



Designation: F1803 – 15 (Reapproved 2019)

Standard Specification for Poly (Vinyl Chloride)(PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter ¹

This standard is issued under the fixed designation F1803; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers requirements for poly(vinyl chloride) (PVC) closed profile sewer pipe and fittings with integral bell and elastomeric seal joints or plain end pipe with couplings in sizes (18 to 60 in.) based on a controlled inside diameter.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 The following safety hazard caveat pertains only to the test methods portion, Section 8, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—Pipe and fittings produced to this specification should be installed in accordance with Practice D2321.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

- D618 Practice for Conditioning Plastics for Testing
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D1784 Specification for Rigid Poly(Vinyl Chloride) (PVC)

¹ This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.62 on Sewer. Current edition approved Aug. 1, 2019. Published August 2019. Originally approved in 1997. Last previous edition approved in 2015 as F1803 – 15. DOI: 10.1520/F1803-15R19.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
- D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
- D2152 Test Method for Adequacy of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
- D2321 Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- D2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- D2444 Practice for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
- D2855 Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets
- D3212 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- F402 Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
- F412 Terminology Relating to Plastic Piping Systems
- F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F679 Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
- 2.2 *Federal Standard:*³
 - Fed. Std. No. 123 Marking for Shipment (Civil Agencies)
- 2.3 *Military Standard:*³
 - MIL-STD-129 Marking for Shipment and Storage

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F412, and abbreviations are in accordance with Terminology D1600, unless otherwise specified. The abbreviation for poly(vinyl chloride) is PVC.

3.2 *Definitions of Terms Specific to This Standard:*

³ DLA Document Services Building 4/D 700 Robbins Avenue Philadelphia, PA 19111-5094 <http://quicksearch.dla.mil/>

3.2.1 *closed profile (CP) gravity sewer pipe, n*—a pipe product consisting of an essentially smooth waterway braced circumferentially or spirally with projections or ribs that are joined by an essentially smooth outer wall (see Fig. 1).

4. Significance and Use

4.1 The requirements of this specification are intended to provide pipe and fittings suitable for nonpressure drainage of sewage and surface water.

NOTE 2—Industrial waste disposal lines should be installed only with the specific approval of the governing code authority since chemicals not commonly found in drains and sewers and temperatures in excess of 140°F may be encountered.

5. Material

5.1 *Basic Materials*—The pipe and fittings shall be made of PVC plastic having a minimum cell classification of 12454 or 12364 as defined in Specification D1784. Homopolymer PVC compounds must meet or exceed the requirements of the above listed minimum cell classification number.

5.2 *Rework Material*—Clean rework material generated from the manufacturer’s own pipe or fittings production may be used by the same manufacturer provided pipe or fittings produced meet all the requirements of this specification.

5.3 *Gaskets*—Elastomeric gaskets shall comply with the requirements described in Specification F477.

5.4 *Lubricant*—The lubricant used for assembly shall be suitable for use with PVC pipe and elastomeric seals for this application and have no detrimental effect on the gasket or on the pipe.

6. Joining Systems

6.1 *Gasketed Joint*—The integral bell gasketed joint, coupling, or fitting joints shall be designed so that when assembled, the gasket (which is attached to either the bell or the spigot) will be compressed radially on the pipe spigot or in the bell to form a water-tight seal. The joints shall be designed to comply with and show no sign of leakage when tested in accordance with 7.7 when assembled with pipe for which they are intended.

6.2 Couplings shall form a water-tight seal when assembled with plain end pipe and show no sign of leakage when tested in accordance with 7.7 when assembled with pipe for which they are intended.

NOTE 3—The outside diameters of products manufactured to this specification are not specified and therefore joint compatibility should be reviewed.

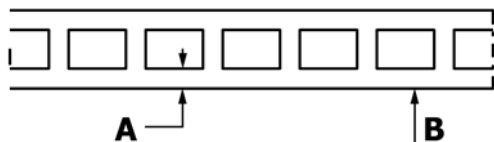


FIG. 1 Typical Closed Profile (CP) (A) Waterway minimum wall (B) Average inside diameter

6.3 The joint shall be designed to avoid displacement of the gasket when assembled in accordance with the manufacturer’s recommendation.

6.4 The assembly of joints shall be in accordance with the manufacturer’s recommendations.

7. Requirements

7.1 *Workmanship*—The pipe and fittings shall be essentially uniform in color, opacity, density, and other properties. The inside and outside surfaces shall be semimatte or glossy in appearance and free of chalking, sticky, or tacky material. The surfaces shall be free of excess bloom; that is, slight bloom is acceptable. The pipe walls shall be free of cracks, holes, blisters, voids, foreign inclusions, or other defects that are visible to the naked eye and that may affect the wall integrity. Bloom or chalking may develop in pipe exposed to direct rays of the sun (ultraviolet radiant energy) for extended periods and consequently these requirements do not apply to pipe after extended exposure to direct rays of the sun.

7.2 Pipe Fitting Dimensions:

7.2.1 *Diameter*—The inside diameter of the pipe shall meet the requirements given in Table 1 when measured in accordance with 8.4.1.

7.2.2 *Wall Thickness*—The minimum wall thickness of the waterway of pipe and fittings fabricated from pipe sections shall meet the requirements given in Table 1 when measured in accordance with 8.4.2. The wall thickness of fittings fabricated from pipes meeting the requirements of Specification F679 are also satisfactory.

7.2.3 *Bell Wall Thickness*—In the case of belled pipe and fittings fabricated from pipe sections, the thickness of the wall in the bell shall be considered satisfactory if it was formed from pipe meeting the previous requirements. For reducing fittings or those with smaller inlets, the minimum wall thickness for each inlet shall be no less than the minimum wall thickness for that size pipe.

7.2.4 Fittings:

7.2.4.1 *Molded Fittings*—Molded fittings conforming to the requirements of Specification F679 may also be used with profile gravity sewer pipe provided an adapter (when required) is used to make the connection. The minimum wall thickness of the molded fittings and adapter shall coincide with the values listed in Table 1 of Specification F679. The thickness in the wall of the adapter bell shall be considered satisfactory if formed from pipe meeting the previous requirements.

7.2.4.2 *Fabricated Fittings*—Fabricated fittings shall be made from the pipe meeting the requirements of this specification, or Specification F679. Fabricated fittings with solvent cement components shall be made in accordance with Practice D2855 and taking cognizance of Practice F402. Unreinforced solvent cement mitted joints shall not be used. Fabricated joints shall be adequately lapped or fusion butt welded and, when needed, additionally reinforced.

7.3 *Pipe Flattening*—There shall be no evidence of splitting, cracking, breaking, or separation of ribs or seams when pipe is tested in accordance with 8.5.

TABLE 1 Pipe Dimensions and Stiffness

Nominal Pipe Size, in.	Minimum Inside Diameter, ^A in. (mm)	Tolerance on Inside Diameter, in. (mm)	Minimum Pipe Stiffness Series 46, lbf/in. ² (kPa)	Waterway Minimum Wall Series 46, in. (mm)
18	17.595 (446.91)	+0.110 (+2.79)	46 (320)	0.070 (1.78)
21	20.690 (525.53)	+0.120 (+3.05)	46 (320)	0.080 (2.03)
24	23.430 (595.12)	+0.140 (+3.56)	46 (320)	0.100 (3.54)
27	26.420 (671.01)	+0.160 (+4.06)	46 (320)	0.115 (2.92)
30	29.410 (747.01)	+0.180 (+4.57)	46 (320)	0.125 (3.18)
33	32.405 (823.09)	+0.190 (+4.83)	46 (320)	0.140 (3.56)
36	35.395 (899.03)	+0.210 (+5.33)	46 (320)	0.150 (3.81)
39	38.385 (974.98)	+0.230 (+5.84)	46 (320)	0.165 (4.19)
42	41.375 (1050.93)	+0.250 (+6.35)	46 (320)	0.180 (4.57)
45	44.370 (1127.00)	+0.260 (+6.60)	46 (320)	0.195 (4.95)
48	47.360 (1202.94)	+0.280 (+7.11)	46 (320)	0.210 (5.33)
54	53.350 (1355.09)	+0.300 (+7.62)	46 (320)	0.225 (5.72)
60	59.340 (1507.24)	+0.320 (+8.128)	46 (320)	0.240 (6.10)

^A In-plant quality control manufacturing. Base inside diameter calculations should include out-of-roundness as a result of shipping and handling.

7.4 *Pipe Impact Strength*—The impact strength shall not be less than the values shown in Table 2 when tested in accordance with 8.6.

NOTE 4—This requirement is intended only for use as a quality control test, not a simulated service test.

7.5 *Pipe Stiffness*—Pipe stiffness values for the pipe shall comply with Table 1 when tested in accordance with 8.7.

7.6 *Gaskets*—Gaskets shall meet the low head application requirements of Specification F477 and be molded into a circular form or extruded to the proper section and then spliced into circular form.

7.7 *Joint Tightness*—All joints shall show no signs of leakage when tested in accordance with Specification D3212 and Fig. 2. All surfaces of the joint upon which the gasket may bear shall be smooth and free of imperfections, ridges, fractures, or cracks that could adversely affect sealability.

7.8 *Acetone Immersion*—The pipe shall meet the requirements as defined in Test Method D2152 when tested in accordance with 8.8.

NOTE 5—This is intended only for use as a quality control test and not for use as a simulated service test.

7.9 *Air Test*—When pipe is made in such a manner that a seam or exposed channel is present, each length shall pass a 3.5-psi air test in accordance with 8.9.

7.10 *Exposed Channels*—Cut exposed channels of closed profile pipe shall be sealed with a material to provide an adequate seal to prevent infiltration and exfiltration and be resistant to sewer and drainage environments.

8. Test Methods

8.1 *Conditioning:*

8.1.1 *Referee Testing*—When conditioning is required for referee tests, condition the specimens in accordance with Procedure A of Practice D618 at 73.4 ± 3.6°F (23 ± 2°C) and

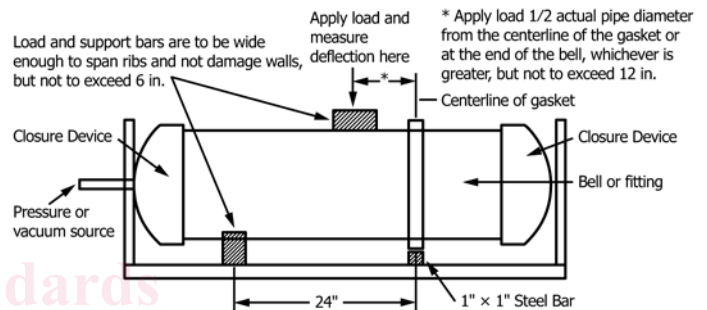


FIG. 2 Shear Deflection Test

50 ± 10 % relative humidity for not less than 40 h prior to test. Conduct tests under the same conditions of temperature and humidity, unless otherwise specified.

8.1.2 *Quality Control Testing*—Condition specimens for a minimum of 4 h in air or 1 h in water at 73.4 ± 3°F (23 ± 2°C). Test the specimens at 73.4 ± 3°F without regard to relative humidity.

8.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 10 % relative humidity, unless otherwise specified in the test methods or in this specification. In cases of disagreement, the tolerances shall be ± 1.8°F (± 1°C) and ± 2 % relative humidity.

8.3 *Sampling*—The selection of the samples of pipe shall be as agreed upon between the purchaser and the seller. In case of no prior agreement, any sample selected by the testing laboratory shall be deemed adequate.

8.4 *Dimensions:*

8.4.1 *Inside Diameter*—Determine the average inside diameter using an internal micrometer or telescoping gage accurate to ± 0.001 in. (± 0.02 mm). Take sufficient readings, a minimum of four, to ensure that the maximum and minimum have been determined. Calculate the average diameter as the arithmetic mean of the diameters measured. As an alternative method, an inside-diameter-type circumferential tape may be used if proper care is taken to align it at right angles to the pipe axis. A tapered plug gage as described in Test Method D2122 may also be used.

TABLE 2 Minimum Impact Strength, 73°F (23°C)

Nominal Size, in.	Impact Strength, ft-lbf(J)
18 to 60	220(299)