



Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)¹

This standard is issued under the fixed designation D2241; 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 reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

1. Scope*

1.1 This specification covers poly(vinyl chloride) (PVC) pipe made in standard thermoplastic pipe dimension ratios and pressure rated for water (see appendix). Included are criteria for classifying PVC plastic pipe materials and PVC plastic pipe, a system of nomenclature for PVC plastic pipe, and requirements and test methods for materials, workmanship, dimensions, sustained pressure, burst pressure, flattening, and extrusion quality. Methods of marking are also given.

1.2 The products covered by this specification are intended for use with the distribution of pressurized liquids only, which are chemically compatible with the piping materials. Due to inherent hazards associated with testing components and systems with compressed air or other compressed gases, some manufacturers do not allow pneumatic testing of their products. Consult with specific product/component manufacturers for their specific testing procedures prior to pneumatic testing.

NOTE 1—Pressurized (compressed) air or other compressed gases contain large amounts of stored energy which present serious safety hazards should a system fail for any reason.

NOTE 2—This standard specifies dimensional, performance and test requirements for plumbing and fluid handling applications, but does not address venting of combustion gases.

1.3 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.

1.4 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.

1.5 The following safety hazards 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. A specific precautionary statement is given in Note 9.

NOTE 3—CPVC plastic pipe (SDR-PR), which was formerly included in this specification, is now covered by Specification F442/F442M.

NOTE 4—The sustained and burst pressure test requirements, and the pressure ratings in the appendix, are calculated from stress values obtained from tests made on pipe 4 in. (100 mm) and smaller. However, tests conducted on pipe as large as 24 in. (600 mm) in diameter have shown these stress values to be valid for larger diameter PVC pipe.

NOTE 5—PVC pipe made to this specification is often belled for use as line pipe. For details of the solvent cement bell, see Specification D2672 and for details of belled elastomeric joints, see Specifications D3139 and D3212.

1.6 *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
- D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
- D1599 Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings
- D1600 Terminology for Abbreviated Terms Relating to Plastics (Withdrawn 2024)³
- D1784 Classification System and Basis for 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

¹ This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.25 on Vinyl Based Pipe.

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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 The last approved version of this historical standard is referenced on www.astm.org.

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

- D2152** Test Method for Adequacy of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
- D2444** Practice for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
- D2672** Specification for Joints for IPS PVC Pipe Using Solvent Cement
- D2837** Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
- D3139** Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
- D3212** Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- F412** Terminology Relating to Plastic Piping Systems
- F442/F442M** Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR–PR)

2.2 NSF Standards:⁴

Standard No. 14 for Plastic Piping Components and Related Materials

Standard No. 61 for Drinking Water Systems Components—Health Effects

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) plastic is PVC.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 hydrostatic design stress—the estimated maximum tensile stress the material is capable of withstanding continuously with a high degree of certainty that failure of the pipe will not occur. This stress is circumferential when internal hydrostatic water pressure is applied.

3.2.2 pressure rating (PR)—the estimated maximum water pressure the pipe is capable of withstanding continuously with a high degree of certainty that failure of the pipe will not occur.

3.2.3 relation between standard dimension ratio, hydrostatic design stress, and pressure rating—The following expression, commonly known as the ISO equation,⁵ is used in this specification to relate standard dimension ratio, hydrostatic design stress, and pressure rating:

$$2S/P = R - 1 \text{ or } 2S/P = (D_o/t) - 1 \quad (1)$$

where:

- S = hydrostatic design stress, psi (or MPa),
- P = pressure rating, psi (or MPa),
- D_o = average outside diameter, in. (or mm),
- t = minimum wall thickness, in. (or mm), and
- R = standard thermoplastic pipe dimension ratio (D_o/t for PVC pipe), also known as SDR.

3.2.4 standard thermoplastic pipe dimension ratio (SDR)—the ratio of pipe diameter to wall thickness. For PVC pipe it is calculated by dividing the average outside diameter of the pipe in inches or millimetres by the minimum wall thickness in inches or millimetres. If the wall thickness calculated by this formula is less than 0.060 in. (1.52 mm), it shall be arbitrarily increased to 0.060 in. (1.52 mm). The SDR values shall be rounded to the nearest 0.5.

3.2.5 standard thermoplastic pipe materials designation code—The pipe materials designation code shall consist of the abbreviation PVC for the type of plastic, followed by the ASTM type and grade in Arabic numerals and the design stress in units of 100 psi (0.7 MPa) with any decimal figures dropped. When the design stress code contains less than two figures, a cipher shall be used before the number, thus a complete material code shall consist of three letters and four figures for PVC plastic pipe materials.

4. Classification

4.1 General—This specification covers PVC pipe made and marked with one of six Type/Grade/Design Stress designations (see **X1.2**) in eleven standard dimension ratios.

4.2 Standard Thermoplastic Pipe Dimension Ratios (SDR)—This specification covers PVC pipe in eleven standard dimension ratios, namely, 13.5, 17, 21, 26, 32.5, 41, and 64 (in the body of the document) and 11, 35, 51 and 81 (in **Annex A1**.) Standard dimension ratios are uniform for all nominal pipe sizes for each material and pressure rating. These are referred to as SDR 11, SDR13.5, SDR17, SDR21, SDR26, SDR32.5, SDR35, SDR41, SDR51, SDR64, and SDR81, respectively. The pressure rating is uniform for all nominal pipe sizes for a given PVC pipe material and SDR (see **Table X1.1**).

4.3 Hydrostatic Design Stresses—This specification covers pipe made from PVC plastics defined by four hydrostatic design stresses developed on the basis of long-term tests (appendix).

5. Materials

5.1 General—Poly(vinyl chloride) plastics used to make pipe meeting the requirements of this specification are categorized by means of two criteria, namely, (1) short-term strength tests, and (2) long-term strength tests.

NOTE 6—The PVC pipe intended for use in the transport of potable water should be evaluated and certified as safe for this purpose by a testing agency acceptable to the local health authority. The evaluation should be in accordance with requirements for chemical extraction, taste, and odor that are no less restrictive than those included in NSF Standard No. 14. The seal or mark of the laboratory making the evaluation should be included on the pipe. See pipe marking requirement for reclaimed water systems.

5.2 Basic Materials—This specification covers pipe made from PVC plastics having certain physical and chemical properties as described in Specification **D1784**.

5.3 Compound—The PVC compounds used for this pipe shall equal or exceed one of the following classes described in Specification **D1784**: PVC 12454 or 14333.

⁴ Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48105, <http://www.nsf.org>.

⁵ ISO R161–1960, Pipes of Plastics Materials for the Transport of Fluids (Outside Diameters and Nominal Pressures) Part 1, Metric Series.