



# Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer and Drain Pipe Containing Recycled PVC Material<sup>1</sup>

This standard is issued under the fixed designation F1732; 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 pipe made from PVC compound that includes recycled PVC material. 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. Four-inch perforated pipe is also covered; the joint tightness test is not applicable for this product. A form of marking to indicate compliance with this specification is also included.

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

1.4 The following precautionary caveat pertains only to the test methods portion, Section 7, 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:<sup>2</sup>

- 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 Ther-

moplastic 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
- D2729 Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3034 Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- F412 Terminology Relating to Plastic Piping Systems
- 2.2 Federal Standard:
  - Fed. Std. No. 123 Marking for Shipment (Civil Agencies)<sup>3</sup>
  - 2.3 Military Standard:
    - MIL-STD-129 Marking for Shipment and Storage<sup>3</sup>

## 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.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *external recycled material*—clean rework material generated by a manufacturer, processor, or fabricator in a facility outside the plant where this pipe (PS 1) is made.

3.2.2 *internal recycled material*—clean rework material generated from the manufacturer's own pipe or fitting production.

3.2.3 *post-consumer recycled material*—those plastics composed of post-consumer material or recovered material only, or both, that may or may not have been subjected to additional

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.

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

processing steps of the types used to make products such as recycled-regrind, or reprocessed or reconstituted plastics. These materials must be clean and graded as to material cell class.

3.2.4 *recycled materials*—general term that encompasses all three subgroups—*external recycled material*, *internal recycled material*, and *post-consumer recycled material*.

NOTE 1—The terms in 3.2.1 and 3.2.3 come from ISO TC 138 SC1. Use of recycled materials will reduce the amount of landfill space needed.

#### 4. Significance and Use

4.1 The requirements of this specification are intended to provide pipe suitable for non-pressure drainage of sewage, surface water, and certain other liquid wastes in applications outside the building limits where toughness, resistance to deterioration from action of water and chemicals, dimensional stability, resistance to aging and, except for the perforated pipe, where strong tight joints are required. The PVC plastic sewer and drain pipe described in this specification are not intended for use as public or municipal collector sewers, or their extended branches, but they are intended for the following:

- 4.1.1 Building sewers and underground drains,
- 4.1.2 Storm drainage,
- 4.1.3 House connections to septic tanks,
- 4.1.4 Leaching system piping for septic tank effluents,
- 4.1.5 Footing drains (foundation drains),
- 4.1.6 Industrial waste disposal,
- 4.1.7 Land drainage.

#### 5. Materials

5.1 *General*—The pipe shall be made from a PVC compound having a minimum tensile strength of 4000 psi (27.6 MPa) and a minimum cell class of 12154-C in accordance with Specification D1784. This PVC compound shall contain a minimum of 5 % of recycled PVC material. Compounds that have different cell classification because one or more properties are superior to those of the specified compounds are also acceptable, as long as the pipe meets all the requirements of this specification.

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

6.3 *Extrusion Quality*—The pipe shall not flake or disintegrate when tested in accordance with Test Method D2152.

NOTE 2—This test is intended only for use as a quality control test, not for use as a simulated service test.

6.4 *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 2). For perforated

**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)              |

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.

#### 6.5 Dimensions:

6.5.1 Pipe dimensions shall comply with Table 2, Table 3, and Table 4, as applicable, when measured in accordance with Test Method D2122.

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

6.5.3 For belled pipe, the thickness of the belled section shall be considered satisfactory if the bell was formed from pipe meeting the requirements of Table 3.

6.6 *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.

NOTE 3—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 4—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 pipe 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.

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

6.8 *Joint Tightness*—Joints made with pipe and fittings or with belled-end pipe shall show no signs of leakage when tested in accordance with 7.5.

6.9 *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 (⅛ in.) on the diameter and + 6, – 0 mm

**TABLE 2 Diameters and Tolerances for PVC Sewer and Drain Pipe**

| Nominal Pipe Size, in. | Average Outside Diameter, in.(mm)        | Average Inside Diameter, min. in. (mm) |
|------------------------|------------------------------------------|----------------------------------------|
| 2                      | 2.250 $\pm$ 0.006<br>(57.15 $\pm$ 0.15)  | 2.000<br>(50.80)                       |
| 3                      | 3.250 $\pm$ 0.008<br>(82.55 $\pm$ 0.20)  | 2.875<br>(73.02)                       |
| 4 <sup>A</sup>         | 4.215 $\pm$ 0.009<br>(107.06 $\pm$ 0.22) | 3.875<br>(98.42)                       |
| 5                      | 5.300 $\pm$ 0.010<br>(134.62 $\pm$ 0.25) | 4.875<br>(123.82)                      |
| 6                      | 6.275 $\pm$ 0.011<br>(159.39 $\pm$ 0.28) | 5.875<br>(149.22)                      |

<sup>A</sup>Standard and perforated pipe.

**TABLE 3 Minimum Well Thicknesses for PVC Sewer and Drain Pipe**

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

(+ ¼, – 0 in.) on the spacing, and the rows shall be parallel to the axis of the pipe and  $120 \pm 5^\circ$  apart when measured in accordance with 7.5.

## 7. Test Methods

**7.1 Conditioning**—Condition the specimens prior to test at  $23 \pm 2^\circ\text{C}$  ( $73.4 \pm 3.6^\circ\text{F}$ ) and  $50 \pm 10\%$  relative humidity for not less than 40 h in accordance with Procedure A of Practice D618 for those tests where conditioning is required.

**7.2 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.

**7.3 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 Specifications D1784.

**7.4 Flattening**—Flatten three specimens of pipe, 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.

**7.5 Joint Tightness**—Join two pieces of pipe in accordance with the manufacturer's instructions and with solvent cement in accordance with 6.7. Allow the joined unit to stand for 24 h at room temperature. Subject the unit to an internal water pressure of 170 kPa (25 psi) at room temperature for 24 h. The joints shall not leak.

**7.6 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  $1^\circ$ .

## 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 the seller. Under such agreement minimum requirements shall not be lowered, nor tests omitted, substituted, 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 *Sewer and Drain*—The marking "Recycled PVC," and

10.1.4 This designation, ASTM F1732.

## 11. Quality Assurance

11.1 When the product is marked with this designation; F1732 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. Installation Procedures

12.1 In order to function properly, pipe and fittings produced to this specification should be installed in accordance with Practice D2321 or the Plumbing Code requirements.

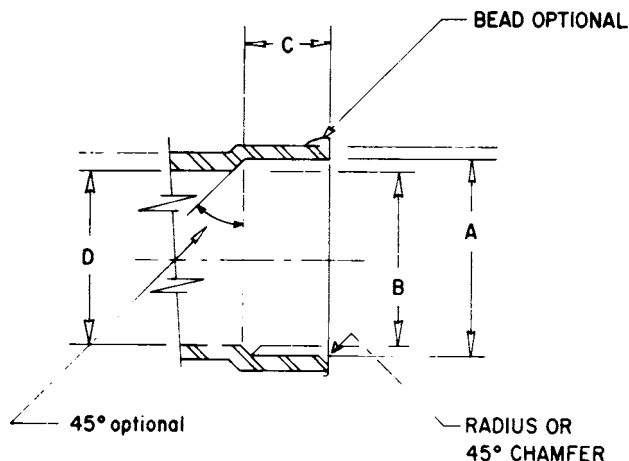
12.2 For installation of perforated pipe, in order to provide adequate drainage of ground waters into the pipe and to sustain proper side support, only Class I material shall be used as recommended.

12.3 Fittings conforming to Specification D2729 or D3034 shall be used with this pipe.

## 13. Keywords

13.1 drain pipe; PVC; recycled PVC; sewer pipe

TABLE 4 Socket Dimensions and Tolerances for PVC Sewer Pipe Bells



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

<sup>A</sup>The 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 12154-B |       |
|-----------------------|-------------|-------|
|                       | psi         | (kPa) |
| 2                     | 59          | (407) |
| 3                     | 19          | (131) |
| 4                     | 11          | (76)  |
| 5                     | 9           | (62)  |
| 6                     | 8           | (55)  |

## 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 (F1732–96(2005)) that may impact the use of this standard.

(I) Revised relative humidity tolerances in **7.1** and **7.2**.

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