



# Standard Specification for Oriented Polypropylene Film<sup>1</sup>

This standard is issued under the fixed designation D2673; 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.

## 1. Scope\*

1.1 This specification covers oriented polypropylene (OPP) film in the thickness range from 10 to 75  $\mu\text{m}$  (0.4 to 3.0 mils).

1.2 The film can contain colorants, stabilizers, or other additives, and can be coated for the improvement of performance properties (heat sealability, gas permeability, and so forth).

1.3 The film can be annealed (heat-set) to reduce the unrestrained linear shrinkage and shrink tension on exposure to heat.

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

1.5 The following safety hazards caveat pertains only to the test methods portion, Section 7, 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>

- D618 Practice for Conditioning Plastics for Testing
- D882 Test Method for Tensile Properties of Thin Plastic Sheeting
- D1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics
- D1434 Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting
- D1746 Test Method for Transparency of Plastic Sheeting

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

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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.

- D1894 Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting
- D1922 Test Method for Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method
- D2457 Test Method for Specular Gloss of Plastic Films and Solid Plastics
- D2578 Test Method for Wetting Tension of Polyethylene and Polypropylene Films
- D2732 Test Method for Unrestrained Linear Thermal Shrinkage of Plastic Film and Sheeting
- D2838 Test Method for Shrink Tension and Orientation Release Stress of Plastic Film and Thin Sheeting
- D3354 Test Method for Blocking Load of Plastic Film by the Parallel Plate Method
- D3892 Practice for Packaging/Packing of Plastics
- D3985 Test Method for Oxygen Gas Transmission Rate Through Plastic Film and Sheeting Using a Coulometric Sensor
- D4000 Classification System for Specifying Plastic Materials
- D4101 Specification for Polypropylene Injection and Extrusion Materials
- D4321 Test Method for Package Yield of Plastic Film
- D5946 Test Method for Corona-Treated Polymer Films Using Water Contact Angle Measurements
- D6988 Guide for Determination of Thickness of Plastic Film Test Specimens
- E96/E96M Test Methods for Water Vapor Transmission of Materials
- E1870 Test Method for Odor and Taste Transfer from Polymeric Packaging Film
- F88 Test Method for Seal Strength of Flexible Barrier Materials

## 3. Terminology

### 3.1 Definitions of Terms Specific to This Standard:

3.1.1 *nominal thickness, width, yield*—target values to be as agreed upon between the seller and the purchaser.

3.1.2 *oriented polypropylene (OPP) film*—a film yielding a minimum tensile strength of 68 MPa (10 000 psi) in at least one principal direction (machine or transverse).

3.1.2.1 *balanced oriented PP film (OPP-B)*—a film in which the machine- and transverse-direction tensile strength both exceed 68 MPa (10 000 psi), but do not differ by more than

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

**TABLE 1 Cell Classification for OPP Film<sup>A</sup>**

Designation Order	Film Property	Cell Limits				
		0	1	2	3	4
1	Coefficient of friction	unspecified	<0.20	0.20 to 0.35	0.35 to 0.50	>0.50
2	Linear thermal shrinkage unrestrained, 120°C, %	unspecified	0 to 3	>3 to 6	>6 to 20	>20
3	Wetting tension, dyne/cm	unspecified	<38	≥38		
4	Heat-sealability, g/mm	unspecified	4 to 10	≥10 to 25	>25	
5	Gloss, 45°	unspecified	50 min	70 min	85 min	
6	Haze, %	unspecified	15 max	7 max	3 max	

<sup>A</sup>With this type of classification it is possible to assemble on paper a combination of properties that is impossible to obtain with the present state of technology. A purchaser wishing to use this specification for the first time will probably find it necessary to contact suppliers to learn what materials are commercially available. After establishing which available material(s) meet the requirements of the application, the purchaser can then specify the material by the appropriate cell classification.

55 MPa (8000 psi), and the machine and transverse elongations do not differ by more than 60 % (absolute).

3.1.2.2 *biaxially oriented PP film (OPP-X)*—a film in which the machine- and transverse-direction tensile strengths both exceed 68 MPa (10 000 psi).

3.1.2.3 *uniaxially oriented PP film (OPP-U)*—a film oriented in one direction (machine or transverse) and yielding a minimum tensile strength of 68 MPa (10 000 psi) in the direction of orientation. (Sometimes called unbalanced.)

#### 4. General Requirements

4.1 *Polymer Material*—The base polymer shall be a Group 1 or 2 polypropylene (PP), as defined in Specification **D4101**, or a blend of such Group 1 or 2 PP with one or more other polymers, provided the PP fraction is the main component.

4.2 *Appearance*—The film shall be as free as commercially feasible of gels, streaks, pinholes, particulate contaminants, and undispersed raw materials. There shall be no other visible defects such as holes, tears, or blisters. The edges shall be free of nicks and cuts visible to the naked eye. There shall be no visible evidence of damage from shipping.

4.3 *Blocking*—The film shall not be blocked excessively. The limits for permissible blocking shall be as agreed upon between the seller and the purchaser.

4.4 *Thickness*—Average thickness shall be within  $\pm 10$  % of the nominal value.

4.5 *Package Yield*—Package yield shall be within the following ranges:

	Deviation from nominal, %
Any one roll	$\pm 10$
Up to 25 rolls	$\pm 10$
25 to 100 rolls	$\pm 6$
Above 100 rolls	$\pm 3$

4.6 *Width*—Average width shall be within  $-3 + 19$  mm ( $-0.12 + 0.75$  in.) of nominal.

4.7 *Length and Splices*—To be agreed upon between the seller and the purchaser.

4.8 *Food-Packaging Requirements*—Films intended for the packaging of food, drugs, and cosmetics shall comply with the requirements of the Federal Food, Drug, and Cosmetic Act as amended.<sup>3</sup>

<sup>3</sup> Available from FDA Center for Food Safety and Applied Nutrition, 200 C Street SW, Washington, DC 20204, or on the web at <http://www.access.gpo.gov/nara/cfr/cfr-table-search.html> or Telephone: (202) 205-5251.

#### 5. Specific Requirements

5.1 The film material shall comply with the definition of oriented PP film (see 3.1).

5.2 For the characterization of commercial PP film, this specification provides a cell classification based on six performance parameters, as defined in **Table 1**. Thus, each film is characterized by a code designation consisting of a six-digit number, preceded by the acronym OPP-U, OPP-X, or OPP-B.

NOTE 2—An example of this code designation would be OPP-B101020, which identifies an untreated balanced film with high gloss and low friction.

#### 6. Sampling

6.1 Adequate statistical sampling shall be considered an acceptable alternative. A batch or lot of film shall be considered as a unit of manufacture as prepared for shipment.

#### 7. Test Methods

7.1 *Conditioning*—Condition the test specimens at  $23 \pm 2^\circ\text{C}$  ( $73.4 \pm 3.6^\circ\text{F}$ ) for not less than 40 h, prior to test in accordance with Procedure A of Practice **D618** for those tests where conditioning is required. In cases of disagreement, the tolerance shall be  $\pm 1^\circ\text{C}$  ( $\pm 1.8^\circ\text{F}$ ).

7.2 *Test Conditions*—Conduct the tests at  $23 \pm 2^\circ\text{C}$  ( $73.4 \pm 3.6^\circ\text{F}$ ) unless otherwise specified in the test methods or in this specification. In cases of disagreement, the tolerance shall be  $\pm 1^\circ\text{C}$  ( $\pm 1.8^\circ\text{F}$ ).

7.3 In addition, for films containing additives of a hydrophilic nature such as some fillers, co-monomers, pigments or other modifiers, conditioning and testing shall be done at  $50 \pm 10$  % relative humidity. In cases of disagreement, the tolerance shall be  $\pm 5$  % relative humidity.

7.4 *Tensile Strength*—Test Methods **D882**.

7.5 *Percentage Elongation at Break*—Test Methods **D882**.

7.6 *Thickness*—Take sample from a 5-cm (2-in.) strip across the web and follow Guide **D6988** for measuring this dimension.

7.7 *Package Yield*—Test Method **D4321**.

7.8 *Coefficient of Friction, Kinetic*—Test Method **D1894**.

7.9 *Unrestrained Linear Thermal Shrinkage*—Test Method **D2732**.

7.10 *Wetting Tension*—Test Method **D2578** or Test Method **D5946**.

7.11 *Heat Sealability*—Test Methods **F88**.

7.12 *Gloss*—Test Method **D2457**, making measurements at an incident angle of 45°.

7.13 *Haze*—Test Method **D1003**.

## 8. Inspection

8.1 Inspection and certification of the film supplied under this specification shall conform to the requirements specified herein and in Classification **D4000**, Section 15.

## 9. Certification

9.1 When agreed upon in writing by the purchaser and the seller, a certification shall be made on the basis of acceptance of the material. This shall consist of a copy of the manufacturer's test report or a statement by the seller, accompanied by a copy of the test results, that the material has been sampled, tested, and inspected in accordance with the provisions of this

specification. Each certification so furnished shall be signed by an authorized agent of the seller or manufacturer.

## 10. Packaging and Marking

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

10.2 *Marking*—Shipping containers shall be marked with the name of the product, nominal thickness, width, and weight of the film contained therein, as defined by the contract or order under which the shipment is made, the name of the manufacturer, and the contract or order number.

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

## 11. Keywords

11.1 balanced oriented PP film; biaxially oriented PP film; oriented polypropylene film; uniaxially oriented PP film

## APPENDIX

### (Nonmandatory Information)

#### X1. OPERATIONAL PROPERTIES

X1.1 When other characterizing properties are desired, the following test methods are recommended:

X1.1.1 *Tensile Modulus of Elasticity (Secant Modulus)*—Test Method A of Test Methods **D882**.

X1.1.2 *Tear Strength*—Test Method **D1922**.

X1.1.3 *Luminous Transmittance*—Test Method **D1003**.

X1.1.4 *Transparency*—Test Method **D1746**.

X1.1.5 *Water-Vapor Transmission*—Test Methods **E96/E96M**, Procedure E.

X1.1.6 *Gas Transmission*—Test Method **D1434**.

X1.1.7 *Oxygen Transmission*—Test Method **D3985**.

X1.1.8 *Odor*—Test Method **E1870**.

X1.1.9 *Shrink Tension and Orientation Release Stress*—Test Method **D2838**.

X1.1.10 *Blocking*—Test Method **D3354**.

## SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this standard since the last issue (D2673 - 09) that may impact the use of this standard. (August 1, 2014)

(1) Revised ISO equivalency statement.

(2) Revised **7.3**.

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