

## SECTION 02530

### SEWER PIPE

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Furnish and install all piping as shown on the Drawings, described in the Specifications and as required for a complete and operable system.
- B. Related Sections:
  - 1. Section 02080: Precast Concrete Sectional Manholes
  - 2. Section 02302: Earthwork

##### 1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. C923 Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
  - 2. D3034 Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
  - 3. D3212 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
  - 4. F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

##### 1.03 SUBMITTALS

- A. Submit the following to the Engineer for review:
  - 1. Data to show that the products specified in this Section conform to the Specification requirements.
  - 2. Leakage testing plan.
  - 3. Test results as required herein.

##### 1.04 QUALITY ASSURANCE

- A. All materials and equipment furnished under this Section shall be of a manufacturer who has been regularly engaged in the design and manufacture of the materials and equipment for a period of at least five years.
- B. Factory Quality Control: The Contractor shall test all products as required herein and by the reference specifications.
- C. Field Quality Control:
  - 1. The owner will inspect the work and witness testing.
  - 2. The Contractor shall:
    - a. Perform leakage tests.
    - b. Perform mandrel tests.

- c. Be responsible for the costs of additional inspection by the Owner from non-compliance.

#### 1.05 POTHOLING (CHECK ON LOCATIONS) NOT USED

### PART 2 - PRODUCTS

#### 2.01 GENERAL

- A. Pipe sizes are nominal diameter unless otherwise noted.
- B. All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.
- C. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the completed product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified hereinafter.

#### 2.02 POLYVINYL CHLORIDE PIPE (PVC)

- A. Pipe and Fittings:
  - Gravity Sewer: Polyvinyl chloride sewer pipe; ASTM D3034, SDR 35.
  - Pressure Sewer: Polyvinyl chloride sewer pipe; ANSI/AWWA C900
- B. Joints:
  - Gravity Sewer: Elastomeric gasket joints; ASTM D3212, ASTM F477.
  - Pressure Sewer: Integral Bell Joint; ASTM D3139, Gasket; ASTM F477.

#### 2.03 REINFORCED CONCRETE PIPE (RCP) (NOT USED)

#### 2.04 DUCTILE IRON PIPE (DIP)

- A. Pipe and Fittings:
  - Gravity Sewer: Ductile iron sewer pipe; ASTM A746
  - Pressure Sewer: Ductile iron sewer pipe; ASTM A377, ANSI/AWWA C110/A21.10
- B. Joints:
  - Gravity Sewer: Rubber Gasket Joints; AWWA C111-12
  - Pressure Sewer: Rubber Gasket Joints; AWWA C111-12

### GRAVITY SEWER

#### 2.05 VITRIFIED CLAY PIPE (VCP) (NOT USED)

#### 2.06 CONNECTION DEVICES

- A. Flexible and Transition Couplings for Gravity Sewer: Flexible and transition couplings shall be elastomeric plastic or synthetic rubber resistant to sewage and grease, chemicals and normal sewer gases. Couplings shall be designed to slip over the outside of the pipes being connected with a snug fit. Coupling shall be

held in place and sealed with full circle stainless steel shear band and two stainless steel band clamps, one around each end. Couplings shall be specifically manufactured for making the transition between various types of pipe with different outside diameters. Couplings shall meet the requirements of the Uniform Plumbing Code. No concentric coupling reducers or donut transition couplings will be allowed. The following are acceptable couplers:

1. PVC SDR-35 Slip Couplers.
  2. Romac 1000 Series and/or 5000 Series "Shear" coupler (or approved equal)
  3. Romac SSI Full Circle Clamp (or approved equal)
- B. Flexible and Transition Couplings for Pressure Sewer:
1. Mechanical Joint Sleeve.
  2. Fernco with stainless steel bands.
- C. Other Devices: Other equivalent connection devices will be considered provided that they are made of elastomers resistant to sewage and grease, chemicals and normal sewer gases. Metallic parts shall be stainless steel.

## 2.07 APPURTENANCES

- A. Furnish and install all necessary guides, inserts, anchors and assembly bolts; washers and nuts, hangers, supports, gaskets, and flanges; all other appurtenant items shown on the Drawings, specified or required for the proper installation and operation of the piping; devices included in or on the piping equipment; and piping accessories.

## PART 3 - EXECUTION

### 3.01 FLOW CONTROL

- A. Divert sewage flows and storm water around all sewer and drain replacement work areas, including building connection sewer replacement. Furnish, install, and operate pumps, plugs, conduits, and other equipment as needed to divert the flow of sewage around the pipeline reach in which work is to be performed. Plugs shall be designed so that all or any portion of the sewage can be released. The plug shall be provided with a tag line. The pumping system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during a rainstorm. If pumping is required on a 24-hour basis and engine drives are required, engines shall be equipped in a manner to keep noise to a minimum. Standby pumps shall be provided as required. Pumping shall be done in such manner as will not damage public or private property or create a nuisance or health menace. After the work has been completed, flow shall be restored to normal. Existing sewers to be abandoned shall be disconnected after the new service is operating.
- B. Notify residents of the impending work and request their cooperation to minimize flows shortly before working in each area.

### 3.02 BUILDING CONNECTION REPLACEMENT (NOT USED)

### 3.03 PIPING INSTALLATION

#### A. Storage and Handling:

1. Great care shall be exercised to prevent damage to the pipe during handling, transportation or storage. Pipe shall not be stored on rough ground and rolling of the pipe on the coating will not be permitted. Any damaged pipe sections shall be repaired or replaced at the expense of the Contractor to the satisfaction of the Engineer.
2. Store polyvinyl chloride pipe under opaque covers which do not transmit ultraviolet light.
3. Each pipe section shall be carefully inspected before installation, and all damaged areas replaced to the satisfaction of the Engineer. All costs associated with the removal and/or replacement of damaged or defective pipe as determined by the Engineer shall be borne by the Contractor.

#### B. General Piping Installation:

1. Trenching, bedding, and backfill for buried piping shall be as shown on the Drawings and as specified in Section 02302, Earthwork For Pipelines.
2. Lay each length of pipe on a firm bed with a true bearing for its entire length between bell holes. Excavate holes of only sufficient size to accommodate the bell at each joint location. Adjust line and grade by scraping away, filling in and tamping the earth to provide true grade to fit the barrel of the pipe. No wedging or blocking up of the pipe shall be permitted. The trench and bell holes shall be kept free from water during the laying of the pipe.
3. Except when noted specifically otherwise on the Drawings, whenever piping leaves a structure, concrete encasement, or concrete bedding, a joint capable of angular deflection shall be provided within 12 inches of the structure, encasement or bedding.
4. All dirt and foreign matter shall be removed from the pipe interior prior to installation and all joints shall be thoroughly cleaned before joining.
5. Plug open ends of pipe when construction is not underway.
6. Lay pipe upgrade with bell end uphill, unless specifically shown otherwise.
7. After making each joint, rigidly secure the pipe in place by backfilling to the top of the pipe at the center, but not as to fill the bell hole nor interfere with the next jointing operation. Use appropriate compaction equipment (e.g., hand held powder puff, etc.) to work the pipe bedding underneath the haunches of the pipe, along the side of the pipe, and over the top of the pipe as shown on the Drawings to receive the required compaction.

#### C. Installation Specifics:

1. Polyvinyl chloride pipe for sewer mains and laterals:
  - a. Install pipe in accordance with the manufacturer's instructions, except that the minimum radius of curvature for a pipeline shall be no less than twice the minimum radius published in the pipe manufacturer's instructions and deflection angles within fittings

- shall be no more than half of the maximum deflection angle published in the manufacturer's instructions.
- b. Place pipe within the installation areas at least 24 hours prior to installation to permit temperature equalization.
  - c. Pipe ends shall be cut squarely, reamed and deburred inside and out.
  - d. Clean pipe ends and bells of dirt, grease and other foreign materials prior to making the joint.
2. Comply with Standard Specifications for Public Works Construction maximum deviation from line and grade.

### 3.04 CLEANING

- A. Prior to testing, and before connecting new sewer to existing sewer system, the inside of each sewer main and public sewer lateral shall be thoroughly cleaned of all dirt, loose scale, sand and other foreign material. Cleaning shall be by flushing with water or bailing as appropriate for the size and type of the pipe and method of cleaning shall be favorably reviewed by the Engineer. Do not allow dirt and debris to enter existing sewer system. Contractor shall be responsible for collecting discharge cleaning water and disposing of it at the Owner's wastewater treatment plant ponds. Contractor shall not discharge cleaning water into existing sewer unless otherwise approved by the Owner. The Owner will provide water for sewer cleaning at no additional cost to the Contractor. Contractor shall provide valving and backflow protecting per Owner's approval at temporary water connection(s).

### 3.05 PERMANENT PLUGS

- A. Clean interior contact surfaces of all pipes to be cut off or abandoned. Construct a non-shrink grout plug in the end of all pipes unless otherwise specified. Minimum length of non-shrink grout plugs shall be 6 inches. All plugs shall be watertight and capable of withstanding all internal and external pressures without leakage.

### 3.06 LEAKAGE TESTS

- A. General:
  1. Perform leakage tests on all sewer mains and public sewer laterals installed in this project.
  2. Furnish all equipment, materials, personnel, and supplies to perform the tests.
  3. Pressure gauges and metering devices shall be of a type, accuracy and calibration acceptable to the Engineer. The Engineer may require certification of the gauges and meters by an independent testing firm at the Contractor's expense.
  4. Leakage tests shall be performed on all piping at a time agreed upon and in the presence of the Engineer.
- B. The leakage test shall be made after all pipe is installed and backfilled. If testing is not completed prior to placing permanent resurfacing or other surface

restoration, the Contractor shall be responsible for the cost to remove and replace pavement or other restored surface features to correct the sewer pipelines or manholes due to a failed test. The Contractor may conduct preliminary tests prior to backfill at no additional cost to the Owner. If the Contractor elects to conduct preliminary tests, he shall provide any necessary temporary thrust restraint, and shall retest as set forth herein.

- C. Test Procedure for Gravity Sewer: Leakage tests shall be air pressure tests conducted as follows:
1. Furnish all materials, equipment and labor for making an air test. Air test equipment shall be favorably reviewed by the Engineer.
  2. The Contractor may conduct at his expense an initial air test of the sewer main after densification of the backfill, but prior to installation of the public sewer laterals. Such tests will be considered to be for the Contractor's information and need not be performed in the presence of the Engineer.
  3. Each section of sewer mains and public sewer laterals shall be tested between successive manholes, or in sections if favorably reviewed by the Engineer, by plugging and bracing all openings in the sewer main and the upper ends of all sewer laterals. Prior to any air pressure testing, all pipe plugs shall be checked with a soap solution to detect any air leakage. If any leaks are found, the air pressure shall be released, the leaks eliminated, and the test procedure started over again. The Contractor has the option of wetting the interior of the pipe prior to the test.
  4. The final leakage test of the sewer main and public sewer laterals, shall be conducted in the presence of the Engineer as per 5 through 6 below:
  5. Air shall be introduced into the pipeline until 4.0 psi (27kPa) gage pressure has been reached; or if groundwater is present, 4.0 psi (27kPa) above the computed pressure exerted by the average adjacent groundwater. Reduce the flow of air and maintain the air pressure within plus or minus 0.5 psi (3kPa) for at least two minutes to allow the internal air temperature to reach equilibrium. Terminate flow of air into the pipeline. Pressure in the pipeline shall be constantly monitored by a gage and hose arrangement separate from hose used to introduce air into the line. A blowoff valve shall be provided on the test apparatus to prevent over pressurizing the pipeline.
  6. After the temperature has stabilized and no air leaks at the plugs have been found, the air pressure shall be permitted to drop until the internal pressure has reached 3.0 psi (21kPa) gage pressure; or when groundwater is present, 3.0 psi (21kPa) above the computed pressure exerted by the average adjacent groundwater. A stopwatch or sweep-second-hand watch shall be used to determine the time lapse required for the air pressure to decrease an additional 1.0 psi (7kPa).
  7. If the time lapse (in seconds) required for the air pressure to decrease the additional 1.0 psi (7kPa) exceeds that shown in the Table, Low Pressure Air Test for Sewers, in the Standard Specifications for Public Works Construction, the pipe shall be presumed to be within acceptance limits for leakage.
  8. If the time lapse is less than that shown in this table, the Contractor shall make the necessary corrections to reduce the leakage to acceptance limits without additional compensation.

T = Time in seconds for pressure to drop to 2.5 psi (17kPa) gage pressure.

D = Inside diameter of pipe in inches (mm).

D. TEST PROCEDURE FOR PRESSURE SEWER:

1. General: Perform leakage tests on the inlet pipe, outlet pipe and interconnected piping. Furnish all equipment, material, personnel, test media and supplies to perform the tests and make all taps and other necessary temporary connections. The test pressure, allowable leakage and test medium shall be as specified. Perform leakage tests on all piping at a time agreed upon and in the presence of the Engineer or Inspector.
2. Buried Piping: Perform the leakage test for buried piping after all pipe is installed and backfilled. However, preliminary tests may be conducted prior to backfill. If preliminary tests are conducted, provide any necessary temporary thrust restraint.
3. Accessories: It is the responsibility of the Contractor to block off or remove equipment, valves, gauges, etc., which are not designed to withstand the full test pressure.
4. Testing Apparatus: Provide pipe taps, nozzles and connections as necessary in piping to permit testing, addition of test media, and draining lines and disposal of water, as is necessary. Plug these openings in a manner favorably reviewed by the Engineer or Inspector after use. Provide all required temporary bulkheads.
5. Correction of Defects: If leakage exceeds the allowable, repair or replace the installation and repeat leakage tests as necessary until conformance to the leakage test requirements specified herein have been fulfilled. All visible leaks shall be repaired even if the pipeline passes the allowable leakage test.
6. Reports: Keep records of each piping test, including:
  - Description and identification of piping tested.
  - Test pressure.
  - Date of test.
  - Witnessing by Contractor and Engineer/Inspector.
  - Test evaluation.Remarks, to include such items as:
  - a. Leaks (type, location).
  - b. Repairs made on leaks.
  - c. Submit test reports to the Engineer or Inspector.
7. Testing Specifications:
  - a. Method: AWWA C600, as modified herein.
  - b. Duration: Four hours.
  - c. Pressure: 150psi measured at lowest point of section of pipeline being tested.
  - d. Medium: Potable water.
  - e. Allowable Leakage: Leakage shall be defined as the quantity of test medium that must be added to the section of pipeline being tested to maintain the specified test pressure for the specified test duration. Maximum allowable leakage shall be as specified in AWWA C600.

### 3.07 MANDREL TEST OF POLYVINYL CHLORIDE PIPE

- A. Deflection Testing: Maximum allowable deflection (reduction in vertical inside diameter) of the installed pipe shall not exceed 5%. The Contractor shall provide acceptable 9-prong mandrel, or other approved device to check the maximum allowable deflection of pipes 21 inches in diameter and smaller thirty (30) days after installation. Testing must be performed by hand pulling a nine-point mandrel a diameter of 95% of the average inside diameter. The allowable limits shall be:

<b>Pipe Diameter</b>	<b>Maximum Allowable Sag</b>
4-inch	1/4-inch
6-inch	3/8-inch
8-inch to 10-inch	1/2-inch
12-inch	3/4-inch
15-inch	1-inch

- B. At any location where the pipe deflection is determined to exceed the allowable limits by the Engineer, the Contractor shall remove, re-bed, restore the surface (e.g., paving or landscaping) and if required, replace the pipe at no additional cost to the Owner. No rerounding of the pipe shall be allowed. The Contractor shall reduce the pipe deflection to 5% or less, as determined by the Engineer. The pipeline shall then be re-tested after thirty (30) days of installation for deflection, CCTV inspection, and air tightness.

END OF SECTION