



## Designation: ~~D3368 – 04 (Reapproved 2010)~~ **D3368 – 14**

# Standard Specification for FEP-Fluorocarbon Sheet and Film<sup>1</sup>

This standard is issued under the fixed designation D3368; 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 ( $\epsilon$ ) 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-~~Scope~~\*

1.1 This specification covers unfilled, unpigmented FEP-fluorocarbon resin sheet and film less than 3.175 mm (0.125 in.) thick. Recycled materials are allowed in accordance with 6.2.

1.2 The values stated in SI units as detailed in **IEEE/ASTM SI 10** are to be regarded as standard and the practices of **IEEE/ASTM SI 10** incorporated herein.

1.3 The following safety hazards caveat pertains only to the test methods portion, Section 14, 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 known ISO equivalent to this standard.

## 2. Referenced Documents

### 2.1 *ASTM Standards*:<sup>2</sup>

**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**D374 Test Methods for Thickness of Solid Electrical Insulation (Withdrawn 2013)**<sup>3</sup>

**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**

**D882 Test Method for Tensile Properties of Thin Plastic Sheeting**

**D883 Terminology Relating to Plastics**

**D2116 Specification for FEP-Fluorocarbon Molding and Extrusion Materials**

**D3892 Practice for Packaging/Packing of Plastics**

**D5740 Guide for Writing Material Standards in the Classification Format**

**E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method**

**IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI)**

### 2.2 *Other Standard*:

**TAPPI 411 Standard Thickness (Caliper) of Paper and Paper Products**<sup>4</sup>

## 3. Terminology

### 3.1 *Definitions*:

3.1.1 For definitions of terms used in this specification, see Terminology **D883**.

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

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee **D20** on Plastics and is the direct responsibility of Subcommittee **D20.15** on Thermoplastic Materials D20.15.12 on Fluoropolymers.

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<sup>2</sup> 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.

<sup>3</sup> The last approved version of this historical standard is referenced on www.astm.org.

<sup>4</sup> Available from Technical Association of the Pulp and Paper Industry (TAPPI), 15 Technology Parkway South, Norcross, GA 30092, http://www.tappi.org.

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

#### 4. Classification

4.1 This specification covers four types of FEP-fluorocarbon sheet and film:

4.1.1 *Type I*—General purpose.

4.1.2 *Type II*—Cementable film. Type II materials can be subdivided into two grades:

4.1.2.1 *Grade 1*—One side cementable, and

4.1.2.2 *Grade 2*—Two sides cementable.

4.1.3 *Type III*—Special film for applications requiring unusual flexural endurance or extreme thermal and chemical service.

4.1.4 *Type IV*—Film for mold release applications.

4.2 A line callout system is used to specify materials in this standard. The system uses predefined cells to refer to specific aspects of this specification, which are illustrated as follows:

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<https://standards.iteh.ai/catalog/standards/sist/a8f27be5-201c-486f-aaf8-ebd7cc65bfe2/astm-d3368-14>

Specification				
Standard Number Block	Type	Grade	Class	Special Notes
Example: Specification D3368 – XX,	II	1		, 0.051 mm thick

For this example, the line callout would be Specification D3368 – XX, II 1, 0.051 mm thick. This callout specifies a film of FEP that is cementable on one side and that has all of the properties listed for that type and grade in the appropriate specified properties or tables, or both, in this specification. Inclusion of a class is provided for in the system, but is not used in this particular specification. A comma is used as the separator between the standard number and the type. Separators are not needed between the type, grade, and class.<sup>5</sup> Provision for special notes is included in the system so that other information can be provided when required, in this case, the thickness of the film. When special notes are used, they shall be preceded by a comma.

## 5. Ordering Information

5.1 The sheet and film shall be furnished in the form of sheets or rolls in accordance with good commercial practice. Rolls shall be wound evenly and tightly on substantial cores suitably restrained to prevent unwinding.

5.2 Dimensions of sheet and film with respect to length, width, and core diameter shall be upon agreement between the purchaser and the manufacturer. The agreement shall apply also to the maximum number of splices per roll and tolerances for length and core.

5.3 Requests for certification or test results shall be made at the time of order placement.

## 6. Materials and Manufacture

6.1 The sheet and film shall be made from FEP-fluorocarbon resin as specified in Specification **D2116** without filler or plasticizer.

6.2 This specification allows for the use of recycled, reprocessed, and reworked FEP materials provided the following:

6.2.1 The final physical, mechanical, and performance requirements as stated in this specification are met.

6.2.2 The toxicological characteristics are essentially unaltered from that of virgin material.

## 7. Other Requirements

7.1 The sheet and film shall conform to the physical, mechanical, and performance property requirements specified in **Table 1**. The nominal thickness of sheet or film and thickness tolerances shall be in accordance with **Table 2**.

7.2 The film and sheet shall be uniform in appearance and shall be sufficiently free of contamination, wrinkles, holes, scratches, and other imperfections so as to be functionally acceptable. The color shall be uniform and be characteristic of unpigmented sheet or film that ranges from clear to translucent and is dependent upon the thickness.

7.3 Tolerances for width of rolls shall be  $\pm 1.6$  mm ( $\pm 0.0625$  in.) for film or sheet thickness less than 0.508 mm (0.020 in.) and  $\pm 3.2$  mm ( $\pm 0.125$  in.) for sheet thickness equal to or greater than 0.508 mm.

## 8. Sampling

8.1 Sampling shall be statistically adequate to satisfy the requirements of **15.4**.

## 9. Number of Tests

9.1 One set of test specimens as prescribed in Section **10** shall be considered sufficient for testing each batch. The average result of the specimens tested shall conform to the requirements of this specification.

## 10. Specimen Preparation

10.1 Take test specimens across the width of film excluding areas of wrinkles, folds, gel, and other obvious, visually determined, imperfections.

## 11. Conditioning

11.1 For those tests where conditioning is required and unless otherwise specified in the test method, condition the test specimens in accordance with Procedure A of Practice **D618** for a period of at least 4 h prior to test.

## 12. Apparatus

12.1 *Heat Sealer*,<sup>6</sup> single heated jaw with silicone rubber pad, temperature range from 150 to 275°C (300 to 525°F), pressure 138 kPa (20 psi), and dwell time 10 s.

<sup>5</sup> See the ASTM *Form and Style Manual*. Available from ASTM Headquarters.

<sup>6</sup> Sentinel Model 12AS or 12-12AS, available from Packaging Industries Group, Inc., 130 North St., Hyannis, MA 02601, or equivalent, has been found satisfactory for this purpose.

**TABLE 1 Detail Requirements for Property Values**

	Type I	Type II	Type III	Type IV
Tensile Strength, min, MPa (psi), at nominal thickness, mm (in.):				
0.0127 (0.0005)	13.8 (2000)	13.8 (2000)	...	11.0 (1600)
<del>0.025 to 3.175 (0.001 to 0.125)</del>	<del>17.25 (2500)</del>	<del>17.25 (2500)</del>	<del>17.25 (2500)</del>	<del>14.5 (2100)</del>
0.025 to 3.175 (0.001 to 0.125)	17.2 (2500)	17.2 (2500)	17.2 (2500)	14.5 (2100)
Elongation at Break, min, %, at nominal thickness, mm (in.):				
0.0127 to 0.025 (0.0005 to 0.001)	175	175	...	150
0.051 to 3.175 (0.002 to 0.125)	250	250	250	250
Dimensional Change on Heating, max, %, at nominal thickness, mm (in.):				
0.0127 to 0.025 (0.0005 to 0.001)	±5	±5	...	±5
0.051 (0.002)	±3	±3	±4	±3
0.076 to 0.508 (0.003 to 0.020)	±2	±2	±3	...
0.762 to 1.524 (0.030 to 0.060)	...	...	±4	...
2.285 to 3.175 (0.090 to 0.125)	...	...	±5	...
Cementability, min, peel strength, kg/m (g/in.), at nominal thickness, mm (in.):				
0.0127 (0.0005)	...	6.69 (170)	...	...
0.025 (0.001)	...	11.8 (300)	...	...
0.051 (0.002)	...	29.5 (750)	...	...
0.076 (0.003)	...	31.5 (800)	...	...
0.102 (0.004)	...	47.2 (1200)	...	...
0.127 (0.005)	...	78.7 (2000)	...	...
0.254 (0.010)	...	94.5 (2400)	...	...
0.508 (0.020)	...	94.5 (2400)	...	...
Dielectric Strength, min, kV/mm (V/mil), at nominal thickness, mm (in.):				
<del>0.127 to 0.025 (0.0005 to 0.001)</del>	<del>160 (4000)</del>	<del>160 (4000)</del>	...	...
0.0127 to 0.025 (0.0005 to 0.001)	157 (4000)	157 (4000)	...	...
<del>0.051 (0.002)</del>	<del>140 (3500)</del>	<del>140 (3500)</del>	...	...
0.051 (0.002)	138 (3500)	138 (3500)	...	...
<del>0.076 (0.003)</del>	<del>120 (3000)</del>	<del>120 (3000)</del>	...	...
0.076 (0.003)	118 (3000)	118 (3000)	...	...
<del>0.102 (0.004)</del>	<del>110 (2750)</del>	<del>110 (2750)</del>	...	...
0.102 (0.004)	108 (2750)	108 (2750)	...	...
<del>0.127 (0.005)</del>	<del>100 (2500)</del>	<del>100 (2500)</del>	...	...
0.127 (0.005)	98 (2500)	98 (2500)	...	...
<del>0.254 (0.010)</del>	<del>72 (1800)</del>	<del>72 (1800)</del>	...	...
0.254 (0.010)	71 (1800)	71 (1800)	...	...
<del>0.356 (0.014)</del>	<del>64 (1600)</del>	<del>64 (1600)</del>	...	...
0.356 (0.014)	63 (1600)	63 (1600)	...	...
<del>0.508 (0.020)</del>	<del>56 (1400)</del>	<del>56 (1400)</del>	...	...
0.508 (0.020)	55 (1400)	55 (1400)	...	...
Density at 23°C, g/cm <sup>3</sup>	2.13 to 2.17	2.13 to 2.17	2.13 to 2.17	2.13 to 2.17

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**TABLE 2 Thickness and Tolerance Requirements**

Nominal Thickness, mm (in.)	Applicable Types	Thickness, mm (in.)			
		min		max	
0.0127 (0.0005)	I, II, IV	0.0089	(0.00035)	0.0165	(0.00065)
<del>0.025 (0.001)</del>	<del>I, II, IV</del>	<del>0.0177</del>	<del>(0.0007)</del>	<del>0.033</del>	<del>(0.0013)</del>
0.025 (0.001)	I, II, IV	0.018	(0.0007)	0.033	(0.0013)
<del>0.051 (0.002)</del>	<del>I, II, III</del>	<del>0.038</del>	<del>(0.0015)</del>	<del>0.0635</del>	<del>(0.0025)</del>
0.051 (0.002)	I, II, III	0.038	(0.0015)	0.064	(0.0025)
<del>0.076 (0.003)</del>	<del>I, II, III</del>	<del>0.05715</del>	<del>(0.00225)</del>	<del>0.094</del>	<del>(0.00375)</del>
0.076 (0.003)	I, II, III	0.057	(0.00225)	0.095	(0.00375)
0.102 (0.004)	I, II, III	0.080	(0.00315)	0.123	(0.00485)
0.127 (0.005)	I, II, III	0.102	(0.004)	0.152	(0.006)
<del>0.254 (0.010)</del>	<del>I, II, III</del>	<del>0.216</del>	<del>(0.0085)</del>	<del>0.292</del>	<del>(0.0045)</del>
0.254 (0.010)	I, II, III	0.216	(0.0085)	0.292	(0.0115)
0.356 (0.014)	I	0.320	(0.0126)	0.391	(0.0154)
0.508 (0.020)	I, II, III	0.432	(0.017)	0.584	(0.023)
0.762 (0.030)	I, III	0.648	(0.0255)	0.876	(0.0345)
1.016 (0.040)	III	0.889	(0.0350)	1.143	(0.0450)
<del>1.524 (0.060)</del>	<del>III</del>	<del>1.372</del>	<del>(0.054)</del>	<del>1.676</del>	<del>(0.0666)</del>
1.524 (0.060)	III	1.372	(0.054)	1.676	(0.0660)
2.413 (0.095)	III	2.172	(0.0855)	2.654	(0.1045)
<del>3.175 (0.125)</del>	<del>III</del>	<del>2.921</del>	<del>(0.113)</del>	<del>3.429</del>	<del>(0.137)</del>
3.175 (0.125)	III	2.870	(0.113)	3.480	(0.137)

12.2 Rod,<sup>7</sup> or other means for coating aluminum evenly with adhesive.

<sup>7</sup> No. 24 "Draw Down" rod, available from R. D. Specialities, Inc., P.O. Box 206, Webster, NY 14580, has been found satisfactory for this purpose.