



Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings¹

This standard is issued under the fixed designation D2729; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This specification covers requirements and test methods for materials, dimensions, workmanship, chemical resistance, and joint tightness of poly(vinyl chloride) (PVC) sewer and drain pipe and fittings. Perforated pipe is also covered; the joint tightness test is not applicable for perforated pipe. A form of marking to indicate compliance with this specification is also included.

1.2 The text of this specification references notes, footnotes, and appendixes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the specification.

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

1.4 The following precautionary caveat pertains only to the test methods portion, Section 6, 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 and health practices and determine the applicability of 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

F412 Terminology Relating to Plastic Piping Systems

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 Storage³

3. Terminology

3.1 *Definitions*—Definitions used 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.

3.1.1 Pipe having perforations is called perforated pipe; without perforations it is called standard pipe.

4. Materials

4.1 *General*—The pipe shall be made from virgin cell 12164 with a minimum tensile strength of 4000 psi (28 MPa), or 12454 poly(vinyl chloride) compounds, as defined and described in Specification **D1784**. The fittings shall be made from virgin poly(vinyl chloride) compounds of cell classification PVC 12454, or PVC 13343. Compounds that have

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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, Attn: NPODS.



different cell classification because one or more properties are superior to those of the specified compounds are also acceptable.

4.2 *Rework Material*—The manufacturer shall use only his own clean pipe or fitting rework material; the pipe and fittings produced shall meet all the requirements of this specification.

5. Requirements

5.1 Qualification and Referee Testing:

5.1.1 *Joint Testing*—Joints made with pipe and fittings or belled end pipe shall show no signs of leakage when tested in accordance with 6.5. This test is not required for perforated pipe.

5.2 Quality Control Testing:

5.2.1 *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.

5.2.2 *Flattening*—There shall be no evidence of splitting, cracking, or breaking when the pipe is tested in accordance with 6.4.

5.2.3 *Extrusion Quality*—The pipe or fittings shall not flake or disintegrate when tested in accordance with Test Method D2152. In the case of fittings, slight flaking in the gate area is acceptable.

NOTE 1—This test is intended only for use as a quality control test, not for use as a simulated service test.

5.2.4 *Impact Resistance*—The impact resistance of pipe shall be determined in accordance with Test Method D2444, using a 20-lb (10-kg) Tup A and Holder B (flat plate), and shall comply with the requirements given in Table 1 (Note 1). For perforated pipe, samples are to be cut and tested at random without regard to hole location, except that the point of impact shall not coincide with a perforation.

5.2.5 Dimensions:

5.2.5.1 Pipe and fittings dimensions (for both standard and perforated pipe) shall comply with Table 2, Table 3, or Table 4, as applicable, when measured in accordance with Test Method D2122.

5.2.5.2 Pipe shall be supplied in 10 ft \pm ¼-in. laying lengths unless otherwise specified.

5.2.5.3 For belled pipe and fittings fabricated from pipe sections, the thickness of the belled section shall be considered satisfactory if the bell was formed from pipe meeting the requirements of Table 3.

5.2.5.4 For molded fittings, the wall thickness of the waterway and socket or bell shall be no less than the respective

TABLE 1 Impact Strength Requirements for PVC Sewer and Drain Pipe at 23°C (73°F)

Nominal Pipe Size, in.	Drop Height	
	ft (20-lb Tup A)	mm (10-kg Tup A)
2	1.75	485
3	2.00	555
4	2.25	625
5	3.00	830
6	3.50	970

TABLE 2 Diameters and Tolerances for PVC Sewer and Drain Pipe

Nominal Pipe Size, in.	Average Outside Diameter, mm (in.)
2	57.15 \pm 0.15 (2.250 \pm 0.006)
3	82.55 \pm 0.20 (3.250 \pm 0.008)
4	107.06 \pm 0.22 (4.215 \pm 0.009)
5	134.62 \pm 0.25 (5.300 \pm 0.010)
6	159.39 \pm 0.28 (6.275 \pm 0.011)

TABLE 3 Minimum Wall Thicknesses for PVC Sewer and Drain Pipe

Nominal Pipe Size, in.	Wall Thickness, mm (in.) ^A
2	1.78 (0.070)
3	1.78 (0.070)
4	1.90 (0.075)
5	2.27 (0.090)
6	2.54 (0.100)

^AFitting Wall Thickness—A \pm 10% variation resulting from core shift is allowable. However, the average of two opposite wall thicknesses shall equal or exceed the value shown in the table.

minimum thickness listed for the equivalent pipe wall in Table 3. 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.

5.2.6 *Pipe Stiffness*—The pipe stiffness at 5 % deflection ($F/\Delta y$) shall not be less than the values given in Table 5 when tested in accordance with Test Method D2412. This requirement does not apply to fittings.

NOTE 2—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 limit.

NOTE 3—The strength and load-carrying capabilities of plastic drain and sewer pipe are measured and reported as Pipe Stiffness which is determined in accordance with Test Method D2412. The term “crush strength” is not applicable to plastic piping because (a) the values obtained can be significantly different, depending on the bedding, loading, or testing technique used; and (b) the term derives from rigid pipe and refers to its ultimate strength at rupture.

5.2.7 *Solvent Cement*—The cement shall comply with Specification D2564.

5.2.8 *Perforations*—Unless otherwise specified, the perforated pipe shall have two rows of holes 13 mm (½ in.) in diameter on 125-mm (5-in.) centers, with allowable tolerances of \pm 1 mm (¼ in.) on the diameter and +6, –0 mm (+¼, –0 in.) on the spacing, and the rows shall be parallel to the axis of the pipe and 120 \pm 5° apart when measured in accordance with 6.6.

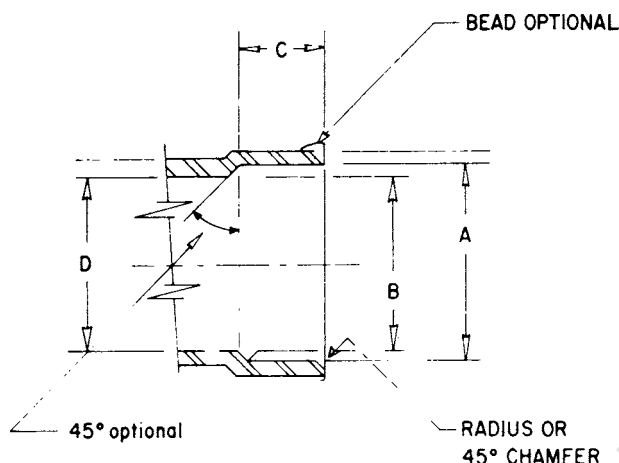
6. Test Methods

6.1 Conditioning:

6.1.1 *Qualification and Referee Conditioning*—Condition the specimens prior to test at 23 \pm 2°C (73.4 \pm 3.6°F) and 50 \pm 10 % relative humidity for not less than 40 h in accordance



TABLE 4 Socket Dimensions and Tolerances for PVC Sewer Pipe Fittings



Nominal Size, in.	A Average Entrance Diameter, mm (in.)	B Average Bottom Diameter, mm (in.)	C Minimum Socket Depth, mm (in.) ^A	D Minimum Inside Diameter, mm (in.) ^A
2	57.51 ± 0.15 (2.264 ± 0.006)	57.02 ± 0.15 (2.245 ± 0.006)	19.05 (0.750)	50.80 (2.000)
3	83.08 ± 0.20 (3.271 ± 0.008)	82.42 ± 0.20 (3.245 ± 0.008)	38.10 (1.500)	73.02 (2.875)
4	107.57 ± 0.22 (4.235 ± 0.009)	106.93 ± 0.22 (4.210 ± 0.009)	44.45 (1.750)	98.42 (3.875)
5	135.38 ± 0.25 (5.330 ± 0.010)	134.49 ± 0.25 (5.295 ± 0.010)	63.50 (2.500)	123.82 (4.875)
6	160.15 ± 0.28 (6.305 ± 0.011)	159.26 ± 0.28 (6.270 ± 0.011)	76.20 (3.000)	149.22 (5.875)

^AThe negative tolerance on minimum dimensions shall be zero.

TABLE 5 Minimum Pipe Stiffness, $F/\Delta y$, at 5 % Deflection
Minimum Pipe Stiffness, kPa (psi)

Nominal Pipe Size, in.	PVC 12454 PVC 12164	
	kPa	psi
2	407	59
3	131	19
4	76	11
5	62	9
6	55	8

with Procedure A of Practice D618 for those tests where conditioning is required.

6.1.2 *Quality Control Testing*—Condition specimens for a minimum of 4 h in air or 1 h in water at $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$). Test the specimens at $23 \pm 2^\circ\text{C}$ without regard to relative humidity.

6.2 *Test Conditions*—Conduct the tests in the standard laboratory atmosphere of $23 \pm 2^\circ\text{C}$ and $50 \pm 10\%$ relative humidity, unless otherwise specified.

6.3 *Materials*—Determine the physical and chemical properties of PVC compounds used in the manufacture of pipe and fittings meeting this specification in accordance with the test methods specified in Specification D1784.

6.4 *Flattening*—Flatten three specimens of pipe, at least 51-mm (2-in.) long, 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. On removal of the load, examine the specimens for evidence of splitting, cracking, or breaking.

6.5 *Joint Tightness*—Join two pieces of pipe by means of a fitting in accordance with the manufacturer's recommendations and with solvent cement as described in 6.8. Allow the joined unit to stand for at least 24 h at room temperature. Subject the unit to an internal water pressure of 170 kPa (25 psi) at room temperature for 24 h. Neither the pipe, fitting, nor joints shall show any leakage.

6.6 *Perforation*—For the perforated pipe the hole diameter and the distance between hole centers shall be measured with a steel rule with at least 1-mm ($1/16$ -in.) graduations. The angle between the two rows of holes shall be measured with an index head capable of measuring accurately to within 1° .

7. Significance and Use

7.1 The pipe and fittings in this specification are designed and have the physical, chemical, and other properties for sewer and drainage applications outside the building. The pipe is not intended for use as public or municipal collector sewers. The following lists the typical applications for the sewer and drain pipe:

- 7.1.1 Building sewers and underground drains—standard,
- 7.1.2 Storm drainage—standard and perforated,
- 7.1.3 House connections to septic tanks—standard,



7.1.4 Leaching system piping for septic tank effluents—standard and perforated,

7.1.5 Footing drains (foundation drains)—standard and perforated,

7.1.6 Industrial waste disposal—standard and perforated, and

7.1.7 Land drainage—standard and perforated.

8. Retest and Rejection

8.1 If the results of any test(s) do not meet the requirements of this specification, the test(s) shall be conducted again only by agreement between the purchaser and seller. Under such agreement, minimum requirements shall not be lowered, changed, or modified, nor shall specification limits be changed. If upon retest, failure occurs, the quantity of product represented by the test(s) does not meet the requirements of this specification.

9. Certification

9.1 When specified in the purchase order or contract, a manufacturer's certification shall be furnished to the purchaser that the material was manufactured, sampled, tested, and inspected in accordance with this specification, and has been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished. Each certification so furnished shall be signed by an authorized agent of the manufacturer.

10. Marking and Labeling

10.1 Pipe in compliance with this specification shall be clearly marked as follows at intervals of 1.5 m (5 ft) or less:

10.1.1 Manufacturer's name or trademark and code,

10.1.2 Nominal pipe size,

10.1.3 The legend "PVC Sewer Pipe" or "PVC Perforated Pipe," and

10.1.4 This designation, "ASTM D2729."

10.2 Fittings in compliance with this specification shall be clearly marked as follows:

10.2.1 Manufacturer's name or trademark,

10.2.2 Nominal size, and

10.2.3 This designation, "ASTM D2729."

NOTE 3—D2729 pipe should be installed in accordance with Practice D2321. Perforated pipe should be installed using Class I material in order to provide ground water drainage and good side support.

11. Quality Assurance

11.1 When the product is marked with this designation, D2729, the manufacturer affirms that the product was manufactured, inspected, sampled, and tested in accordance with this specification and has been found to meet the requirements of this specification.

12. Keywords

12.1 drain pipe; fittings; perforated pipe; pipe; poly(vinyl chloride); PVC

SUPPLEMENTARY REQUIREMENTS

GOVERNMENT/MILITARY PROCUREMENT

These requirements apply *only* to federal/military procurement, not domestic sales or transfers.

S1. *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. The producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless the purchaser disapproves. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to ensure that material conforms to prescribed requirements.

NOTE S1.1—In U.S. federal contracts, the contractor is responsible for inspection.

S2. *Packaging and Marking for U.S. Government Procurement*:

S2.1 *Packaging*—Unless otherwise specified in the contract, the materials shall be packaged in accordance with the supplier's standard practice in a manner ensuring arrival at destination in satisfactory condition and which will be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules.

S2.2 *Marking*—Marking for shipment shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

NOTE S2.1—The inclusion of U.S. Government procurement requirements should not be construed as an indication that the U.S. Government uses or endorses the products described in this specification.



SUMMARY OF CHANGES

Committee F17 has identified the location of selected changes to this standard since the last issue (D2729–03) that may impact the use of this standard.

- (1) Removed specific references to four-inch perforated pipe (in scope and in tables) so that all diameters may be perforated under the standard.
- (2) Removed redundant references to PVC cell class 12454.
- (3) Changed relative humidity requirements for conditioning and testing from $\pm 5\%$ to $\pm 10\%$ to coincide with Practice D618.
- (4) Corrected apparent error in 6.1.2: changed + to \pm .
- (5) Clarified length of flattening test specimens as at least 2 in. long (6.4).
- (6) Clarified that joint test specimens shall stand at least 24 h at room temperature prior to testing (6.5)

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