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Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications[1]

This standard is issued under the fixed designation D 4397; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This specification covers polyethylene sheeting, 250 µm (0.010 in. or 10 mils) or less in thickness, intended for construction, industrial, and agricultural applications.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 The following precautionary statement pertains only to the test methods portion, Section 8 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 specification.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D 374 Test Methods for Thickness of Solid Electrical Insulation ~~D618Practice for Conditioning Plastics and Electrical Insulating Materials for Testing~~

D 618 Practice for Conditioning Plastics for Testing

D 882 Test ~~Methods~~Method for Tensile Properties of Thin Plastic Sheeting

D 883 Terminology Relating to Plastics

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

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

D 1898 Practice for Sampling of Plastics

D 2103 Specification for Polyethylene Film and Sheeting

D 3892 Practice for Packaging/Packing of Plastics

D 4976 Specification for Polyethylene Plastics Molding and Extrusion Materials

E~~96~~ 96/E 96M Test Methods for Water Vapor Transmission of Materials

E 1347 Test Method for Color and Color-Difference Measurement by Tristimulus ~~(Filter)~~ Colorimetry

F 88 Test ~~Methods~~Method for Seal Strength of Flexible Barrier Materials

2.2 *Military Standard:*

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes[3]

3. Terminology

3.1 *Definitions*—The plastics terminology used in this specification is in accordance with the definitions given in Terminology D 883.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *nominal length*—the length of sheeting in any roll, as specified on product labels, invoices, sales literature, and the like.

3.2.2 *nominal net weight*—the weight of sheeting in any roll, as specified on product labels, invoices, sales literature, and the like.

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[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.

[3] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

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

3.2.3 *nominal thickness*—the thickness of sheeting in any roll, as specified on product labels, invoices, sales literature, and the like.

3.2.4 *nominal width*—the width of sheeting in any rolls, as specified on product labels, invoices, sales literature, and the like.

4. Materials

4.1 The sheeting shall be made from polyethylene or modified polyethylene, such as an ethylene copolymer consisting of a major portion of ethylene in combination with a minor portion of some other monomer, or a mixture of polyethylene with a lesser amount of other polymers.

NOTE 2—Polyethylene sheeting is made in a variety of colors, opacities, translucencies, and dimensions. It is recommended that manufacturers be consulted on the varieties available.

5. *General Requirements* General Requirements

5.1 *Appearance*—The sheeting shall have appearance qualities conforming with those produced by good commercial practices. It shall be as free as is commercially possible of gels, streaks, pinholes, particles of foreign matter, and undispersed raw material. There shall be no other visible defects such as blocking, holes, tears, or blisters. The edges shall be free of nicks and cuts visible to the unaided eye.

5.2 *Dimensions*:

5.2.1 *Size*—The nominal thickness, width, and length of the sheeting in each roll shall be agreed upon between the buyer and the seller.

5.2.2 *Tolerances*:

5.2.2.1 *Thickness*—The thickness at any point, when measured in accordance with ~~8.5~~8.7, shall not be less than 80 % of the nominal thickness.

5.2.2.2 *Width*—The tolerance for widths of 0.3 m (1 ft) or more, shall be 3.2 mm (⅛ in.) per foot of nominal width. For all widths less than 0.3 m (1 ft), the tolerance shall be 3.2 mm (⅛ in.). Width to be measured in accordance with ~~8.6~~8.8.

5.2.2.3 *Length*—The length of sheeting per roll, when measured in accordance with ~~8.6~~8.8, shall be within + 3 % to – 1 % of the length specified.

5.2.3 *Minimum Net Weight*—The actual net weight of each roll shall be not less than the nominal net weight, when determined in accordance with the formula established in ~~8.7~~8.9. The nominal net weight shall, in turn, be the labeled net weight.

6. Detail Requirements

6.1 *Color and Finish*—The sheeting may be natural, (essentially colorless), color tinted, translucent, or opaque. The surface finish may be plain, printed, or otherwise treated as agreed upon between the buyer and the seller.

6.2 *Impact Resistance*—The average impact resistance shall be not less than the resistance specified in Table 1, when tested in accordance with ~~8.8~~8.10.

6.3 *Mechanical Properties*—The average tensile strength and elongation at break for all thicknesses of sheeting shall be as specified in Table 2, when tested in accordance with ~~8.9~~8.11.

6.4 *Reflectance*—The daylight reflectance of white opaque sheeting, intended for use in curing concrete, shall be not less than 70 %, when determined in accordance with ~~8.10~~8.12.

6.5 *Luminous Transmittance*—Black sheeting intended for exclusion of light and for maximum resistance to weathering shall have an average luminous transmittance not greater than 1 %, when determined in accordance with ~~8.11~~8.13. This low level of luminous transmittance indicates a high degree of opacity.

6.6 *Water Vapor Transmission Rate (WVTR)*—The average water vapor transmission shall not be greater than 22.0 g/m^2(1.40 g/100 in.^{2}) per 24 h for sheeting 25 µm (1 mil) in thickness, when determined in accordance with ~~8.12~~8.14. The water vapor transmission rate is inversely proportional to the thickness. Maximum limits for rate of water transmission as a function of thickness are given in Table 3. Equivalent maximum limits in terms of permeance are given in Table 4. It should be noted that the

TABLE 1 Dart Drop Impact Resistance[A]

Nominal Thickness, µm (mils)	Dart Drop Impact Resistance, min, g
25 (1.0)	40
38 (1.5)	65
50 (2.0)	85
75 (3.0)	125
100 (4.0)	165
125 (5.0)	205
150 (6.0)	260
175 (7.0)	315
200 (8.0)	370
225 (9.0)	420
250 (10.0)	475

[A] Values for nominal thickness other than those listed shall be determined by arithmetical interpolation.

TABLE 2 Mechanical Properties

	Lengthwise Direction	Crosswise Direction
Tensile strength, min, MPa (psi)	11.7 (1700)	8.3 (1200)
Elongation, min, %[A]	225	350

[A] For films of nominal thickness of <2 mils (<50 µm), minimum % to be 200 and 325, respectively (LD/CD).

TABLE 3 Specification for Water Vapor Transmission Rate (WVTR)[A]

WVTR (g/24·h·m^2) max	Nominal Thickness		WVTR (g/ 24·h·100·in.^{2}) max
	µm	(mils)	
22.0	25	(1)	1.40
11.0	50	(2)	0.70
7.3	75	(3)	0.47
5.5	100	(4)	0.35
4.4	125	(5)	0.28
3.7	150	(6)	0.23
3.1	175	(7)	0.20
2.8	200	(8)	0.18
2.4	225	(9)	0.16
2.2	250	(10)	0.14

[A] Values for nominal thickness other than those listed shall be determined by arithmetical interpolation.

TABLE 4 Specification for Permeance[A]

Permeance[B] (metric perms), max	Nominal Thickness		Permeance[C] (perms), max
	µm	(mils)	
0.50	25	(1)	0.76
0.25	50	(2)	0.38
0.17	75	(3)	0.25
0.12	100	(4)	0.19
0.10	125	(5)	0.15
0.084	150	(6)	0.13
0.070	175	(7)	0.11
0.063	200	(8)	0.096
0.054	225	(9)	0.082
0.050	250	(10)	0.076

[A] Values for nominal thickness other than those listed shall be determined by arithmetical interpolation.

[B] Permeance in metric perms is found by dividing WVTR, g/24·h·m^2, by the pressure difference of water vapor, µm Hg, at the test temperature.

[C] Permeance in perms is found by dividing WVTR, grains/h·ft ^{2}, by the pressure difference of water vapor, in. Hg at the test temperature. To convert WVTR from g/h·100 in. ^{2} to grains/h·ft ^{2}, multiply by 0.926.

WVTR requirement is not necessary for all applications (such as pallet wrap). However, Table 3 and Table 4 may be used for those cases where the WVTR is an important consideration.

7. Sampling

7.1 Samples for test purposes shall be taken from rolls, selected at random from the total number of rolls in each shipment or lot, in accordance with Table 5.

TABLE 5 Sampling for Test Procedures

Rolls in Shipment or Lot	Rolls Sampled
2 to 9	1
10 to 15	2
16 to 40	3
41 to 65	5
66 to 110	7
111 to 180	10
181 to 300	15
301 to 500	25
501 to 800	35
801 to 1300	50