



Designation: **D1710–08 D1710–15**

Standard Specification for Extruded Polytetrafluoroethylene (PTFE) Rod, Heavy Walled Tubing and Basic Shapes¹

This standard is issued under the fixed designation D1710; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification covers extruded polytetrafluoroethylene (PTFE) rod, heavy-walled tubing, and basic shapes manufactured from the PTFE resin of Specification **D4894** and reprocessed PTFE resin (as defined in **Guides D5033 and D7209**).

1.2 The specification covers all sizes of rod, tubing, and basic shapes with a wall thickness of 1.6 mm ($\frac{1}{16}$ in.) or greater. These materials must be made wholly from PTFE and produced in accordance with good commercial ram extrusion practices.

NOTE 1—This specification and ISO/DIS 13000-1 (1997) and ISO/DIS 13000-2 (1997) differ in approach, however, data obtained using either are technically equivalent.

NOTE 2—For compression molded PTFE materials, see Specification D3294. Material that can be certified to Specification D3294 may be substituted for Specification D1710, however the reverse is not true.

1.3 The values stated in SI units, as detailed in IEEE/ASTM SI 10 are to be regarded as the standard. The inch-pound units given in parentheses are provided for information only.

1.4 The following precautionary caveat pertains to the test methods portion, Section 12, only 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

D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

D374 Test Methods for Thickness of Solid Electrical Insulation (Withdrawn 2013)³

D618 Practice for Conditioning Plastics for Testing

D638 Test Method for Tensile Properties of Plastics

D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D883 Terminology Relating to Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics

D3892 Practice for Packaging/Packing of Plastics

D4894 Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials

~~**D5033** Guide for Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics (Withdrawn 2007)³~~

D5740 Guide for Writing Material Standards in the Classification Format

D5947 Test Methods for Physical Dimensions of Solid Plastics Specimens

D7209 Guide for Waste Reduction, Resource Recovery, and Use of Recycled Polymeric Materials and Products (Withdrawn 2015)³

E94 Guide for Radiographic Examination

IEEE/ASTM SI 10 Standard for the Use of the International System of Units (SI): The Modern Metric System⁴

¹ This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials. Current edition approved April 1, 2008; Sept. 1, 2015. Published May 2008; September 2015. Originally approved in 1960. Last previous edition approved in 2002 as **D1710–02; D1710–08**. DOI: 10.1520/D1710-08; 10.1520/D1710-15.

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.

⁴ Available from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

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

2.2 ISO Standards:⁵

ISO 13000-1 (2005) Plastics—Polytetrafluoroethylene (PTFE) Semi-Finished Products, Part 1: Basis for Specification

ISO 13000-2 (2005) Plastics—Polytetrafluoroethylene (PTFE) Semi-Finished Products, Part 2: Preparation of Test Specimen and Determination of Properties

3. Terminology

3.1 Definitions:

3.1.1 Definitions are in accordance with Terminology **D883** unless otherwise specified.

3.1.2 *lot, n*—one production run or a uniform blend of two or more production runs.

3.2 *Abbreviations*—Abbreviations are in accordance with Terminology **D1600**. PTFE is the acronym for polytetrafluoroethylene.

4. Classification

4.1 This specification covers three types of PTFE rod, heavy-walled tubing, and basic shapes. They are as follows:

4.1.1 *Type I, Premium*—A type of rod, heavy-walled tubing, or basic shape requiring both maximum physical and electrical properties to meet rigid requirements.

4.1.2 *Type II, Non-electrical Premium*—A type of rod, heavy-walled tubing, or basic shape requiring physical properties, but no electrical requirements.

4.1.3 *Type III*—A type of rod, heavy-walled tubing, or basic shape for non-critical chemical, electrical, and mechanical applications.

4.1.4 *Type IV*—A type of rod, heavy-walled tubing, or basic shape for chemical, electrical, and mechanical applications, not requiring physical property testing as described for Types I, II, and III, in Tables 1 and 2.

NOTE 3—Type I and Type II are Grade 1 (Virgin Resin) and Type III and Type IV are Grade 2 (Reprocessed Resin).

4.2 A one-line system is used to specify materials covered by this specification. The system uses predefined cells to refer to specific aspects of this specification, illustrated as follows:

Standard Number Block	Specification Type	Grade	Class	Special notes
Example: Specification D1710-08	1	1	A	

4.2.1 For this example, the line callout would be Specification D1710-08, 11 A, and would specify that a rod, heavy-walled tubing, or basic shape has all of the properties listed for that type, grade, and class. A comma is used as the separator between the standard number and the type. Separators are not needed between the type, grade, and class. A provision for special notes is included so that other information can be provided when required. An example would be to specify the dimension tolerances for each size of rod, heavy-walled tubing, or basic shape. When special notes are used, they shall be preceded by a comma.

4.3 The types are further subdivided into two grades:

4.3.1 *Grade 1*—Made only from virgin resin.

4.3.2 *Grade 2*—Made using reprocessed resin.

4.4 The grades are further subdivided into four classes:

4.4.1 *Class A*—Rod, heavy-walled tubing, or basic shape having normal dimensional stability.

4.4.2 *Class B*—Rod, heavy-walled tubing, or basic shape meeting the dimensional stability requirements of **Table 1**.

4.4.3 *Class C*—Same as Class A, but, in addition, completely examined for internal defects.

4.4.4 *Class D*—Same as Class B, but, in addition, completely examined for internal defects.

5. Materials and Manufacture

5.1 The rod, heavy-walled tubing, or basic shapes from Types I, II, III, and IV shall be made from non-pigmented PTFE as free of foreign matter as commercially practical.

6. General Requirements

6.1 The rod, heavy-walled tubing, or basic shapes covered by this specification shall meet the mechanical and electrical requirements specified in **Table 1** when tested by the methods given in Section 12. The heavy-walled tubing covered by this specification shall meet the mechanical and electrical requirements in **Table 2** when tested by the methods given in Section 12.

7. Dimensions, Mass, and Permissible Variations

7.1 The dimensions and tolerances of heavy-walled tubing shall be in accordance with **Table 3**. Measurements shall be made in accordance with Method A of Test Methods **D374** or Test Method **D5947**.

⁵ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

TABLE 1 Detail Requirements of Extruded Rod

Properties	Type I			Type II			Type III		
	Rod Diameter, in. ^A			Rod Diameter, in. ^A			Rod Diameter, in. ^A		
	under ½	½ to 1½	over 1½	under ½	½ to 1½	over 1½	under ½	½ to 1½	over 1½
Specific gravity, min	2.14	2.15	2.15	2.14	2.15	2.15	2.12	2.13	2.14
Tensile strength, min, MPa (psi)	13.8 (2000)	14.5 (2100)	15.2 (2200)	13.8 (2000)	14.5 (2100)	15.2 (2200)	9.7 (1400)	10.3 (1500)	11.0 (1600)
Elongation at Break, min, %	150	175	200	100	125	150	50	75	75
Dielectric strength, min, V/mil	700	750	750
Dimensional stability, ^B max, %									
Length	1.5	1.5	...	1.5	1.5	...	3.0	3.0	...
Diameter	0.5	0.5	...	0.5	0.5	...	1.0	1.0	...

^A 1 in. = 25.4 mm.

^BThis requirement applies only to rod of Classes B and D that is under 25.4 mm (1 in.) in diameter. Values for larger sizes shall be as agreed upon by manufacture and buyer or manufacture stating material was stress relieved after manufacture of extruded rod.

TABLE 2 Properties of PTFE Heavy-Walled Tubing

Grade	Type I		Type II		Type III	
	Grade 1	Grade 2	Grade 1	Grade 2	Grade 1	Grade 2
Specific Gravity, min	2.15	2.14	2.15	2.14	2.14	2.13
Tensile Strength, min, MPA (psi)	13.8 (2000)	10.4 (1500)	13.8 (2000)	10.4 (1500)	11.0 (1600)	9.0 (1300)
Elongation at break, min, %	150	140	150	140	100	80
Dielectric Strength, min 1 mm (0.040 in.) kV/mm Short Time (V/mil)	29.5 (750)	27.5 (700)	25.6 (650)	23.6 (600)	12 (325)	10 (250)
Dimensional Stability max, Classes B and D, %						
Length	1.5	1.5	2.0	2.0	2.5	2.5
Diameter	0.5	0.5	0.75	0.75	1.0	1.0

TABLE 3 Diameter and Tolerances for PTFE Rod and Heavy-Walled Tubing

Nominal Inside or Outside Diameter, ^A mm (in.)	Tolerance, ^B mm (in.)
1.6 (1/16)	0.13 (0.005)
3.2 (1/8)	0.18 (0.007)
4.8 (3/16)	0.23 (0.009)
6.3 (1/4)	0.30 (0.012)
9.5 (3/8)	0.30 (0.012)
12.7 (1/2)	0.36 (0.014)
15.8 (5/8)	0.41 (0.016)
19.1 (3/4)	0.43 (0.017)
25.4 (1)	0.51 (0.020)
31.8 (1 1/4)	0.64 (0.025)
38.1 (1 1/2)	0.76 (0.030)
44.4 (1 3/4)	0.89 (0.035)

^AIntermediate diameters shall conform to the tolerances of the next larger diameter in the table.

^BThe tolerance is plus for outside diameters and minus for inside diameters.