Designation: D 3981 – 08

Standard Specification for Polyethylene Films Made from Medium-Density Polyethylene for General Use and Packaging Applications[1]

This standard is issued under the fixed designation D 3981; 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 unpigmented, unsupported, sheet or tubular, medium-density polyethylene films (hereafter referred to as film or films) from resins having densities in the range from 926.0 to 938.0 kg/m^3 (0.926 to 0.938 g/cm^3), inclusive, as measured on molded plaques.

1.2 This specification is applicable to homopolymer polyethylene but is not restricted to it.

1.3 This specification is also applicable to films made from copolymer polyethylene commonly referred to in industry as low-pressure polyethylene.

1.4 This specification is also applicable to films made from blends of homopolymers and copolymers, including ethylene/vinyl-acetate copolymers.

1.5 This specification allows for the use of recycled polyethylene film or resin as feedstock, in whole or in part, as long as all the requirements of this specification are met and as long as any specific requirements as governed by the producer and end user are also met (see Note 1).

NOTE 1—Guide D 5033 contains terminology and definitions relating to recycled plastics.

1.6 Special care must be exercised if this specification is applied to colored or pigmented films. This specification does not address specific problems associated with coloring, such as, quantity and quality of pigment dispersion, optical properties, and increase in density. These and other areas must be taken into account by mutual agreement between the supplier and the purchaser.

1.7 The thickness of the films covered by this specification range from 25 to 100 μm (0.001 to 0.004 in.), inclusive. The maximum width of the sheet or lay-flat is 3.05 m (120 in.).

1.8 This specification does not cover oriented heat-shrinkable films.

1.9 This specification defines the levels of various physical properties from which specifications for specific films are to be described. The levels of physical properties required by a film for a given application are selected from Section 6 and the corresponding tables. However, Sections 7.2-7.5 relating to tolerances shall apply without change to all film falling within the scope indicated by the title and 1.1-1.4.

1.10 This specification covers dimensional tolerances, classification, intrinsic quality requirements, and test methods. The dimensional tolerances include thickness, width, and length or yield. Classification defines types, classes, surfaces, and finishes. The intrinsic quality requirements include density, workmanship, impact strength, tensile strength, heat sealability, and odor, as well as the classification properties for stiffness, coefficient of friction, optical properties, and surface treatment. A sampling method is included.

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

1.12 The following precautionary caveat pertains only to the test methods portion, Section 10, 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 2—There is no known ISO equivalent to this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D 374 Test Methods for Thickness of Solid Electrical Insulation

D 882 Test Method for Tensile Properties of Thin Plastic Sheeting

D 883 Terminology Relating to Plastics

D 1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics

D 1505 Test Method for Density of Plastics by the Density-Gradient Technique

D 1709 Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method

[1] This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.19 on Film and Sheeting.

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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.

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

D 1894 Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting
D 1898 Practice for Sampling of Plastics[3]
D 2103 Specification for Polyethylene Film and Sheeting
D 2457 Test Method for Specular Gloss of Plastic Films and Solid Plastics
D 2578 Test Method for Wetting Tension of Polyethylene and Polypropylene Films
D 4321 Test Method for Package Yield of Plastic Film
D 4703 Practice for Compression Molding Thermoplastic Materials into Test Specimens, Plaques, or Sheets
D 4976 Specification for Polyethylene Plastics Molding and Extrusion Materials
D 5033 Guide for Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics[3]
E 462 Test Method for Odor and Taste Transfer from Packaging Film[3]

NOTE 3—Relevant government regulations also apply to this specification.

NOTE 4—If this product is intended for packaging foods, medicines, drugs, and cosmetics it is subject to applicable regulations of the Food and Drug Administration or the Department of Agriculture and must comply with such regulations. If it is necessary to comply with regulations of other government agencies, such as the Consumer Product Safety Commission, Environmental Protection Agency, Department of Transportation, Federal Trade Commission, etc., such compliance shall be arranged between the purchaser and the seller prior to placing an order.

F 88 Test Method for Seal Strength of Flexible Barrier Materials

3. Terminology

3.1 Unless otherwise indicated the terminology used in this specification is in accordance with definitions given in Terminology D 883.

4. Classification

4.1 The medium-density film is, by this specification, classified by Types: 0, 1, 2, and 3; Surfaces: 0, 1, 2, and 3; Classes: 0, 1, 2, and 3; and Finishes: 1, 2, 3, and 4. These classifications are described in detail in 6.1.

5. Materials

5.1 The film shall be made from a homopolymer polyethylene, copolymer polyethylene (see Note 5), or blends of homopolymers or copolymers, or both, so that it meets the density and other film requirements listed herein.

NOTE 5—From a polyethylene, polyethylene plastic, or an ethylene plastic as defined in Terminology D 883.

5.2 The film shall be made from resins having a density between 926.0 and 938.0 kg/m^3 (0.926 and 0.938 g/cm^3), inclusive.

5.3 The film shall be natural in color (essentially colorless) unless a color has been agreed upon between the supplier and the purchaser. If colored, the quality and uniformity of coloring shall be by agreement between the supplier and the purchaser. Also, if added colorants or pigments are used in an amount such that some film properties are affected, this shall be taken into account by mutual agreement between the supplier and the purchaser.

6. *Physical Requirements* Physical Requirements

6.1 *Classification Properties*:

6.1.1 *Type*—The 1 % secant modulus for all thicknesses of film shall be as specified in Table 1 for Types 0, 1, 2, and 3.

6.1.2 *Surface*—The kinetic coefficient of friction shall be as specified in Table 2 for Surfaces 0, 1, 2, and 3.

6.1.3 *Class*—The optical properties shall be as specified in Table 3 of Classes 0, 1, 2, and 3. The three optical properties of clarity, gloss, and haze do not always correlate. The particular property of most importance for the specific application shall be established and the value for this property shall then govern, in case of any inconsistency.

6.1.4 *Finish*—The surface treatment level of the film shall be as specified in Table 4 for Finishes 1, 2, 3, and 4.

6.2 *Other Physical Properties*:

6.2.1 *Impact Resistance*—Impact resistance of the film shall be established by mutual agreement between the supplier and the purchaser if this property is required.

NOTE 6—Dart-impact resistance of medium-density polyethylene films can be substantially less than that of low-density polyethylene films.

6.2.2 *Tensile Properties*—The tensile strength and elongation at break for all thicknesses shall be as specified in Table 5.

6.2.3 *Heat Sealability*—The minimum ratio of heat-seal strength to the film strength in the two principal directions shall be as specified in Table 6.

6.2.4 *Odor*—The odor level of the film shall average no more than a 3.5 rating level.

7. Dimensions

7.1 *Size*—The nominal thickness, width, length per roll or roll diameter, and yield of the film shall be established by mutual agreement between the purchaser and the supplier.

7.2 *Thickness Tolerance*—The average thickness and the thickness variation across the film shall be within the tolerances given in Table 7.

7.3 *Width Tolerance*—The width shall be within the tolerances given in Table 8.

7.4 *Yield Tolerance*—The deviation of the actual yield from nominal yield shall be within the tolerances given in Table 9.

7.5 *Flatness*—The flatness of the film shall be within limits as mutually agreed upon between the purchaser and the supplier.

8. Workmanship, Finish, and Appearance

8.1 *Film*—The film shall have workmanship qualities conforming to good commercial practice. The quality of film with

TABLE 1 Classification for Type

Type	1 % Secant Modulus, MPa (psi)
0	170 (25 000) or less
1	>170 to 240 (25 000 to 35 000)
2	>240 to 345 (35 000 to 50 000)
3	345 (50 000)

[3] Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.