



Standard Specification for Unsintered Pigmented Polytetrafluoroethylene (PTFE) Extruded Film or Tape¹

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 >97 % 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 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.*

NOTE 2—Although this specification and ISO/DIS 13000-1 (1997) and ISO/DIS 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.

2. Referenced Documents

2.1 ASTM Standards:²

D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials

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.

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

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 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

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

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/cm³.

4.1.2 Type II—Low Density Tape with an apparent density of 0.60-0.80 g/cm³.

4.1.3 Type III—Wire and Cable Tape with an apparent density of 1.40-1.65 g/cm³.

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.

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	Type	Specification Grade	Class	Special Notes
Block 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.)

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.

TABLE 1 TYPE I Thread Seal Tape^A with an Apparent Density of 0.50 to 1.60 g/cm³

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	0.0035	+0.0010			40
				-0.0381		-0.0015			
Premium	1.20	1.60	0.076	±0.0127	0.0030	±0.0005	11.72	1700	75

^AWhere no property is listed, there is no requirement.

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

Grade	Apparent Density, g/cm ³		Thickness			Tensile Strength at Yield		Elongation at Maximum Strength	
	Min	Max	mm	Tol	(in.)	Tol	MPa	psi	
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

^AThe values in this table are the default values for Type II pigmented tape in the thickness listed. Other low apparent density products that do not fall into these ranges are available. Agreement between manufacturer and consumer regarding test values that differ from those seen in this table are acceptable.

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

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

^AIn 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.

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

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 quantity contained therein. Each roll or package shall be marked to designate type, lot number, and manufacturer's name.

10.3 All packaging and marking provisions of Practice D3892 shall apply to this specification.

11. Keywords

11.1 apparent density; elongation; extruded; film; fluorocarbon film; pigmented; PTFE; PTFE tape; tape; tensile; thread seal tape; unsintered

SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this standard since the last issue (D7193 - 05) that may impact the use of this standard. (February 1, 2011)

- (1) Added Summary Of Changes section as the last issue was the original issue.
- (2) Revised permissive text throughout.
- (3) Added **Note 1** after **1.1** directing the user to the appropriate standard for non-pigmented versions of this material.
- (4) Updated reference standards **2.1**.
- (5) Changed test method from D638 to **D882** in **3.3.3** to harmonize with Guide **D6040**.
- (6) Revised **Note 4** in Section **4** regarding alternate, user-specific, required densities.
- (7) Added **5.3** to address dielectric breakdown requirements.
- (8) Added **5.4** to address dielectric constant and volume resistivity requirements should they exist.
- (9) Added **5.5** and **Table 4** covering width tolerance of slit tapes ASTM.

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