Designation: D7193 – 17 (Reapproved 2022)

Standard Specification for Unsintered Pigmented Polytetrafluoroethylene (PTFE) Extruded Film or Tape[1]

This standard is issued under the fixed designation D7193; 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 unsintered, pigmented, extruded films or tapes manufactured from polytetrafluoroethylene, in nominal thicknesses from 0.025 mm (0.001 in.) to 0.51 mm (0.020 in.), which are ≥99 % virgin PTFE in composition prior to introducing pigments.

NOTE 1—For unsintered non-pigmented products refer to Specification D6585.

1.1.1 The use of recycled PTFE for production of unsintered extruded films or tapes has not been identified at this time. When commercial usable processes and materials are available, this specification will be revised to include recycled materials.

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

1.3 *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.*

NOTE 2—Although this specification and ISO 13000-1 (1997) and ISO 13000-2 (1997) differ in approach or detail, data obtained relating to specific properties, using either are technically equivalent.

NOTE 3—This specification is intended to be a complement to Specification D6585, as the materials covered herein vary significantly enough due to their additives to warrant a stand-alone set of requirements.

1.4 *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]

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

D150 Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation

D257 Test Methods for DC Resistance or Conductance of Insulating Materials

D618 Practice for Conditioning Plastics for Testing

D882 Test Method for Tensile Properties of Thin Plastic Sheeting

D883 Terminology Relating to Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics

D1711 Terminology Relating to Electrical Insulation

D3892 Practice for Packaging/Packing of Plastics

D6040 Guide to Standard Test Methods for Unsintered Polytetrafluoroethylene (PTFE) Extruded Film or Tape

D6585 Specification for Unsintered Polytetrafluoroethylene (PTFE) Extruded Film or Tape

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

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

2.2 *ISO Standards:*[3]

ISO 13000-1 Plastics—Polytetrafluoroethylene (PTFE) Semi-Finished Products—Part 1: Requirements and Designation

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

2.3 *GSA Standard:*[4]

A-A-58092 Tape, Anti-Seize Polytetrafluoroethylene

[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.

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

[4] Available from General Services Administration, Engineering and Commodity Management Division (9FTE-10), 400 15th St. SW, Auburn, WA 98001

3. Terminology

3.1 *Definition*—Definitions are in accordance with Terminologies D883, D1711, and Test Methods D257; and abbreviated terms are in accordance with Terminology D1600, unless otherwise specified.

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

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *film, n*—full width material received as finished film.

3.3.2 *tape, n*—material that has been slit from the finished film.

3.3.3 *tensile strength at yield, n*—from Test Methods D882.

3.3.4 *pigment*—liquid or dry matter used as an additive, to alter the color of finished film or tape.

4. Classification

4.1 This specification covers three types of unsintered, pigmented, extruded PTFE tapes:

4.1.1 *Type I*—Thread Seal Tape (TST) with an apparent density of 0.50-1.60 g/cm^3.

4.1.2 *Type II*—Low Density Tape with an apparent density of 0.60-0.80 g/cm^3.

4.1.3 *Type III*—Wire and Cable Tape with an apparent density of 1.40-1.65 g/cm^3.

NOTE 4—Other products that do not fall into these density ranges are available. The values vary on these products and must be agreed to between supplier and purchaser.

4.2 Grades of tape are identified in Tables 1-3.

NOTE 5—Other products that do not fall into these ranges are available.

4.3 A line callout system is used to specify materials in this specification. The system uses pre-defined cells to refer to specific aspects of this specification, as illustrated below:

Standard Number Block	Type	Specification Grade	Class	Special Notes
ASTM D7193	III	2 mil	---	Color to be Royal Blue

For this example, the line call-out would be: ASTM D7193, III, 2 MIL, Color to be Royal Blue, that specifies an unsintered wire and cable tape, 2 mil thick, having all of the properties listed for that type and grade 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 and grade because they are, in turn, Roman numerals and Arabic digits as provided in Section B8. of the *Form & Style for ASTM Standards*, April 2004 Edition. Provision for "Special Notes" is included so that other information can be provided when required. This example relates to wire and cable tape with the added requirement that it be royal blue in color. When special notes are used, they shall be preceded by a comma.

5. Performance Requirements

5.1 Basic requirements from the property tables are always in effect unless superseded by specific suffix requirements, which always take precedence.

5.2 The materials shall conform to the requirements in Tables 1-4 and suffix requirements as they apply.

5.3 The dielectric breakdown strength of unsintered samples shall be tested in accordance with Test Method D149. The required values are to be agreed upon between producer and consumer.

5.4 If invoked by contract, or to gain understanding of the electrical performance consistency of a particular material dielectric constant and volume resistivity shall be tested in accordance with Test Methods D150 and D257, as seen in the guidelines found in Guide D6040.

5.5 The width tolerance of slit tape shall be in accordance with Table 4 unless otherwise specified by contract.

6. Sampling

6.1 Sampling shall be in accordance with an adequate statistical sampling procedure.

7. Conditioning

7.1 For those tests where conditioning is required, condition the test specimens in accordance with Procedure A of Practice D618, except the time shall be for a period of at least 4 h prior to test instead of the 40 h required by this method. If the test material has been exposed to temperatures below 20°C (68°F) within a 24 h period prior to test, the conditioning shall be at least 24 h.

7.2 Conduct tests at the standard laboratory temperature of 23 ± 2°C (73.4 ± 3°F). The maintenance of constant humidity is not necessary. In reference cases, the standard atmosphere and 50 ± 5 % relative humidity shall apply.

8. Test Methods

8.1 The properties enumerated in this specification shall be determined in accordance with test methods referenced in Section 2. (For example, see Test Methods D6040.)

TABLE 1 TYPE I Thread Seal Tape with an Apparent Density of 0.50 to 1.60 g/cm^3

NOTE 1—Where no property is listed, there is no requirement.

Grade	Apparent Density, g/cm^3		Thickness				Tensile Strength at Yield		Elongation at Maximum Strength
	Min	Max	mm	Tol	(in.)	Tol	MPa	psi	Min percent
Economy	0.50	0.90	0.076		0.0030				
Standard	0.80	1.10	0.076	±0.0127	0.0030	±0.0005			50
Mil Spec.A-A-58092	1.20		0.088	+0.0254 -0.0381	0.0035	+0.0010 -0.0015			40
Premium	1.20	1.60	0.076	±0.0127	0.0030	±0.0005	11.72	1700	75

TABLE 2 Type II Low Density Tape with an Apparent Density of 0.60 to 0.80 g/cm³

Grade	Apparent Density, g/cm³		Thickness				Tensile Strength at Yield		Elongation at Maximum Strength
	Min	Max	mm	Tol	(in.)	Tol	MPa	psi	Min percent
4 Mil	0.60	0.80	0.102	±0.0076	0.004	±0.0003	13.10	1900	40
5 Mil	0.60	0.80	0.127	±0.0102	0.005	±0.0004	13.10	1900	40
10 Mil	0.60	0.80	0.254	±0.0127	0.010	±0.0005	8.27	1200	40

TABLE 3 Type III Wire and Cable Tape with an Apparent Density of 1.40 to 1.65 g/cm³

NOTE 1—In cases where actual product thickness is between thickness values called out in this table, the actual thickness shall be rounded to the nearest defined increment using guidelines found in Practice E29, and the corresponding requirements applied.

Grade	Apparent Density, g/cm³		Thickness				Tensile Strength at Yield		Elongation at Maximum Strength
	Min	Max	mm	Tol	(in.)	Tol	MPa	psi	Min percent
2 Mil	1.4	1.65	0.050	±0.0076	0.002	±0.0003	12.41	1800	25
3 Mil	1.4	1.65	0.076	±0.0076	0.003	±0.0003	11.03	1600	25
4 Mil	1.4	1.65	0.102	±0.0076	0.004	±0.0003	10.34	1500	25
5 Mil	1.4	1.65	0.127	±0.0076	0.005	±0.0003	9.65	1400	25
6 Mil	1.4	1.65	0.152	±0.0102	0.006	±0.0004	7.58	1100	25
7 Mil	1.4	1.65	0.178	±0.0102	0.007	±0.0004	6.89	1000	25
8 Mil	1.4	1.65	0.203	±0.0102	0.008	±0.0004	6.21	900	25
9 Mil	1.4	1.65	0.229	±0.0102	0.009	±0.0004	5.52	800	25
10 Mil	1.4	1.65	0.254	±0.0127	0.010	±0.0005	4.83	700	50
11 Mil	1.4	1.65	0.279	±0.0152	0.011	±0.0006	4.48	650	50
12 Mil	1.4	1.65	0.305	±0.0229	0.012	±0.0009	4.14	600	50
13 Mil	1.4	1.65	0.330	±0.0279	0.013	±0.0011	3.79	550	50
14 Mil	1.4	1.65	0.356	±0.0330	0.014	±0.0013	3.10	450	50
15 Mil	1.4	1.65	0.381	±0.0381	0.015	±0.0015	2.76	400	50
16 Mil	1.4	1.65	0.406	±0.0406	0.016	±0.0016	2.76	400	50
17 Mil	1.4	1.65	0.432	±0.0432	0.017	±0.0017	2.76	400	50
18 Mil	1.4	1.65	0.457	±0.0457	0.018	±0.0018	2.76	400	50
19 Mil	1.4	1.65	0.483	±0.0483	0.019	±0.0019	2.76	400	50
20 Mil	1.4	1.65	0.508	±0.0508	0.020	±0.0020	2.76	400	50

TABLE 4 Width Tolerances

Width (mm)	Tolerance (mm)	Width (in.)	Tolerance (in.)
Below 6.35	±0.38	Below ¼	±0.015
Between 6.35 and 25.4	±0.51	Between ¼ and 1	±0.020
Between 25.4 and 50.8	±0.64	Between 1 and 2	±0.025
Between 50.8 and 76.2	±0.89	Between 2 and 3	±0.035
Between 76.2 and 152.4	±1.91	Between 3 and 6	±0.075
Between 152.4 and 304.8	±3.18	Between 6 and 12	±0.125
Greater than 304.8	±6.35	Greater than 12	±0.250

8.1.1 The number of samples shall be consistent with the requirements of Section 6.

8.1.2 One set of test specimens shall be considered sufficient for testing each lot. The average result of the specimens shall conform to the requirements of this specification.

9. Inspection and Certification

9.1 Inspection and certification of the material supplied with reference to a specification based on this classification system shall be for conformance to the requirements specified herein.

9.2 Lot-acceptance inspection shall be the basis on which acceptance or rejection of the lot is made.

9.3 Periodic check inspection with reference to a specification based upon this classification system shall consist of the tests for all requirements of the material under the specification. Inspection frequency shall be adequate to ensure the material is certifiable in accordance with 9.4.

9.4 Certification shall be that the material was manufactured by a process in statistical control, sampled, tested, and inspected in accordance with this classification system, and that the average values for the lot meet the requirements of the specification.

9.5 A report of test results shall be furnished when requested. The report shall consist of results of the lot-acceptance inspection for the shipment and the results of the most recent periodic-check inspection.

10. Packaging and Package Marking

10.1 *Packaging*—The materials shall be packaged in standard commercial containers constructed so as to ensure acceptance by common carrier unless otherwise specified in the contract or order.

10.2 *Package Marking*—Shipping containers shall be marked with the name of the material, type, thickness, and