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AnAmerican National Standard

# Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings[1]

This standard is issued under the fixed designation F679; 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 and test methods for materials, dimensions, workmanship, flattening resistance, impact resistance, pipe stiffness, extrusion quality, joining system, and a form of marking for large diameters, 18 to 60 in. poly(vinyl chloride) (PVC) sewer pipe and fittings with integral bell elastomeric seal joints and smooth inner walls.

1.2 The requirements of this specification are intended to provide pipe and fittings suitable for nonpressure drainage of sewage and surface water. Pipe and fittings produced to this specification should be installed in accordance with Practice D2321.

NOTE 1—Industrial waste disposal lines should be installed only with the specific approval of the governing code authority since temperatures in excess of 140°F (60°C) and chemicals not commonly found in drains and sewers may be encountered.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values in parentheses are provided for information purposes only.

1.4 The following precautionary caveat pertains only to the test method portion, Section 7, of this specification: *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability or regulatory limitations prior to use.*

## 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) 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 Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

D2564 Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

D2855 Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

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

2.2 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)[3]

2.3 *Military Standard:*

MIL-STD-129 Marking for Shipment and Storage[3]

## 3. Terminology

3.1 *Definitions:*

3.1.1 *General*—Definitions used in the specification are in accordance with Terminology F412, unless otherwise indicated. The abbreviation for poly(vinyl chloride) pipe is PVC, in accordance with Terminology D1600.

[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.

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[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.

[3] Available from Standardization Documents, Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094.

***A Summary of Changes section appears at the end of this standard**

## 4. Materials

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

4.2 *Rework Material*—Clean rework material generated from the manufacturer's own pipe or fittings production may be used by the same manufacturer provided that the rework material meets the requirements of 4.1 and that the pipe or fittings produced meet all the requirements of this specification.

4.3 *Gaskets*—Rubber gaskets shall be in compliance with Specification F477.

4.4 *Lubricant*—The lubricant used for assembly shall have no detrimental effect on the gasket or pipe.

## 5. Joining System

5.1 *Integral Bell Gasketed Joint*—The joint shall be designed so that when assembled, the gasket inside the bell will be compressed radially on the pipe spigot to form a water-tight seal.

5.2 The joint shall be designed to avoid displacement of the gasket when installed in accordance with the manufacturer's recommendations.

5.3 The assembly of joints shall be in accordance with the pipe manufacturer's recommendations.

## 6. Requirements

6.1 *Workmanship*—The pipe and fittings shall be homogeneous 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.

6.2 *Pipe Dimensions:*

6.2.1 *Pipe Diameter*—The average outside diameter of the pipe shall meet the requirements given in Table 1, when measured in accordance with Test Method D2122.

6.2.2 *Wall Thickness*—Pipe wall thicknesses shall meet the requirements of Table 1, when measured in accordance with Test Method D2122. 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 above requirements.

6.3 *Pipe Flattening*—There shall be no evidence of splitting, cracking, or breaking, when pipe is tested in accordance with 7.4.

6.4 *Wall Thickness of Fittings*—The minimum wall thicknesses of the fittings shall be the same as the minimum wall thickness of the equivalent size of pipe as specified in Table 1. For reducing fittings or those with smaller inlets, the minimum wall thickness of each inlet shall be no less than the minimum wall thickness for that size pipe. The thickness shall be determined in accordance with Test Method D2122.

NOTE 2—Owing to the present state of technology in the industry, all



**TABLE 1 Pipe Dimensions and Minimum Pipe Stiffness**

| Nominal Pipe Size | Average Outside Diameter | | Tolerance on Average Outside Diameter | | Min Wall Thickness | | Min Pipe Stiffness | |
|---|---|---|---|---|---|---|---|---|
| in. | in. | (mm) | in. | (mm) | in. | (mm) | psi | kPa |
| 18 | 18.701 | (475) | ±0.028 | (±0.71) | 0.499 | (12.7) | 46 | (320) |
| 21 | 22.047 | (560) | ±0.033 | (±0.84) | 0.588 | (14.9) | 46 | (320) |
| 24 | 24.803 | (630) | ±0.037 | (±0.94) | 0.661 | (15.5) | 46 | (320) |
| 27 | 27.953 | (710) | ±0.042 | (±1.07) | 0.745 | (18.9) | 46 | (320) |
| 30 CIOD | 32.000 | (813) | ±0.040 | (±1.02) | 0.853 | (21.7) | 46 | (320) |
| 36 CIOD | 38.300 | (973) | ±0.050 | (±1.27) | 1.021 | (25.9) | 46 | (320) |
| 42 CIOD | 44.500 | (1130) | ±0.060 | (±1.52) | 1.187 | (30.1) | 46 | (320) |
| 48 CIOD | 50.800 | (1290) | ±0.075 | (±1.90) | 1.355 | (34.4) | 46 | (320) |
| 54 CIOD | 57.560 | (1462) | ±0.085 | (±2.15) | 1.535 | (39.0) | 46 | (320) |
| 60 CIOD | 61.610 | (1565) | ±0.090 | (±2.30) | 1.643 | (41.7) | 46 | (320) |
| 18 | 18.701 | (475) | ±0.028 | (±0.71) | 0.584 | (14.8) | 75 | (517) |
| 21 | 22.047 | (560) | ±0.033 | (±0.84) | 0.689 | (17.5) | 75 | (517) |
| 24 | 24.803 | (630) | ±0.037 | (±0.94) | 0.775 | (19.7) | 75 | (517) |
| 27 | 27.953 | (710) | ±0.042 | (±1.07) | 0.874 | (22.2) | 75 | (517) |
| 30 CIOD | 32.000 | (813) | ±0.040 | (±1.02) | 1.000 | (25.4) | 75 | (517) |
| 36 CIOD | 38.300 | (973) | ±0.050 | (±1.27) | 1.197 | (30.4) | 75 | (517) |
| 42 CIOD | 44.500 | (1130) | ±0.060 | (±1.52) | 1.391 | (35.3) | 75 | (517) |
| 48 CIOD | 50.800 | (1290) | ±0.075 | (±1.90) | 1.588 | (40.3) | 75 | (517) |
| 54 CIOD | 57.560 | (1462) | ±0.085 | (±2.15) | 1.799 | (45.7) | 75 | (517) |
| 60 CIOD | 61.610 | (1565) | ±0.090 | (±2.30) | 1.926 | (48.9) | 75 | (517) |
| 18 | 18.701 | (475) | ±0.028 | (±0.71) | 0.671 | (17.0) | 115 | (790) |
| 21 | 22.047 | (560) | ±0.033 | (±0.84) | 0.791 | (20.1) | 115 | (790) |
| 24 | 24.803 | (630) | ±0.037 | (±0.94) | 0.889 | (22.6) | 115 | (790) |
| 27 | 27.953 | (710) | ±0.042 | (±1.07) | 1.002 | (25.5) | 115 | (790) |
| 30 CIOD | 32.000 | (813) | ±0.040 | (±1.02) | 1.148 | (29.1) | 115 | (790) |
| 36 CIOD | 38.300 | (973) | ±0.050 | (±1.27) | 1.373 | (34.1) | 115 | (790) |
| 42 CIOD | 44.500 | (1130) | ±0.060 | (±1.52) | 1.596 | (40.5) | 115 | (790) |
| 48 CIOD | 50.800 | (1290) | ±0.075 | (±1.90) | 1.822 | (46.3) | 115 | (790) |
| 54 CIOD | 57.560 | (1462) | ±0.085 | (±2.15) | 2.064 | (52.4) | 115 | (790) |
| 60 CIOD | 61.610 | (1565) | ±0.090 | (±2.30) | 2.210 | (56.1) | 115 | (790) |

fittings are fabricated fittings. Fabricated fittings with solvent-cemented components should be made in accordance with Practice D2855 and taking cognizance of Practice F402.

6.5 *Pipe Impact Strength*—The impact strength of the pipe shall be not less than 220 ft·lbf (298.3 J), when tested in accordance with 7.5.

NOTE 3—This requirement is intended only for use as a quality control test, not as a simulated service test. As aged impact data is developed, the applicable aged impact values will be included to reflect long-term performance needs.

6.6 Pipe Stiffness—Pipe stiffness values for the pipe shall comply with Table 1, when tested in accordance with 7.6.

6.6.1 The wall thickness must be increased to meet the pipe stiffness requirement PS46 or PS115 listed in Table 1 when material with modulus lower than 500,000 psi (3447 MPa) is used.

6.7 *Gaskets:*

6.7.1 All gaskets shall meet the requirements of Specification F477 and be molded into a circular form or extruded to the proper section and then spliced into circular form. Gaskets shall be made of a properly vulcanized high-grade elastomeric compound.

6.7.2 The basic polymer shall be natural rubber, synthetic elastomer, or a blend of both.

6.7.3 The gasket shall be designed with an adequate compressive force so as to effect a positive seal under all combinations of joint tolerances. The gasket shall be the only element depended upon to make the joint flexible and watertight.

6.8 *Joint Tightness*—Joints made with pipe and fittings shall show no sign of leakage, when tested in accordance with Specification D3212. 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.

6.9 *Acetone Immersion*—The pipe shall not show excessive flaking or disintegrate, when tested in accordance with Test Method D2152.

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

## 7. Test Methods

7.1 *Conditioning:*

7.1.1 *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 50 ± 5 % relative humidity for not less than 40 h prior to test. Conduct tests under the same conditions of temperature and humidity, unless otherwise specified.

7.1.2 *Quality Control Tests*—For quality control tests, condition specimens for a minimum of 4 h in air or 1 h in water at 73.4 ± 3.6°F (23 ± 2°C). Test the specimens at 23± 2°C without regard to relative humidity.

7.2 *Test Conditions*—Conduct tests in the Standard Laboratory Atmosphere of 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 5 % relative humidity, unless otherwise specified in this specification. In cases of disagreement, the tolerances shall be ±1.8°F (±1°C) and ±2 % relative humidity.

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

7.4 *Flattening*—Flatten three specimens of pipe, each 6 in. (152 mm) in length, between parallel plates in a suitable press until the distance between the plates is 40 % of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is completed within 2 to 5 min. The specimen shall pass if no splitting, cracking, or breaking is observed under normal light with the unaided eye.

7.5 *Impact Resistance*—Determine the impact resistance of the pipe in accordance with Test Method D2444, using a 30-lb (15-kg) or 20-lb (10-kg) Tup B and flat-plate holder B. Ten specimens shall be tested; nine out of ten passing constitutes an acceptable product.

NOTE 5—Sections shorter than those specified in Test Method D2444, but not less than 6 in. (152 mm) in length, may be tested to accommodate the impact-testing machine since this will be a more severe impact-resistance test.

7.6 *Pipe Stiffness*—Determine the pipe stiffness at 5 % deflection datum in accordance with Test Method D2412. Test three specimens, each 6 in. (152 mm) in length, and determine the average pipe stiffness at 5 % deflection in accordance with Test Method D2412. The pipe stiffness shall equal or exceed the minimum value listed in Table 1.

NOTE 6—The 5 % deflection criterion, which was arbitrarily selected for testing convenience, should not be considered as a limitation with respect to in-use deflection. The engineer is responsible for establishing the acceptable deflection limit.

7.7 *Acetone Immersion*—This test shall be conducted in accordance with Test Method D2152. This procedure is used for determining the degree of fusion of extruded PVC plastic pipe as indicated by reaction to immersion in anhydrous acetone. It is applicable only for distinguishing between unfused and properly fused PVC.

## 8. Retest and Rejection

8.1 If the results of any test(s) do not meet the requirements of this specification, the test(s) may be conducted again in accordance with an agreement between the purchaser and the seller. There shall be no agreement to lower the minimum requirement of the specification by such means as omitting tests that are a part of the specification, substituting or modifying a test method, or by changing the specification limits. In retesting, the product requirements of this specification shall be met, and the test methods designated in the specification shall be followed. If, upon retest, failure occurs, the quantity of product represented by the test(s) does not meet the requirements of this specification.

## 9. Inspection

9.1 *General*—Inspection by the purchaser shall not relieve the manufacturer of the responsibility of furnishing material meeting in all respects the requirements of this specification.

9.2 *Notification*—If inspection is specified by the purchaser, the manufacturer shall notify the purchaser in advance of the