

SECTION 02622

POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1 - GENERAL

1.1 SCOPE

- A. The work covered by this section includes furnishing all labor, equipment, and materials required to install and test polyvinyl chloride (PVC) pressure pipe, including valves, unions, fittings, couplings, adaptors, and accessories, as shown on the Drawings and/or specified herein.
- B. The Contractor's attention is called to the fact that all PVC piping and accessories are not necessarily shown completely on the Drawings which are more or less schematic. However, the Contractor shall furnish and install all piping indicated or required for proper operation of the equipment or services requiring such piping.

1.2 QUALITY ASSURANCE

- A. The Contractor, at the Engineer's request, shall furnish a certificate from the manufacturer of the pipe and fittings that the manufacturer is fully competent and capable of manufacturing PVC pipe and fittings of uniform texture and strength that will fully comply with these specifications and have so manufactured this class of pipe in sufficient quantities to be certain that it will meet all normal field conditions of usage. The manufacturer must have adequate equipment and quality control facilities to be sure that each extrusion of pipe is uniform in texture, dimensions, and strength.
- B. All pipe shall be tested and inspected at the place of manufacture for all requirements of the latest ASTM and Commercial Standard tests and certified copies of the test reports covering each shipment shall be submitted to the Engineer prior to laying.
- C. Each length of pipe and each fitting shall have the following data clearly marked on each piece:
 - 1. Nominal size
 - 2. Type and grade of material and ASTM or AWWA standard
 - 3. SDR, DR, class, or schedule rating

4. Manufacturer
5. National Sanitation Foundation's seal of approval

1.3 SHOP DRAWINGS AND ENGINEERING DATA

Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.

1.4 STORAGE AND PROTECTION

- A. PVC piping and accessories shall be stored and protected in accordance with the requirements of the section entitled "Storage and Protection" of these Specifications.
- B. PVC pipe and fitting shall be stored under cover.
- C. All pipe and accessories shall be stored aboveground and fully supported so as not to bend or deflect excessively under its own weight. Height of stacked pipe shall not exceed 4 feet. Bundled pipe shall not be stacked more than two (2) bundles high.
- D. Kinked, flattened, buckled, broken, or otherwise defective pipe and fittings shall not be used and shall be removed from the site.
- E. Pipe shall be handled using nylon slings. Wire rope slings or chains shall not be used.

1.5 GUARANTEE

Provide a guarantee against defective equipment and workmanship in accordance with the requirements of the section entitled "Warranties and Bonds" of these Specifications.

1.6 COLOR

Pipe used to convey water shall be white or blue. Pipe used to convey wastewater shall be any color other than white, blue or purple.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

- A. The pipe and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties.
- B. The manufacturer shall provide waterstops, acceptable to the Engineer, which shall be applied to the outside of plastic pipe when the pipe is to be enclosed in any structure where concrete or mortar is used which will prevent leakage along the outer wall of the barrel of the pipe.
- C. No single piece of pipe shall be laid on any project covered by this specification unless it is found to be generally straight. Such pipe shall have a maximum ordinate as measured from the concave side of the pipe not to exceed 1/16-inch per foot of length. If the deviation from straightness exceeds this requirements, then the particular piece of pipe shall be rejected for use until it can comply with this provision.
- D. Wyes, tees, bends, and adapters and any other fittings required or directed by the Engineer shall be constructed of ductile iron as directed in section entitled "Ductile Iron Piping and Ductile Iron and Cast Iron Fittings" of these Specifications. Engineering data from such fittings showing cross-sectional views with dimensions shall be provided and such data and fittings shall be approved by the Engineer prior to their use. The materials used in the manufacturer of fittings shall conform with the requirements for the pipe with which they shall be used and any variation of such requirements shall be subject to the approval of the Engineer. Fittings shall have wall thicknesses equal to or greater than that of the pipe to which they are joined.

2.2 PIPE

- A. PVC pipe shown on the Drawings to be buried underground and used to convey water or wastewater shall have push-on joints unless otherwise noted on the Drawings. All pipe material shall be Grade 1, Type I, polyvinyl chloride (PVC) in accordance with ASTM D 1784, Class 12454-B. All pipe material for water lines shall be National Sanitation Foundation approved for use with potable water. Pipe in sizes 1½ inches through 3 inches shall be SDR 21 with 200 psi pressure rating in accordance with ASTM D 2241 or DR 14 Class 200 in accordance with AWWA C900. Pipe in sizes 4 inches and larger for water lines shall be either SDR 21 with 200 psi pressure rating in accordance with ASTM D 2241, DR 14 Class 200 in accordance with AWWA C 900 or DR 21 with 200 psi pressure

rating in accordance with AWWA C905, depending on which is called for on the Drawings. Pipe in sizes 4 inches and larger for wastewater shall be either SDR 21 with 200 psi pressure or SDR 26 with 160 psi pressure rating both in accordance with ASTM D2241, DR 14 Class 200 or DR 18 Class 150 both in accordance with AWWA C900, DR 21 with 200 psi pressure rating or DR 26 with 160 pressure rating both in accordance with AWWA C905, depending on which is called for on the drawings. If the type pipe is not shown on the drawings, the choice shall be the Contractor's option. Maximum lengths of pipe shall not exceed 20 feet.

2.3 FITTINGS

- A. Fittings in PVC piping system for pipe 2 inches or smaller conveying water or wastewater may be PVC where the required fittings are available and with the approval of the Engineer. Such fittings shall comply with the requirements of ASTM D-2467 for Moulded, Schedule 80, socket welded fittings.
- B. Fittings for pipe larger than 2 inches or unavailable in PVC shall be cast iron or ductile iron as specified in section entitled "Ductile Iron Pipe and Ductile Iron and Cast Iron Fittings" of these Specifications. Engineering data for fitting showing cross-sectional views with dimensions shall be provided and such data and fittings shall be approved by the Engineer prior to their use. Connections between cast iron or ductile iron fittings and PVC pipe shall be made by use of special adaptors similar to Mueller Transition Gland A-399 by Mueller Company, Transition Gasket F6340 by Clow Corporation or a similar transition which has been approved by the Engineer. The joint shall be mechanical joint for ductile iron or cast iron as described in section entitled "Ductile Iron Piping and Ductile Iron and Cast Iron Fittings" of these Specifications.

2.4 JOINTS (PUSH-ON)

- A. The joints shall be designed so that the pipe and fittings may be connected on the job without the use of solvent cement or any special equipment. The push-on joint shall be single rubber gasket joint designed to be assembled by the positioning of a continuous, molded, rubber ring gasket in an annular recess in the pipe or fitting entering pipe into the socket thereby compressing the gasket radially to the pipe to form a positive seal. The gasket and the annular recess shall be so designed and shaped that the gasket is locked in place against displacement as the joint is assembled. Details of the joint design and assembly shall be in accordance with the joint manufacturer's standard practice. The joints shall be designed so as to provide for the thermal expansion or contraction experienced with a total temperature change of at least 75°F in each joint per length of pipe. The joint shall comply with ASTM D 3139. Gasket shall comply with ASTM F 477.

- B. Lubricant furnished for lubricating joints shall be nontoxic, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe material, and shall not impart color, taste, or odor to water. The lubricant containers shall be labeled with the manufacturer's name.
- C. Gaskets shall meet all applicable requirements of ANSI A21.11. Gasket dimensions shall be in accordance with the manufacturer's standard design dimensions and tolerances. The gasket shall be of such size and shape as to provide an adequate compressive force against the spigot and socket after assembly to effect a positive seal under all combinations of joint and gasket tolerances. The trade name or trademark, size, mold number, gasket manufacturer's mark and year of manufacture shall be molded in the rubber on the back of the gaskets.
- D. Gaskets shall be vulcanized natural or vulcanized synthetic rubber. No reclaimed rubber shall be used. When two (2) hardnesses of rubber are included in a gasket, the soft and hard portions shall be integrally molded and joined in a strong vulcanized bond. They shall be free of porous areas, foreign material, and visible defects. The required properties of the gasket rubber and the required method of test are given in the following table:

<u>Property</u>	<u>ASTM Test Method</u>	<u>Main Body of Gasket</u>	<u>Harder Portion (if used)</u>
Hardness, Durometer "A"	D676 at 76±	45 - 70	78 - 90
Minimum Ultimate Tensile, psi	D412	2,000	1,200
Minimum Ultimate Elongation, Percent*	D412	300	125
Minimum Aging Percent**	D572***	60	60

* Of original length

** Of original values of tensile and ultimate elongation.

*** Oxygen pressure method: After 96 hours at 70 ±1°C at 300 +10 psi.

- E. The gasket manufacturer shall set up such quality control procedures as will insure the gasket's meeting the requirements of this standard. He shall furnish a monthly report of representative quality control test results to the pipe manufacturer.

- F. A sample push-on fitting shall be submitted to the Engineer for examination and approval prior to delivery of any pipe.

2.5 DETECTOR WIRE

A continuous single strand solid copper #12 AWG detector wire shall be placed approximately 6" over all PVC pipe. Provide a continuous loop to ground level in all valve boxes.

PART 3 - EXECUTION

3.1 LAYING PIPE

- A. All provisions with respect to trenching, backfilling, bedding, and pipe laying shall conform to the applicable requirements of the sections entitled "Earthwork" and "Ductile Iron Piping and Ductile Iron and Cast Iron Fittings" of these Specifications.
- B. All provisions with respect to connections and existing utilities shall comply with the applicable requirements of the section entitled "Ductile Iron Piping and Ductile Iron and Cast Iron Fittings" of these Specifications.
- C. When a joint consists of a PVC flange and a metal flange, the metal flange shall be flat faced and furnished with a full face resilient gasket.
- D. Valves shall be installed with the flow arrow in the proper direction.
- E. Service line taps into PVC pipe shall be made using tapping saddle constructed for use on PVC pipe. The saddle shall be constructed of bronze or brass, shall have all stainless steel bolts or screws, and have a resilient rubber gasket to provide a positive, watertight seal.
- F. PVC pipe laid underground shall have a minimum of 48 inches of cover in traffic areas and 30 inches of cover in non-traffic areas.
- G. A 3-inch wide detector tape shall be buried 12 inches above the top of the pipe continuously along the entire length of pipe.

3.2 EXISTING UTILITIES

- A. All existing sewers, water lines, gas lines, underground conduits, telephone lines, sidewalks, curbs, gutters, pavements, electric lines, or other utilities or structures in the vicinity of the work shall be carefully protected by the Contractor from

damage at all times. Where it is necessary for the proper accomplishment of the work to repair, remove and/or replace any such utility, the work shall be done under the provisions set forth in the "General Conditions." No separate payment shall be made for removing and replacing and/or repairing damaged existing sewers; water, gas, electric, telephone lines or conduits; or other utilities, culverts, drains, or conduits of similar existing services or structures. Similar repair and replacement of sidewalks, curbs, gutters, and pavements are provided elsewhere in these Specifications.

- B. Sewers shall be laid at least 10 feet, horizontally, from any existing or proposed water main. If conditions prevent the 10 foot separation, the sewer may be constructed closer to a water main if it is laid in a separate trench and if the elevation of the invert of the water main is at least 18 inches above the top of the sewer.
- C. When sewers cross under water mains, the top of the sewer shall be at least 18 inches below the bottom of the water main. If necessary, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint cast iron or ductile iron pipe for a distance of 10 feet on each side of the sewer. One full length of water main shall be centered over the sewer so that both joints will be as far from the sewer as possible.
- D. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both water main and sewer shall be constructed of mechanical-joint cast iron pipe and shall be pressure tested to assure water tightness.
- E. When sewer lines cross under culverts where the sewer and the culvert are less than 18 inches apart, the sewer line shall be encased in concrete or shall be constructed of ductile iron if shown on the drawings.

3.3 FIELD TESTING

- A. After all piping has been placed and backfilled between the joints, each run of newly laid pipe, or any valved section thereof, shall be tested by the Contractor in the presence of the Engineer, and tests shall be continued until all leaks have been made tight to the satisfaction of the Engineer.
- B. All piping shall be subject to hydrostatic gauge pressure equal to the rated pressure class of the pipe being tested. The allowable leakage shall be as shown in Table 1. The duration of the test shall be minimum of 2 hours.
- C. The Contractor shall take all precautions necessary to protect any equipment that might be damaged by the pressures used in the tests. Delicate equipment shall be valved off, removed, or otherwise protected.

- D. All piping shall be securely anchored and restrained against movement prior to application of test pressures. Prior to the pressure test, pipe laid in trenches shall be partially backfilled adequately to secure the pipe during the test. All joints, fittings, and valves will be left open where possible. All exposed pipe, fittings, valves, and joints shall be carefully examined during the pressure test.
- E. Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants, blow-offs, or air release valves are not available at the high places, the Contractor shall make the necessary taps at points of highest elevation before the test is made and insert plugs after the test has been completed.
- F. Any excessive leakage developing during the test shall be corrected at the Contractor's expense. If the defective portion cannot be located, the Contractor, at his expense, shall remove and reconstruct as much of the original work as necessary to obtain a facility meeting the specified leakage limits.
- G. After all test on any section have been completed to the satisfaction of the Engineer, the Contractor shall carefully clean, blow out, and drain the line of all water to prevent the freezing of the same. The Contractor shall also demonstrate to the satisfaction of the Engineer that any and all lines are free from obstructions and foreign material.
- H. The Contractor shall bear the complete cost of the tests, including set-up, labor, temporary piping, blocking, gauges, bulkheads, water, air, soap solutions, and any other materials required to conduct the tests.

TABLE 1

ALLOWABLE LEAKAGE
U. S. GALLONS PER 100 JOINTS PER HOUR

Pipe Diameter (inches)	Test Pressure (psi)			
	50	100	150	200
4	0.35	0.50	0.60	0.75
6	0.53	0.75	0.90	1.10
8	0.70	1.00	1.20	1.40
10*	0.88	1.25	1.50	1.75
12*	1.05	1.50	1.80	2.10
14*	1.23	1.75	2.10	2.45
16*	1.41	2.00	2.40	2.80

*Single-gasket coupling is one joint. Twin-gasket coupling is two joints.

3.4 DISINFECTION

After installation and testing, all potable water piping shall be disinfected in accordance with the requirements of AWWA C601.

END OF SECTION 02622.