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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Specification for Polychlorotrifluoroethylene (PCTFE) Extruded Plastic Sheet and Film[1]

This standard is issued under the fixed designation D 3595; 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 extruded sheet and film in thicknesses from 0.015 to 0.25 mm (0.0006 to 0.01 in.).

1.2 The values stated in SI units shall be regarded as the standard.

1.3 The following precautionary statement pertains only to the test methods portion, Section 9 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.*

NOTE 1—There is no ISO equivalent specification to this specification.

2. Referenced Documents

2.1 *ASTM Standards:*

D 374 Test Methods for Thickness of Solid Electrical Insulation[2]

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing[3]

D 882 Test Methods for Tensile Properties of Thin Plastic Sheeting[3]

D 883 Terminology Relating to Plastics[3]

D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature[3]

D 1430 Specification for Polychlorotrifluoroethylene (PCTFE) Plastics[3]

D 1600 Terminology for Abbreviated Terms Relating to Plastics[3]

D 1898 Practice for Sampling of Plastics[3]

D 3892 Practice for Packaging/Packing of Plastics[4]

F 1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor[3]

3. Terminology

3.1 Definitions of terms used in this specification shall be in accordance with Terminology D 883.

3.2 Abbreviations are in accordance with Terminology D 1600. PCTFE is the abbreviation for polychlorotrifluoroethylene.

4. Classification

4.1 This specification covers three types of polychlorotrifluoroethylene sheet and film:[5]

4.1.1 *Type I*—Transparent film, with high and low moisture vapor transmission rate.

4.1.2 *Type II*—Dimensionally stable transparent sheet and film with low moisture vapor transmission rate.

4.1.3 *Type III*—Dimensionally stable transparent film with very low moisture vapor transmission rate.

4.1.4 *Type IV*—Low crystalline transparent film with high ductility and extremely low moisture vapor transmission.

4.2 A one-line system may 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
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Example: Specification D 4895 — 89,	I	6	C	

For this example, the line callout would be Specification D 4895 – 89,I6C, and would specify a coagulated dispersion form of polytetrafluoro-ethylene 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.[6] Provision for Special Notes is included so that other information can be provided when required. An example would be in Specification D 3295 – 81a where dimensions and tolerances are specified for each AWG size within Type and Class. When Special Notes are used, they should be preceded by a comma.

[1] This specification is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials (Section D20.15.12).

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[2] *Annual Book of ASTM Standards*, Vol 10.01.

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

[4] *Annual Book of ASTM Standards*, Vol 08.02.

[5] The basic polymer used to make these types of polymer does not correspond to the types given in Specification D 1430.

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

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

5. Requirements

5.1 The sheet and film shall be manufactured from polychlorotrifluoroethylene (PCTFE) plastics that consist of at least 90 % chlorotrifluoroethylene. The remaining 10 % may include chemical modifications, such as co-monomers, but not colorants, fillers, plasticizers, or mechanical blends of other resins.

5.2 The length, width, roll core diameter, and maximum number of splices permitted shall be as agreed upon between the purchaser and the seller. The tolerance for roll width shall be 3 % mm (⅛ in.). The tolerance for roll length shall be ± 10 % of the specified length.

5.3 Thickness tolerances shall be as specified in Table 1.

5.4 The sheet and film shall conform to the property values specified in Table 2, Table 3, and Table 4.

5.5 The material shall be essentially free from contamination, wrinkles, holes, scratches, and other imperfections unless otherwise agreed upon between the purchaser and the seller.

6. Sampling

6.1 Unless otherwise agreed between the purchaser and the seller the materials shall be sampled in accordance with the sampling procedure prescribed in Practice D 1898.

6.1.1 Adequate statistical sampling shall be considered an acceptable alternative.

6.2 A lot shall consist of all material of the same thickness delivered at the same time.

7. Number of Tests

7.1 One set of test specimens as prescribed in Section 8 shall be considered sufficient for testing each batch. The average result of the specimens tested shall conform to the requirements of this specification.

8. Specimen Preparation

8.1 *Conditioning*—For those tests where conditioning is required, condition the test specimens in accordance with Procedure A of Practice D 618 for a period of at least 24 h prior to test.

8.2 *Test Conditions*—Unless otherwise specified, conduct tests at the Standard Laboratory Temperature of 23 ± 2°C (70 to 77°F) and at 50 ± 5 % relative humidity.

8.3 *Preparation of Specimens*—Take test specimens across the width of the roll.

9. Test Methods

9.1 *Thickness*—Measure the thickness of the sheet of film in accordance with Test Methods D 374, Method A or C. Measure the sample across the web width at 25-mm (1-in.) increments. All readings shall be within the specified tolerances. Abnormal readings may occasionally result from spot imperfections. Discard such readings and take new readings in the same area (excluding the defect).

9.2 *Tensile Strength and Elongation*—Determine tensile strength and elongation of the sheet or film in accordance with Test Methods D 882, Method A. The specimen size shall be 25 by 127 mm (1 by 5 in.). Elongation rate shall be 508 mm (20 in.)/min. Separation between jaws shall be 51 mm (2 in.). Edges of the specimen shall be parallel within 2 % of the width.

9.3 *Dimensional Stability*—Test dimensional stability of the sheet or film in accordance with Test Method D 1204 after exposure to 149°C (300°F) for 10 min.

9.4 *Moisture Vapor Transmission Rate*—Measure the moisture vapor transmission rate in accordance with Test Method F 1249 at 100 % relative humidity at 38°C (100°F).

TABLE 1 Thickness Tolerance

Thickness		Tolerance, %	Type Availability
mm	in.		
0.015	0.0006	±20	IV
0.019	0.00075	±20	III
0.023	0.0009	±20	IV
0.038	0.0015	±20	I,
0.051	0.0002	±15	I, II, III, IV
0.076	0.0003	±15	II
0.127	0.0005	±15	II
0.19	0.0075	±10	II
0.20	0.0078	±10	III
0.25	0.010	±10	II

TABLE 2 Tensile Strength and Elongation

Thickness, mm (in.)	Type	Tensile Strength, min		Elongation, min, %
		psi	MPa	
0.019 to 0.038 (0.00075 to 0.0015)	I, II, III	2800	19.32	50
0.051 to 0.25 (0.020 to 0.01)	I, II, III	3100	21.40	50
0.016 to 0.051 (0.0006 to 0.002)	IV	4500	31.0	70

TABLE 3 Dimensional Stability

Thickness, mm (in.)	Type	Shrinkage,[A] max,%
0.038 to 0.051 0.0015 to 0.002	I	±17
0.019 to 0.051 0.00075 to 0.002	II, III	±3
0.051 to 0.25	III	±3
0.002 to 0.25	II	±5
0.016 to 0.051 0.0006 to 0.002)	IV	±15

[A] Positive sign means increase in length.

TABLE 4 Moisture Vapor Transmission Rate

Thickness		Type	Moisture Vapor Transmission Rate, max, $g/m^2 \times 24$ h
mm	in.		
0.038	0.0015	I	0.61
0.019	0.00075	III	0.68
0.051	0.002	II	0.57
0.0051	0.002	III	0.31
0.016	0.0006	IV	0.42
0.051	0.002	IV	0.12

10. Inspection

10.1 Inspection of the material shall be agreed upon between the purchaser and the seller as part of the purchase contract.

11. Rejection and Rehearing

11.1 Material that fails to conform to the requirements of this specification may be rejected.

12. Packaging and Package Marking

12.1 *Packaging*—The material shall be packaged in standard commercial containers so constructed as to ensure acceptance by common or other carriers for safe transportation at the lowest rate to the point of delivery, unless otherwise specified in the contract or order.

12.2 *Marking*—Shipping containers shall be marked with the name of the material, type, size, and quantity contained therein. Each roll of tape shall be marked to designate type, grade, and lot number. The marking will be in the core and on the pallet.

12.3 All packing, packaging, and marking provisions of Practice D 3892 shall apply to this specification.

13. Keywords

13.1 chlorofluorocarbon plastics; copolymer; extruded PCTFE; fluorocarbon polymer; fluoropolymers; homopolymer; PCTFE; PCTFE film; PCTFE sheet; polychlorotrifluoroethylene

SUMMARY OF CHANGES

This section identifies the location of selected changes to this test method. For the convenience of the user, Committee D-20 has highlighted those changes that may impact the use of this test method. This section may also include descriptions of the changes, or reasons for the changes, or both.

D 3595 – 97:

(*1*) Changed extruded sheet and film thicknesses in 1.1.

(*2*) Added Note 1.

(*3*) Added Test Method F 1249 to 2.1.

(*4*) Added revisions to 4.1.1, 4.1.3, and 4.1.4 .

(*5*) Table 1 reflects changes in thicknesses for standard products.

(*6*) The sheet and film shall conform to the property values specified in Table 2, Table 3, and Table 4. These tables have been changed to reflect the new thickness and addition of Type IV material.

(*7*) Revised 8.3.

(*8*) Changed dimensional stability to 10 min in 9.3.

(*9*) Revised 9.4 and deleted the section on the old MVTR method, including Footnote 7.

(*10*) Revised 12.2.2.

(*11*) Added *homopolymer* and *copolymer* to Keywords.