the amount of leakage.
 - (b) Until satisfactory performance of test.
- (8) Engineer will witness pressure and leakage test.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

Measurement and payment will be made in accordance with Section 01210 - Measurement and Payment.

**** END OF SECTION 02535 ****