Designation: D 2673 – 99

Standard Specification for Oriented Polypropylene Film[1]

This standard is issued under the fixed designation D 2673; 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 oriented polypropylene (OPP) film in the thickness range from 10 to 75 µm (0.4 to 3.0 mils).

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

1.3 The film may 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 the 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 similar or equivalent ISO standard. ISO TC 61/SC 11 Project 715 is writing a document that is similar 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 1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics[3]

D 1434 Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting[4]

D 1746 Test Method for Transparency of Plastic Sheeting[5]

D 1894 Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting[5]

D 1898 Practice for Sampling of Plastics[5]

D 1922 Test Method for Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method[5]

D 2457 Test Method for Specular Gloss of Plastic Films and Solid Plastics[5]

D 2578 Test Method for Wetting Tension of Polyethylene and Polypropylene Films[5]

D 2732 Test Method for Unrestrained Linear Thermal Shrinkage of Plastic Film and Sheeting[5]

D 2838 Test Method for Shrink Tension and Orientation Release Stress of Plastic Film and Thin Sheeting[5]

D 3354 Test Method for Blocking Load of Plastic Film by the Parallel Plate Method[6]

D 3892 Practice for Packaging/Packing of Plastics[6]

D 3985 Test Method for Oxygen Gas Transmission Rate Through Plastic Film and Sheeting Using a Coulometric Sensor[7]

D 4000 Classification System for Specifying Plastic Materials[6]

D 4101 Specification for Propylene Plastic Injection and Extrusion Materials[6]

D 4321 Test Method for Package Yield of Plastic Film[6]

E 96 Test Methods for Water Vapor Transmission of Materials[8]

E 462 Test Method for Odor and Taste Transfer from Packaging Film[9]

F 88 Test Methods for Seal Strength of Flexible Barrier Materials[7]

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

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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 15.09.

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

[6] *Annual Book of ASTM Standards*, Vol 08.03.

[7] *Annual Book of ASTM Standards*, Vol 15.09.

[8] *Annual Book of ASTM Standards*, Vol 04.06.

[9] *Annual Book of ASTM Standards*, Vol 15.07.

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

both exceed 68 MPa (10 000 psi), but do not differ by more than 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 D 4101, 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 ±10 % of the nominal value.

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

	Deviation from nominal, %
Any one roll	±10
Up to 25 rolls	±10
25 to 100 rolls	±6
Above 100 rolls	±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.[10]

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 Unless otherwise specified, the films shall be sampled in accordance with the sampling procedure prescibed in Practice D 1898. 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 and may consist of a blend of two or more production runs of film.

7. Test Methods

7.1 *Conditioning*—Condition the test specimens at 23 ± 2°C (73 ± 4°F) and 50 ± 5 % relative humidity for at least 40 h, when conditioning is required. Follow Practice D 618, Procedure A. In case of disagreement, the tolerances shall be ±1°C (±2°F) and ±2 % relative humidity.

7.2 *Test Conditions*—Conduct the testing at 23 ± 2°C (73 ± 4°F) and 50 ± 5 % relative humidity, unless otherwise specified in the test methods. In cases of disagreement, the tolerances shall be ±1°C (±2°F) and ±2 % relative humidity.

7.3 *Tensile Strength*—Test Methods D 882.

7.4 *Percentage Elongation at Break*—Test Methods D 882.

7.5 *Blocking*—Test Method D 3354.

7.6 *Thickness*—Take sample from a 5-cm (2-in.) strip across the web and follow Test Methods D 374. Either Test Method A or C may be used, but, in case of dispute, Test Method A shall be the arbitration procedure.

NOTE 3—Standard commercial apparatus with foot sizes from 4.8 to 9.5 mm (3⁄16 to 3⁄8 in.) in diameter, and effective pressure on the foot from 0.02 to 0.17 MPa (3 to 25 psi), yield essentially equivalent values.

7.7 *Package Yield*—Test Method D 4321.

7.8 *Coefficient of Friction, Kinetic*—Test Method D 1894.

7.9 *Unrestrained Linear Thermal Shrinkage*—Test Method D 2732.

7.10 *Wetting Tension*—Test Method D 2578.

7.11 *Heat Sealability*—Test Methods F 88.

7.12 *Gloss*—Test Method D 2457, making measurements at an incident angle of 45°.

7.13 *Haze*—Test Method D 1003.

TABLE 1 Cell Classification for OPP Film

Designation Order	Film Property	Cell Limits				
		0	1	2	3	4
1	Coefficient of friction	unspecified	<0.20	0.20 to 0.35	0.36 to 0.50	>0.50
2	Linear thermal shrinkage unrestrained, 120°C, %	unspecified	0 to 3	4 to 6	7 to 20	>20
3	Wetting tension, N/m	unspecified	<0.035	≥0.035		
4	Heat-sealability, kg/m	unspecified	4 to 10	11 to 25	>25	
5	Gloss (instrument reading)	unspecified	50 min	70 min	85 min	
6	Haze, %	unspecified	15 max	7 max	3 max	

[10] 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.

8. Inspection

8.1 Inspection and certification of the film supplied under this specification shall conform to the requirements specified herein and in Classification D 4000, 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 D 3892 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 D 882.

X1.1.2 *Tear Strength*—Test Method D 1922.

X1.1.3 *Luminous Transmittance*—Test Method D 1003.

X1.1.4 *Transparency*—Test Method D 1746.

X1.1.5 *Water-Vapor Transmission*—Test Methods E 96, Procedure E.

X1.1.6 *Gas Transmission*—Test Method D 1434.

X1.1.7 *Oxygen Transmission*—Test Method D 3985.

X1.1.8 *Odor*—Test Method E 462.

X1.1.9 *Shrink Tension and Orientation Release Stress*—Test Method D 2838.

SUMMARY OF CHANGES

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

D 2673 – 94a:

(*1*) Extended the thickness range to 75 µm and decreased the minimum tensile strength to 68 MPa.

D 2673 – 99:

(*1*) Revised ISO equivalency statement (Note 1) and Footnote 10 to reflect current information.