Designation: D3294 – 15

Standard Specification for Polytetrafluoroethylene (PTFE) Resin Molded Sheet and Molded Basic Shapes[1]

This standard is issued under the fixed designation D3294; 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 establishes requirements and methods of test for the material, dimensions, and workmanship, and the physical and electrical properties of molded sheet in minimum thicknesses of 0.794 mm (1/32 in.) manufactured from PTFE resin molding materials defined in Specification D4894.

1.2 This specification also establishes requirements for molded basic shapes made from molding materials. This specification is for products 300 mm (12 in.) or less in a dimension parallel to and 12.7 mm (0.5 in.) or greater in the dimension perpendicular to the direction of the applied molding pressure.

1.3 The values stated in SI units are to be regarded as the standard.

1.4 The following precautionary 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 and health practices and determine the applicability of regulatory limitations prior to use.* Special attention is called to 13.2, 13.3, 13.6, 13.8, and A1.

NOTE 1—There is no known ISO equivalent to this standard.

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D374 Test Methods for Thickness of Solid Electrical Insulation (Withdrawn 2013)[3]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

D1708 Test Method for Tensile Properties of Plastics by Use of Microtensile Specimens

D3892 Practice for Packaging/Packing of Plastics

D4591 Test Method for Determining Temperatures and Heats of Transitions of Fluoropolymers by Differential Scanning Calorimetry

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

D5947 Test Methods for Physical Dimensions of Solid Plastics Specimens

E94 Guide for Radiographic Examination

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

3. Terminology

3.1 *Definitions:*

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

3.1.2 *lot, n*—one continuous production run or a uniform blend of two or more production runs of one size sheet or molded basic shape.

3.2 *Abbreviations:*

3.2.1 Abbreviations are in accordance with Terminology D1600.

4. Classification

4.1 This specification covers the following four types of molded basic sheets and shapes:

4.1.1 *Type I*—Premium; normally used for exacting electrical, mechanical, or chemical applications.

[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 (Section D20.15.12).

Current edition approved Sept. 1, 2015. Published September 2015. Originally approved in 1974. Last previous edition approved in 2009 as D3294 - 09. DOI: 10.1520/D3294-15.

[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.

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

4.1.2 *Type II*—General purpose; for electrical, mechanical, and chemical applications not requiring premium material.

4.1.3 *Type III*—Mechanical Grade; for non-critical chemical, electrical, and mechanical applications.

4.1.4 *Type IV*—Utility; having no electrical requirements and with mechanical properties at a lower level.

4.2 Types I, II, and III shall be subdivided into two grades as follows:

4.2.1 *Grade 1*—made only from virgin resin.

4.2.2 *Grade 2*—made using reprocessed resin.

4.3 The grades shall be further subdivided into three classes as follows:

4.3.1 *Class A*—resistant to thermal dimensional change not exceeding 0.5 %.

4.3.2 *Class B*—thermal dimensional change not exceeding 5.0 %.

4.3.3 *Class C*—no requirement for thermal dimensional change.

4.4 A one-line system shall be used to specify materials covered by this specification. The system uses predefined cells to refer to specific aspects of this specification, as illustrated below.

Specification				
Standard Number Block	Type	Grade	Class	Special Notes
Example: Specification D3294 – 03,	I	I	A	

For this example, the line callout would be Specification D3294 – 03, 11A and would specify premium virgin form of polytetrafluoroethylene that has all of the properties listed for that Type, Grade, and Class in the appropriate specified properties, tables, or both, in the specification identified. A comma is used as the separator between the standard Number and the Type. Separators are not needed between the Type, Grade, and Class.[4] Provision for Special Notes is included so that other information shall be provided when required. An example would be in Specification D3295 where dimensions and tolerances are specified for each AWG size within Type and Class. When Special Notes are used, they shall be preceded by a comma.

5. Ordering Information

5.1 The molded sheet or basic shapes covered in this specification shall be ordered stating the type, grade, and class and that they meet the requirements of this specification.

6. Materials

6.1 The sheet or molded basic shape from Types I, II, III, or IV shall be made from unpigmented PTFE as free of foreign matter as commercially practical.

7. Requirements

7.1 The sheet covered by this specification shall meet the physical and electrical requirements specified in Table 1 when tested by the methods given in Section 13.

[4] See the ASTM *Form and Style Manual*. Available from ASTM International Headquarters.

TABLE 1 Physical and Electrical Requirements for PTFE Sheets[A]

Types	Tensile Strength[A] (min) psi	Elongation[A] (min) Percent	Dielectric Strength[B] (min) Volts Per Mill	Specific[C] Gravity	Porosity[D]
I	4500	300	600	2.15 to 2.18[E]	Zero penetration
II	3000	225	500	2.14 to 2.19	Not required
III	2000	150	300	2.13 to 2.19	Not required
IV	1300	75	Not required	2.13 to 2.20	Not required

[A] See 13.2.
[B] See 13.3
[C] See 13.4
[D] See 13.6
[E] PTFE sheet used for tank lining shall be Type I but shall have a specific gravity of 2.19 to 2.22.

7.2 The molded basic shapes covered by this specification shall meet the physical and electrical requirements specified in Table 2 when tested by the test methods given in Section 13.

7.2.1 *Melting Point*—the melting point of all types of sheet and molded basic shapes shall be 327 ± 10°C when tested in accordance with paragraph 13.8.

8. Dimensions

8.1 The size, shape, dimensional tolerances, and dimensional stability shall be as specified in the contract or order.

8.2 The tolerance on length and width shall be plus 6.3 mm (¼ in.), minus 0 mm (0 in.).

9. Workmanship, Finish, and Appearance

9.1 *Color*—Type I shall be white to translucent. Types II, III, and IV are typically white, but vary to off white or light gray. For Types II, III, and IV occasional small gray, brown, or black spots shall not be considered as cause for rejection.

9.2 *Finish*—The material shall be as free as is commercially practical from surface blisters, wrinkles, cracks and other surface defects that might affect its serviceability. It shall also be commercially free of macroscopic voids, cracks, and foreign inclusions.

9.3 *Internal Defects*—The moldings shall be as free as is commercially practical of microscopic voids, cracks, and foreign inclusions.

10. Sampling

10.1 Sampling shall be statistically adequate to satisfy the requirements of 15.1

11. Number of Tests

11.1 Routine lot inspection tests shall consist of all the tests specified in Table 1, Table 2, or Table 3.

TABLE 2 Physical and Electrical Requirements for Basic Shapes

Types	Tensile Strength psi (min)	Elongation % (min)	Dielectric Strength Volts per mil (min)	Specific Gravity
I	4800	325	1200	2.14 to 2.18
II	3200	240	850	2.14 to 2.19
III	1500	75	250	2.13 to 2.20
IV	1500	75	Not required	2.13 to 2.20