



Designation: D 5047 – 95

## Standard Specification for Polyethylene Terephthalate Film and Sheeting<sup>1</sup>

This standard is issued under the fixed designation D 5047; 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 approval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This specification covers requirements for biaxially oriented polyethylene terephthalate film and sheeting in thicknesses from 1.5  $\mu\text{m}$  (0.06 mil) to 35.5  $\mu\text{m}$  (14.0 mil). For this specification polyethylene terephthalate film and sheeting shall be defined as the material derived from terephthalate acid and ethylene glycol and shall consist of at least 90 % polyethylene terephthalate homopolymer. This specification does not apply to coated, coextruded, tinted, pigmented, or metallized film or sheeting.

1.2 Polyethylene terephthalate materials, being thermoplastic, are reprocessible and recyclable.<sup>2</sup> This specification allows for the use of those polyethylene terephthalate plastic materials, provided that any specific requirements as governed by the producer and end user are met.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

NOTE 1—There is no similar or equivalent ISO standard.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- D 149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies<sup>3</sup>
- D 150 Test Methods for A-C Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials<sup>3</sup>
- D 257 Test Methods for D-C Resistance or Conductance of Insulating Materials<sup>3</sup>
- D 374 Test Methods for Thickness of Solid Electrical Insulation<sup>3</sup>
- D 774 Test Method for Bursting Strength of Paper<sup>4</sup>

- D 882 Test Methods for Tensile Properties of Thin Plastic Sheeting<sup>5</sup>
- D 883 Terminology Relating to Plastics<sup>5</sup>
- D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting<sup>5</sup>
- D 1505 Test Method for Density of Plastics by the Density-Gradient Technique<sup>5</sup>
- D 1894 Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting<sup>5</sup>
- D 1898 Practice for Sampling of Plastics<sup>5</sup>
- D 1922 Test Method for Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method<sup>5</sup>
- D 2176 Test Method for Folding Endurance of Paper by the M.I.T. Tester<sup>4</sup>
- D 2275 Test Method for Voltage Endurance of Solid Electrical Insulating Materials Subjected to Partial Discharges (Corona) on the Surface<sup>3</sup>
- D 2305 Test Methods for Testing Polymeric Films Used for Electrical Insulation<sup>3</sup>
- D 3417 Test Method for Heats of Fusion and Crystallization of Polymers by Thermal Analysis<sup>6</sup>
- D 3892 Practice for Packaging/Packing of Plastics<sup>6</sup>
- D 3985 Test Method for Oxygen Gas Transmission Rate Through Plastic Film and Sheeting Using a Coulometric Sensor<sup>4</sup>
- D 5033 Guide for the Development of Standards Relating to the Proper Use of Recycled Plastics<sup>7</sup>
- E 96 Test Methods for Water Vapor Transmission of Materials<sup>8</sup>

### 3. Terminology

3.1 *Definitions*—Unless otherwise indicated, the terminology used in this specification is in accordance with Terminology D 883.

#### 3.2 *Description of Term Specific to This Standard:*

3.2.1 *polyethylene terephthalate film and sheeting*—material derived from terephthalate acid and ethylene glycol and consisting of at least 90 % polyethylene terephthalate homopolymer.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.19 on Film and Sheeting.

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This revision includes the additional ISO equivalency statement, reference to recycled materials, and the addition of a keywords section.

<sup>2</sup> See Guide D 5033 for information and definitions related to recycled plastics.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 10.01.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 15.09.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 08.01.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 08.02.

<sup>7</sup> *Annual Book of ASTM Standards*, Vol 08.03.

<sup>8</sup> *Annual Book of ASTM Standards*, Vol 04.06.

#### 4. Ordering Information

4.1 Users should select the preferred options permitted herein and include the following information in the purchase contract:

- 4.1.1 Title, number, and date of this specification,
- 4.1.2 Length and width of sheets (see 5.1),
- 4.1.3 Thickness of sheets (see 5.1), and
- 4.1.4 Requirements for packaging, packing, and marking (see 10.1).

#### 5. General Requirements

5.1 The nominal thickness, width, and roll length including allowable splices per roll shall be established by mutual agreement between the purchaser and the seller.

5.2 Typical properties are shown in Table 1 and may be specified by agreement between the purchaser and the seller.

#### 6. Detail Requirements

6.1 *Form*—The film or sheeting shall be furnished flat or in rolls in the dimensions specified.

6.2 *Thickness*—The thickness shall be within  $\pm 18\%$  of nominal for film 19  $\mu\text{m}$  (0.75 mil) or under and within  $\pm 14\%$  of nominal for film or sheeting over 19  $\mu\text{m}$ . Thickness shall be tested in accordance with Test Methods D 374.

6.3 *Width*—The width shall be within  $\pm 1.6\text{ mm}$  ( $\frac{1}{16}$  in.) of width ordered on rolls or flat sheets up to 1 m (40 in.) wide and within  $\pm 3.2\text{ mm}$  ( $\frac{1}{8}$  in.) on rolls or sheets over 1 m wide.

6.4 *Weight*—The weight shall be within  $\pm 10\%$  of weight ordered for orders up to 1100 kg (2500 lb) and within  $\pm 5\%$  for orders over 1100 kg.

6.5 *Workmanship*—Quality of film or sheet with regard to gels, streaks, pinholes, particles of foreign matter, undispersed raw materials, holes, tears, and blisters shall be mutually established by the purchaser and the seller.

#### 7. Sampling

7.1 Unless otherwise agreed upon between the purchaser and the seller, the film or sheeting shall be sampled in accordance with the sampling procedure prescribed in Practice D 1898. Adequate statistical sampling shall be considered an acceptable alternative.

#### 8. Testing

8.1 The film or sheet shall be tested as appropriate to establish conformance to critical requirements based on the intended application and as agreed upon between the purchaser and the seller.

#### 9. Certification and Inspection

9.1 Certification and lot acceptance of the film or sheet may be made as agreed upon between the purchaser and the seller.

9.2 Periodic check inspection shall consist of the tests agreed upon between the purchaser and the seller.

9.3 A report of the test results shall be furnished at a frequency agreed upon between the purchaser and the seller when specified in a purchase order or contract.

#### 10. Packaging, Packing, and Marking

10.1 Provisions of Practice D 3892 apply for packaging, packing, and marking of plastic materials.

**TABLE 1 Typical Properties**

Property	Typical Value	Test Condition	ASTM Test Method
Ultimate tensile strength (MD)	170 MPa (25 000 psi)	25°C	D 882, Method A
Ultimate elongation (MD)	120 %	25°C	D 882, Method A
Tensile modulus (MD)	3800 MPa (550 000 psi)	25°C	D 882, Method A
Folding endurance (MIT)	100 000 cycles	25°C	D 2176 (1-kg load)
Tear strength—propagating (Elmendorf)	20 g/25 m	25°C	D 1922
Tear strength—initial (Graves)	800 g/25 m	25°C	D 1004
Bursting strength (Mullen)	0.45 MPa (66 psi)	25°C	D 774
Density	1.395 g/cm <sup>3</sup>	25°C	D 1505
Coefficient of friction (kinetic) (film-to-film)	0.45		D 1894
Oxygen transmission	93 cm <sup>3</sup> /m/24 h	25°C	D 3985
Water vapor transmission	28 g/m/24 h		E 96
Melting point	250°C		D 3417
Strain relief	1.5 %	30 min at 150°C	D 2305
Dielectric strength—short term (25- $\mu\text{m}$ film)	14 000 V/25 m	25°C-DC (500 V/s)	D 2305
	7500 V/25 m	25°C-60 Hz	D 149 and D 2305
	5000 V/25 m	150°C-60 Hz	
Dielectric constant	3.30	25°C-60 Hz	D 150
	3.25	25°C-1 KHz	
	3.0	25°C-1 MHz	
	2.8	25°C-1 GNz	
	3.7	150°C-60 Hz	
Dissipation factor	0.0025	25°C-60 Hz	D 150
	0.0050	25°C-1 KHz	
	0.016	25°C-1 MHz	
	0.003	25°C-GHz	
Volume resistivity	0.0040	15°C-60 Hz	
	10 <sup>18</sup> ohm-cm	25°C	D 257 and D 2305
Surface resistivity	10 <sup>13</sup> ohm-cm	150°C	
	10 <sup>16</sup> ohm/sq	23°C-30 % RH	D 257
Insulation resistance	10 <sup>12</sup> ohms/sq	23°C-80 % RH	
	10 <sup>12</sup> ohms	35°C-90 % RH	D 257 and D 2305
Corona resistance (75 $\mu\text{m}$ )	30 h (single sheet)	3000 VAC, 60 Hz	D 2275

## **11. Keywords**

### 11.1 film; polyethylene terephthalate; sheeting

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