Designation: D 2740 – 89

AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race St., Philadelphia, Pa. 19103
Reprinted from the Annual Book of ASTM Standards, Copyright ASTM
If not listed in the current combined index, will appear in the next edition.

Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Tubing[1]

This standard is issued under the fixed designation D 2740; 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 poly(vinyl chloride) (PVC) tubing pressure rated for water (Appendix). Included are criteria for classifying PVC plastic tubing materials and PVC plastic tubing, 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 values in parentheses are for information purposes only.

1.3 The following safety hazards caveat pertains only to the test method portion, Section 7, of this specification. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems 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:*

D 618 Methods of Conditioning Plastics and Electrical Insulating Materials for Testing[2]

D 883 Definitions of Terms Relating to Plastics[2,3]

D 1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure[3]

D 1599 Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings[3]

D 1600 Abbreviations of Terms Relating to Plastics[2,3]

D 1784 Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds[3]

D 2122 Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings[3]

D 2152 Test Method for Degree of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion[3]

D 2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials[3]

F 412 Definitions of Terms Relating to Plastic Piping Systems[3]

2.2 *NSF Standard:*

Standard No. 14 for Plastic Piping Components and Related Materials[4]

3. Definitions

3.1 *General*—Definitions are in accordance with Definitions D 883 or F 412 and abbreviations are in accordance with Abbreviations D 1600, unless otherwise indicated. The abbreviation for poly(vinyl chloride) plastic is PVC.

3.2 *hydrostatic design stress*—the estimated maximum tensile stress in the wall of the tubing in the circumferential orientation due to internal hydrostatic water pressure that can be applied continuously with a high degree of certainty that failure of the tubing will not occur.

3.3 *pressure rating (PR)*—the estimated maximum pressure that water in the tubing can exert continuously with a high degree of certainty that failure of the tubing will not occur.

3.4 *relation between dimensions, hydrostatic design stress, and pressure rating*—the following expression, commonly known as the ISO equation,[5] is used in this specification to relate dimensions, hydrostatic design stress, and pressure rating:

$$2S/P = (D_0/t) - 1 \text{ or } 2S/P = R - 1$$

where:

S = hydrostatic design stress, MPa (or psi),
P = pressure rating, MPa (or psi),
D_0 = average outside diameter, mm (or in.),
t = minimum wall thickness, mm (or in.), and
R = standard thermoplastic pipe dimension ratio (D_0/t for PVC tubing).

3.5 *standard dimension ratio (SDR)*—the average outside diameter in inches divided by the minimum wall thickness in inches, rounded to the nearest 0.5

3.6 *standard thermoplastic tubing materials designation code*—the tubing 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 hydrostatic design stress in units of 100 psi with any decimal figures dropped. Where the hydrostatic design code contains less than two figures, a cipher shall be used before the number. Thus a complete material code consists of three

[1] This specification is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.25 on (Vinyl Based) Pipe.

Current edition approved Feb. 24, 1989. Published May 1989. Originally published as D 2740 – 68. Last previous edition D 2740 – 88.

[2] *Annual Book of ASTM Standards*, Vol 08.01.

[3] *Annual Book of ASTM Standards*, Vol 08.04.

[4] Available from the National Sanitation Foundation, P.O. Box 1468, Ann Arbor, MI 48106.

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

TABLE 1 Outside Diameters and Tolerances for PVC Tubing

Nominal Tubing Size, in.	Outside Diameter, in.	Tolerance	
		For Average, in.	For Max (Out-of-Roundness)[A] in.
½	0.625	±0.004	±0.015
¾	0.875	±0.004	±0.015
1	1.125	±0.004	±0.015
1¼	1.375	±0.004	±0.015

[A] The maximum and minimum (out-of-roundness) tolerances apply only to tubing as extruded.

letters and four figures for PVC plastic tubing materials (see Section 4).

3.7 *tubing*—for the purpose of this specification, pipe made to specific outside diameters as shown in Table 1.

4. Classification

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

4.2 *Standard Thermoplastic Pipe Dimension Ratios (SDR)*—This specification covers PVC tubing in four standard dimension ratios, namely 13.5, 17, 21, and 26. These are referred to as SDR 13.5, SDR 17, SDR 21, and SDR 26, respectively. The pressure rating is uniform for all nominal tubing sizes for a given PVC pipe material and SDR (Appendix).

4.3 *Hydrostatic Design Stresses*—This specification covers PVC tubing made from four PVC plastics as defined by hydrostatic design stresses developed on the basis of longterm tests (Appendix).

5. Materials

5.1 *General*—PVC plastics used to make tubing 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 1—PVC tubing 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 National Sanitation Foundation (NSF) Standard 14. The seal or mark of the laboratory making the evaluation should be included on the tubing.

5.2 *Basic Materials*—This specification covers tubing made from PVC plastics having certain physical and chemical properties as described in Specification D 1784.

5.3 *Compound*—The PVC compound used for this tubing shall equal or exceed one of the following classes described in Specification D 1784: 12454-B, 12454-C, or 14333-D.

5.4 *Rework Material*—Clean, rework material, generated from the manufacturer's own tubing production, may be used by the same manufacturer, as long as the rework material produces tubing meeting all the requirements of this specification.

6. Requirements

6.1 *Workmanship*—The tubing shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other defects. The tubing shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

6.2 *Dimensions and Tolerances:*

6.2.1 *Outside Diameters*—The outside diameters and tolerances shall be as shown in Table 1 when measured in accordance with Test Method D 2122. The tolerances for out-of-roundness shall apply only to tubing prior to shipment. Out-of-roundness (deviations of maximum and minimum outside diameters from the average outside diameter) shall be ± 0.015 in. as extruded. Coiling may increase the out-of-roundness to some degree, depending on the coiling method and coil dimensions.

6.2.2 *Wall Thicknesses*—The wall thicknesses and tolerances shall be as shown in Table 2 when measured in accordance with Test Method D 2122.

6.2.3 *Wall Thickness Range*—The wall thickness range shall be within 12 % when measured in accordance with Test Method D 2122.

6.3 *Sustained Pressure*—The tubing shall not fail, balloon, burst, or weep as defined in Test Method D 1598 at the test pressures given in Table 3, when tested in accordance with 7.4.

6.3.1 *Accelerated Regression Test*—At the option of the manufacturer, an accelerated regression test may be substituted for the sustained pressure test. The test shall be conducted in accordance with 7.4.1. The pipe shall demonstrate a hydrostatic design basis projection at the 100 000 h intercept that meets the hydrostatic design basis category requirement (Table 1, Test Method D 2837) for the PVC

TABLE 2 Wall Thickness and Tolerances for PVC Plastic Tubing

Nominal Tubing Size, in.	Wall Thickness,[A] in.							
	PVC2110		PVC2112		PVC2116		PVC1120 PVC1220 PVC2120	
	Min	Tolerance	Min	Tolerance	Min	Tolerance	Min	Tolerance
½	0.062	+0.015	0.062	+0.015	0.062	+0.015	0.062	+0.015
¾	0.065	+0.015	0.062	+0.015	0.062	+0.015	0.062	+0.015
1	0.083	+0.015	0.066	+0.015	0.062	+0.015	0.062	+0.015
1¼	0.102	+0.015	0.081	+0.015	0.065	+0.015	0.062	+0.015

[A] The minimum is the lowest wall thickness of the tubing at any cross section. The maximum permitted wall thickness, at any cross section, is the minimum wall thickness plus the stated tolerance. All tolerances are on the plus side of the minimum requirement. The standard dimension ratios (SDR) are as follows:

For PVC2110	13.5
For PVC2112	17
For PVC2116	21
For PVC1120, 1220, and 2120	26