



The Plastic Pipe and Fittings Association

PPFA

POLYVINYL CHLORIDE (PVC) PLASTIC PIPE AND FITTINGS FOR WATER SERVICE

Specification Sheet: POLYVINYL CHLORIDE (PVC) PLASTIC PIPE AND FITTINGS FOR WATER SERVICE

1. PRODUCT NAME

PolyVinyl Chloride (PVC) Plastic Pipe and Fittings for Water Service Systems

2. MANUFACTURER

For a list of member manufacturers, contact the Plastic Pipe and Fittings Association, 800 Roosevelt Road, Building C, Suite 20, Glen Ellyn, IL 60137; phone: (630) 858-6540; fax: (630) 790-3095; website: www.ppfahome.org.

3. PRODUCT DESCRIPTION

Basic Use: Water service systems. PVC pipe can be used in residential, commercial and industrial applications. Pipe and fittings are joined by elastomeric sealing connections or solvent cementing. There is a full complement of PVC fittings and valves available for potable water applications. Pipe and fittings are available in sizes $\frac{1}{2}$ inch through 24 inches.

Connections between PVC pipe and other piping materials are accomplished by use of adapter fittings. Adapter fittings connect by threaded joints, compression connections or flanges.

Composition and Materials: PVC is a thermoplastic material, and the PVC compounds commonly meet the requirements of ASTM D 1784 Cell Class 12454 or 14333.

Grades: PVC pipe is available in a variety of wall thicknesses, including Schedule 40, Schedule 80, Sched-

ule 120, SDR 13.5, SDR 17, SDR 21, SDR 26, SDR 32.5, SDR 41, SDR 64, DR 14, DR 18, or DR 25.

Schedule 40, Schedule 80, and Schedule 120 PVC plastic pipes have outside diameters that correspond to Iron Pipe Size (IPS) steel pipe. IPS OD PVC pipe is also available in SDR wall thicknesses. Pressure ratings for Schedule pipe vary with pipe size, but each SDR pipe has the same pressure rating for all sizes. The DR pipe is mostly Cast Iron Pressure pipe OD.

Limitations: PVC plastic pipe is pressure rated at 73.4° F. These ratings decrease as temperature increases. Consult manufacturer's instructions for details.

Some plastics are affected by ultraviolet radiation. Pigments are added to PVC to make pipe and fittings resistant to degradation. While pipe and fittings may be exposed to sunlight during construction, prolonged exposure should be avoided. When use conditions require longer term exposure, consult the pipe or fitting manufacturer.

4. TECHNICAL DATA

Applicable Standards: ASTM D 1785 or CSA CAN/CSA B137.3 apply to IPS Schedule 40, Schedule 80, and Schedule 120 PVC pipe. ASTM D 2241 applies to IPS OD PVC pipe having wall thicknesses based on SDR 13.5, SDR 17, SDR 21, SDR 26, SDR 32.5, SDR 41, or SDR 64. AWWA C900 or

AWWA C905 apply to PVC pipe having wall thicknesses based on DR 14, DR 18, or DR 25. This pipe carries pressure class ratings that differ from the pressure ratings found on the ASTM standard pipe. ASTM D 2466 or CSA CAN/CSA B137.3 applies to PVC Schedule 40 plastic pipe fittings.

Quality Control: Most pipe and fittings are evaluated and listed by an ANSI accredited third party listing agency (e.g., NSF or UL). These agencies certify PVC piping as conforming with ANSI/NSF 14 and 61 for use in potable water systems and for strength and durability requirements. Contact the manufacturer for any additional information.

Chemical Resistance: PVC pipe and fittings are resistant to normal chemicals encountered in disinfecting potable water systems. PVC piping resists certain chemical actions on the exterior of the pipe when located in hazardous environments. Contact manufacturer for a detailed list of chemicals that PVC piping can resist.

Temperature Rating: PVC pipes carry 73° F pressure ratings that are printed on the pipe. For service at other temperatures, consult the pipe manufacturer. Plumbing codes stipulate a minimum pressure rating of 160 psi at 73.4° F. Most PVC pipe exceeds this code requirement. For full details, see the ASTM Standard or the pipe manufacturer's literature.

TABLE 1
EQUIVALENT LENGTH OF PIPE PVC PIPE FITTINGS (FT.)

Pipe Size (in)	90° Elbow	45° Elbow	Through Tee Run	Through Tee Branch
1/2	1.5	0.8	1.0	4.0
3/4	2.0	1.0	1.4	5.0
1	2.25	1.4	1.7	6.0
1 1/4	4.0	1.8	2.3	7.0
1 1/2	4.0	2.0	2.7	8.0
2	6.0	2.5	4.3	12.0
2 1/2	8.0	3.0	5.1	15.0
3	8.0	4.0	6.3	16.0
4	12.0	5.0	8.3	22.0
6	18.0	8.0	12.5	32.0
8	22.0	10.0	16.5	38.0
10	26.0	13.5	17.5	57.0
12	32.0	15.5	20.0	67.0

Flow Characteristics: PVC plastic pipe does not corrode or accumulate mineral deposits. PVC plastic pipe should be designed for a maximum flow rate of 5 to 8 feet per second. Avoid higher velocities to reduce water hammer.

Pressure loss through PVC is minimal because of the smooth interior wall. The common equation used to size a pressure water piping system is the Hazen-Williams Equation. A Hazen-Williams C factor of 150 is commonly used for PVC plastic pipe even though measured values of 155 to 165 have been obtained. The Hazen-Williams Equation is as follows:

$$f = 0.2083(100)^{1.812} (Q^{1.852}/d^{4.8655})$$

C

Where

f = friction loss per 100 feet in feet of water

C = roughness coefficient

Q = flow rate in gpm

d = inside diameter of pipe in inches

Friction loss for flow through fittings is based on equivalent lengths of pipe. Equivalent lengths of pipe for fitting sizes 1/2 through 12 inches are shown in Table 1. Flow Velocity/Head Loss tables are available from the pipe and fitting manufacturers.

Water Hammer: Intensity of water hammer in PVC pipe is approximately 1/3 the intensity of water hammer in copper or steel pipe. To limit the impact of the water hammer, velocity of flow should be controlled. Piping should be sized to maintain a velocity of less than 8 feet per second in pipe sizes less than 1 inch, and less than 5 feet per second in diameters of 1 1/4 inches or larger.

Laying Lengths: PVC pipe is normally supplied in 20-foot lengths, but other lengths are available.

Trenching and Bedding: PVC pipe should be installed underground in accordance with ASTM D 2774. Pipe trenches should be as narrow as possible but of sufficient width to install pipe. PVC pipe must be installed below recorded frost level.

When rock, hard pan, boulders, or other material that can damage the PVC plastic pipe are encountered, trenches should be over-excavated a minimum of 4 inches for bedding. Bedding on bottom of trench may consist of evenly graded, free-flowing granular material free from stones or rocks greater than 3/4 inch in diameter. Backfill material less than 1/2 inch in diameter should be placed in 6 inch layers around the pipe, with each layer tamped in place. Final compaction is recommended to be 85 percent Proctor Density or greater.

Expansion and Contraction: PVC pipe has a higher expansion and contraction rate than metallic pipe. The coefficient of linear expansion for PVC plastic is 0.000028 in/in/°F. This rate translates into an expansion of 1.01 inches for every 100-feet. with a temperature change of 30° F.

Where small diameter PVC pipe is installed in long straight lengths, with solvent cemented joints, compensation for expansion and contraction must be provided. This can be accomplished by snaking the pipe in the trench. Pipe flexibility allows for compensation of thermal expansion. Additional detailed information can be obtained from the pipe manufacturer.

5. INSTALLATION

Preparatory Work: PVC pipe must be cut square with a wheeled cutter, miter saw, or power saw designed for that use. Pipe ends must be deburred, chamfered and wiped clean and dry.

Methods: Elastomeric connections of PVC pipe are made by lubricating the spigot end of the pipe with joint lubricant compatible with PVC. The spigot end of the PVC pipe is inserted into the gasketed bell end. Do not insert past the stop mark on the spigot end.

Solvent cementing of PVC pipe and fittings is a multi-step process. Use PVC solvent cement conforming to ASTM D 2564 and follow the procedure or instructions found on the container label. In the event of conflicting instructions from the pipe, fittings or cement manufacturer, use a primer and solvent cement conforming to ASTM F 656 in the joining procedure. The joint must be made while the solvent cement is still wet.

When threaded adapter fittings are installed, apply PVC compatible joint tape or paste thread sealant to male threads. Adapter fittings shall be installed in accordance with manufacturer's installation instructions.

Precautions: Joining PVC pipe and fittings should be performed in well-ventilated locations. Contact of primer and solvent cement with the skin must be avoided. Eye protection is recommended during solvent cementing. See ASTM F 402 for more safe handling details.

The installation must prevent the pipe from coming in contact with large rocks or stones. Care must be exercised to avoid rough handling or abrasion of the pipe and fittings.

Pipe and fittings are not intended to be continuously exposed to direct sunlight.

Plumbing Codes: PVC pipe may be used in any water service system, outside of buildings without limitations, in the following model plumbing codes: BOCA National Plumbing Code, IAPMO Uniform Plumbing Code, ICC International Plumbing Code, NAPHCC National Standard Plumbing Code, and SBCCI Standard Plumbing Code.

Verify acceptance and installation of PVC piping systems with the local code enforcement authorities having jurisdiction.

6. AVAILABILITY AND COST

Availability: PVC pipe and fittings are available through local plumbing and waterworks supply wholesalers, hardware stores, and home and farm centers throughout the United States and Canada.

Cost: PVC pipe is less expensive than metallic piping materials used in equivalent water service systems.

7. WARRANTY

PVC plastic pipe and fittings manufacturers generally warrant that their pipe and fittings are free from defects and conform to designated standards. However, most

warranties contain limitations such as, for example, they are only applicable to pipe and fittings installed in accordance with manufacturer's installation instructions. Warranties should be read carefully.

Manufacturers of the pipe and fittings are not responsible for improper use, handling, or installation of the product.

8. MAINTENANCE

Normal maintenance as required.

9. TECHNICAL SERVICES

Manufacturers of PVC pipe and fittings provide technical manuals and engineering data upon request.

10. MORE INFORMATION

Additional product information is available upon request from the Plastic Pipe and Fittings Association, 800 Roosevelt Rd., Building C, Suite 20, Glen Ellyn, IL 60137; (630) 858-6540; fax (630) 790-3095; www.ppfahome.org.

The information herein has been prepared solely from publicly available sources or from consensus positions adopted by manufacturers of these products or other interested parties in the industry. PPFA disclaims warranties, expressed or implied, as to the fitness for any particular purpose or suitability for any specific installation.