



Standard Specification for Oriented Poly(Vinyl Chloride), PVCO, Pressure Pipe¹

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1. Scope*

1.1 This specification covers requirements for materials, dimensions, sustained pressure, accelerated regression testing, burst pressure, flattening, impact resistance, workmanship, solvent cement joint testing, and methods of marking for oriented poly(vinyl chloride) (PVCO) pipe for pressure applications.

1.2 The PVCO pipe shall be joined using either elastomeric seals (gaskets) or solvent cement with primer. The gasketed joint shall meet the requirements of Specification D3139 and the elastomeric seal shall meet the requirements of Specification F477. The solvent cemented joint shall meet the requirements of 5.3.3.

1.3 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.

1.4 The following safety hazards caveat pertains only to the test method 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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

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.

D883 Terminology Relating to Plastics

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

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

D2152 Test Method for Adequacy of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion

D2241 Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

D2444 Practice 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

D2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

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

D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

F412 Terminology Relating to Plastic Piping Systems

F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F656 Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic 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 Available from DLA Document Services Building 4/D 700 Robbins Avenue Philadelphia, PA 19111-5094 <http://quicksearch.dla.mil/>

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



2.4 Other Standards:

NSF Standard No. 14 for Plastic Piping Components and Related Materials⁴

ANSI/NSF Standard No. 61 for Drinking Water System Components—Health Effects⁴

2.5 PPI Publications:⁵

PPI-TR 2 PPI PVC Range Composition Listing of Qualified Ingredients

PPI-TR 3 Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe

3. Terminology

3.1 *General*—Definitions are in accordance with Terminologies D883 and F412 and abbreviations are in accordance with Terminology D1600, unless otherwise indicated. The abbreviation for poly(vinyl chloride) plastics is PVC.

3.2 Definitions:

3.2.1 *PVCO pipe, n*—abbreviation for oriented poly(vinyl chloride) plastics. PVCO pipe is PVC pressure pipe which attains a relatively high strength by reorienting the molecules. Conventionally extruded PVC pipe is expanded circumferentially (for example, 2-in. diameter is expanded to 4-in. diameter) through the application of pressure and temperature. The expansion reorients the PVC molecular structure in the hoop direction, thereby increasing the material strength.

3.2.2 *IPS, adj*—Iron Pipe Size, a set of standard outside diameters.

3.2.3 *CIOD, adj*—Cast Iron Outside Diameter—a set of standard outside diameters.

3.3 Definitions of Terms Specific to This Standard:

3.3.1 *expansion ratio (ER), n*—the ratio of the finished PVCO pipe outside diameter to the outside diameter of the original starting stock.

3.3.2 *standard thermoplastic pipe material designation code, n*—the molecularly oriented poly(vinyl chloride) materials designation code shall consist of the abbreviation PVCO for the type of plastics, followed by the ASTM type and grade in arabic numerals and the hydrostatic design stress in units of 100 psi (0.69 MPa) with any decimal figures dropped. The ASTM type and grade shall be that of the starting stock material. The hydrostatic design stress shall be that of the finished PVCO pipe.

3.3.2.1 *Discussion*—A complete material designation code shall consist of four letters and four figures (for example; a PVCO pipe manufactured from 12454 (Type 1, Grade 1) material starting stock and having an HDB of 7100 psi (48.92 MPa) [HDS of 3550 psi] (24.46 MPa)] will have a material designation code of PVCO 1135) as per Specification D2241.

3.3.3 *starting stock, n*—the conventionally extruded PVC pipe of uniform wall thickness which will be expanded to a larger diameter, molecularly oriented pipe.

3.3.4 *wall-thickness-ratio (WTR), n*—the ratio of the finished product wall thickness to the wall thickness of the starting stock.

4. Materials

4.1 *General*—Poly(vinyl chloride) plastics used to make PVCO 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.

4.1.1 *Supplementary Requirement*—This applies whenever a regulatory authority or user calls for the product to be used to convey or to be in contact with potable water. Potable water applications products intended for contact with potable water shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61 or the health effects portion of NSF Standard No. 14 by an acceptable certifying organization when required by the regulatory authority having jurisdiction.

4.2 The PVC compound used for the starting stock of this pipe shall equal or exceed the following cell classification described in Specification D1784: PVC 12454 (Type 1, Grade 1).

4.3 Long Term Hydrostatic Strength—this specification covers PVCO pipe, made from PVC plastic pipe starting stock:

4.3.1 The PVC compound used to make the pipe starting stock shall have a minimum Hydrostatic Design Basis of 4000 psi (27.58 MPa) at 73 °F (23 °C), determined in accordance with Test Method D2837.

4.3.2 Finished PVCO pipe shall have a minimum Hydrostatic Design Basis of 7100 psi (48.92 MPa) at 73 °F (23 °C), determined by testing in accordance with Test Method D1598, with data evaluated in accordance with Test Method D2837, as provided in 5.3.2.

4.4 *Rework Materials*—Clean, rework material, generated from the manufacturer's own starting stock pipe production, shall be permitted to be used by the same manufacturer, as long as the pipe produced meets all the requirements of this specification. Recycled materials shall not be used in the compound

4.5 *Solvent Cement*—the solvent cement shall meet the requirements of Specification D2564 and be marked for use with PVCO pipe.

4.6 *Primer*—The primer shall meet the requirements of Specification F656 and be marked for use with PVCO pipe.

5. Requirements

5.1 *General*—These requirements are for finished PVCO pipe, unless otherwise noted.

5.2 Dimensions and Tolerances:

5.2.1 *Outside Diameters*—The outside diameters and tolerances shall be shown in Table 1 and Table 2 when measured in accordance with Test Method D2122. The tolerances for out-of-roundness shall apply only on pipe prior to shipment.

5.2.2 *Wall Thicknesses*—The wall thicknesses and tolerances shall be as shown in Table 3 and Table 4 when measured in accordance with Test Method D2122

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

⁵ Available from Plastics Pipe Institute (PPI), 105 Decker Court, Suite 825, Irving, TX 75062, <http://www.plasticpipe.org>.