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StandardSpecification for Oriented Poly(Vinyl Chloride), PVCO, Pressure Pipe[1]

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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, and methods of marking for oriented poly(vinyl chloride) (PVCO) pipe for pressure applications.

1.2 The PVCO pipe shall be joined using elastomeric seals (gaskets). The joint shall meet the requirements of Specification D3139 and the elastomeric seal shall meet the requirements of Specification F477. The PVCO shall not be joined by solvent cementing.

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

1.4 The following safety hazards caveat pertains only to the test method 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 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

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 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

D2444 Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

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

F412 Terminology Relating to Plastic Piping Systems

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

2.2 *Other Standards:*

NSF Standard No. 14 for Plastic Piping Components and Related Materials[3]

ANSI/NSF Standard No. 61 for Drinking Water System Components—Health Effects[3]

PPI-TR 3 Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe[4]

3. Terminology

3.1 *Definitions:*

3.1.1 *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.

3.1.2 *PVCO pipe*—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

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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 the National Sanitation Foundation, P.O. Box 1468, Ann Arbor, MI 48106.

[4] Available from Plastics Pipe Institute, 1275 K St. N.W., Suite 400, Washington, DC 20005.

expansion reorients the PVC molecular structure in the hoop direction, thereby increasing the material strength.

3.2 *Definitions of Terms Specific to This Standard:*

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

3.2.2 *standard thermoplastic pipe material designation code*—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.

3.2.3 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).

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

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

4. Classification

4.1 *General*—This specification covers PVCO made from PVC plastic pipe, starting stock, having a hydrostatic design stress of 2000 psi (13.78 MPa) determined in accordance with Test Method D2837. Finished PVCO pipe shall have a hydrostatic design stress of 3550 psi (24.46 MPa) determined by testing in accordance with Test Methods D1598, with data evaluated in accordance with Test Methods D2837, as in 6.3.2.

5. Materials

5.1 *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.

5.1.1 *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.

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

5.3 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). Recycled materials shall not be used in the compound.

5.4 *Rework Materials*—Clean, rework material, generated from the manufacturer's own 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.

6. Requirements

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

6.2 *Dimensions and Tolerances:*

6.2.1 *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.

6.2.2 *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.

6.3 *Qualification Tests*—These tests are for qualification of the compound and extrusion process, not for quality control.

6.3.1 *Sustained Pressure*—The sustained pressure test shall be completed for each diameter at initial start-up. Thereafter, it shall be completed whenever there is a change in the ER (3.2.1), or the WTR (3.2.5), or whenever a change is made to the compound which is outside the allowable limits of the Plastics Pipe Institute PVC compound range formula (see PPI TR-3). The pipe shall not fail, balloon, burst, or weep as defined in Test Method D1598 at the test pressures given in Table 5 when tested in accordance with 7.4.

6.3.2 *Accelerated Regression Test*—This test shall be completed on a representative diameter at initial start-up. A representative diameter is one which has an ER, a WTR, and a compound which is the same as the other diameters manufactured. Thereafter, it shall be completed on a representative diameter whenever there is a change in the ER or the WTR, or whenever a change is made to the compound which is outside the allowable limits of the Plastics Pipe Institute PVC compound range formula (see PPI TR-3). The test shall be conducted in accordance with 7.5.

6.3.2.1 The pipe shall demonstrate a minimum hydrostatic design basis projection, at the 100 000-h intercept, of 6810 psi (46.92 MPa) (for Hydrostatic Design Basis Categories, see Table 1 of Test Method D2837). At the option of the manufacturer, the accelerated regression test may be used as a substitute for both pressure tests, sustained and burst (6.4.1).

6.4 *Quality Control Tests*—These tests are intended to ensure the quality of the finished pipe product.

6.4.1 *Burst Pressure*—The minimum burst pressure for PVCO pipe shall be as given in Table 6, when determined in accordance with 7.6.

TABLE 1 IPS PVCO Pipe—Outside Diameters and Tolerances

Nominal Pipe Size, in.	Average Outside Diameter, in. (mm)	Tolerance, ±in. (mm)
4	4.500 (114.30)	0.009 (0.23)
6	6.625 (168.28)	0.011 (0.28)
8	8.625 (219.08)	0.015 (0.38)
10	10.750 (273.05)	0.016 (0.41)
12	12.750 (323.85)	0.017 (0.43)
14	14.000 (355.60)	0.018 (0.46)
16	16.000 (406.40)	0.019 (0.48)