



Standard Specification for Polyethylene Sheeting in Thickness of 0.25 mm (0.010 in.) and Greater¹

This standard is issued under the fixed designation D 4801; 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 requirements for extruded- and compression-molded sheeting made from low-, medium- and high-density polyethylenes and copolymers in thickness of 0.25 mm (0.010 in.) and greater. Sheeting conforming to this specification is intended for use in the thinner gages principally for chemical tank linings, spacers in electrical equipment, and for thermoforming into such items as trays, pallets, and shipping containers. The thicker gages are used principally as machine-shop stock.

1.2 Polyethylene materials, being thermoplastics, are reprocessible and recyclable (see Guide D 5033). This specification allows for the use of those polyethylene 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.

1.4 The following precautionary caveat pertains only to the test methods portion, Section 11, 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.

2. Referenced Documents

2.1 ASTM Standards:

D 374 Test Methods for Thickness of Solid Electrical Insulation²

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing³

D 638 Test Method for Tensile Properties of Plastics³

¹ 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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Changes in this edition were made in the scope and referenced documents, and a keywords section was added.

² Annual Book of ASTM Standards, Vol 10.01.

³ Annual Book of ASTM Standards, Vol 08.01.

D 883 Terminology Relating to Plastics³

D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature³

D 1248 Specification for Polyethylene Plastics Molding and Extrusion Materials³

D 1898 Practice for Sampling of Plastics³

D 2103 Specification for Polyethylene Film and Sheeting³

D 3892 Practice for Packaging/Packing of Plastics⁴

D 5033 Guide for the Development of Standards Relating to the Proper Use of Recycled Plastics⁵

2.2 Military Standard:⁶

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

2.3 Federal Standard:⁶

Fed. Std. No. 406, Plastics: Methods of Testing (Method 6051, Warpage)

2.4 Federal Specification:⁶

L-P-390C-Plastic, Molding and Extrusion Material, Polyethylene and Copolymers (Low, Medium, and High Density)

3. Terminology

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

4. Classification

4.1 The polyethylene sheeting in accordance with this specification is classified by special types as follows:

4.1.1 *Type I*—General purpose, natural and colors.

4.1.2 *Type II*—Dielectric, natural and colors.

4.1.3 *Type III*—Weather-resistant, black.

5. Ordering Information

5.1 Users should select the preferred options permitted herein and include the following information in the purchase contract.

⁴ Annual Book of ASTM Standards, Vol 08.02.

⁵ Annual Book of ASTM Standards, Vol 08.03.

⁶ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

5.1.1 Title, number, and date of this specification.

5.1.2 Classification according to Specification D 1248 (Tables 4A, Tables 4B, and Tables 4C) of the material to be used to manufacture the sheet (see 6.1).

5.1.3 Length and width of sheets (see 7.5 and 7.6).

5.1.4 Thickness of sheets (see 7.5).

5.1.5 Color (see 7.7).

5.1.6 Requirements for packaging, packing, and marking (see 13.1).

6. Materials and Manufacture

6.1 *Materials*—The sheeting shall be manufactured from polyethylene thermoplastic material of the special grade specified in 5.1.2. The supplier shall furnish, for the material used, data for the classification properties.

6.2 *Manufacture*—Sheeting shall be formed by extrusion molding and roll polishing, or compression molding.

7. Detail Requirements

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

7.2 *Tensile Strength and Elongation*—Sheeting having a thickness of 3.2 mm (0.125 in.) and under shall have tensile strength and elongation not less than 90 % of the values specified in Specification D 1248 (Tables 4A, Tables 4B, and Tables 4C) for the applicable type and grade. Sheetting greater than 3.2 mm (0.125 in.) in thickness shall meet the tensile strength and elongation requirements of Specification D 1248. The type, class, and grade requirements for Fed. Spec. L-P-390C are included in the tables in Specification D 1248.

7.3 *Shrinkage*—The sheeting, when tested as specified in 11.3, shall conform to the requirements as determined between the user and the supplier.

7.4 *Warpage and Twist*—The sheeting, when tested as specified in 11.4, shall conform to the requirements as determined between the user and the supplier.

7.5 *Dimensions*—Sheeting shall be supplied in the width, length (or weight), and thickness as specified between the user and the supplier, except a maximum of 4 % of the sheet in a shipment may be trimmed 55-mm (2-in.) undersize or half-size. Such trimmed sheet shall be packed separately from full-sized sheet. The thickness shall be tested according to 11.5. Thickness tolerances are shown in Table 1.

7.6 *Length or Weight and Diameter of Rolls*—Sheeting in rolls shall be supplied with either the length or weight specified, except that one roll in a shipment may have the lesser length or weight required to make the total length or weight of the shipment equal to the quantity ordered. The diameter of the roll may be specified.

7.7 *Color*—The sheeting shall be of the color specified by the user.

7.8 *Grade*—The sheeting shall be of the grade specified by the user.

TABLE 1 Thickness Tolerances

Nominal Thickness, mm (in.)	Thickness Tolerance, Percent of Nominal
0.254 to 1.78 (0.010 to 0.070), incl	±10
Greater than 1.78 (0.070)	±5

7.9 *Workmanship*—The sheeting shall have a smooth finish and shall be free of cracks, blisters, bubbles, discolorations, craze, surface scratches that form definite indentations, and other defects that could affect appearance or serviceability.

7.9.1 *Dimensional Defects*—The sheeting shall show none of the defects described in Table 2.

7.9.2 *Defects in Color, Appearance, and Workmanship*—The sheeting shall show none of the defects described in Table 3.

8. Sampling

8.1 Unless otherwise agreed upon between the user and the supplier, the materials shall be sampled in accordance with the sampling procedure prescribed in Practice D 1898. Adequate statistical sampling shall be considered an acceptable alternative. A lot of material shall be considered as a unit of manufacture as prepared for shipment, and may consist of a blend of two or more production runs or batches.

9. Testing

9.1 Test the sheeting for the applicable characteristics listed in 7.2, 7.3, and 7.4 and Table 1 and Table 2 in accordance with the test methods specified herein, for each lot submitted for inspection.

10. Conditioning

10.1 Condition the test specimens at 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 5 % relative humidity for not less than 40 h prior to testing in accordance with Procedure A of Practice D 618.

11. Test Methods

11.1 Conduct tests at 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 5 % relative humidity.

11.2 *Tensile Strength and Elongation*—Test in accordance with Test Method D 638. Determine tensile strength at yield and elongation at break.

11.2.1 *Test Specimens*—Prepare test specimens by die cutting or machining. In extruded sheet, properties may be dependent on the sampling direction; therefore, test specimens should be cut in the extrusion direction or in both the extrusion and transverse directions if agreed upon between the supplier and the user.

TABLE 2 Examination of the Sheeting for Defects in Dimensions

Examine	Defects
Length and width (sheet)	not of the length and width specified varies by more than +3.2, -0 mm (+1/8, -0 in.) varies by more than ±13 mm (±1/2 in.) from true rectangles
Width (sheeting)	not of the width specified varies by more than +13, -0 mm (+1/2, -0 in.)
Length or weight of rolls (sheeting)	not of the length or weight specified varies by more than +3, -1 %
Diameter of rolls (sheeting)	not of the diameter specified
Cores (sheeting)	not having lengths equal to the nominal width of the sheeting, +13, -0 mm (+1/2, -0 in.) not having inside diameters as specified varies by more than +3.2, -0 mm (+1/8, -0 in.) for a 76-mm (3-in.) diameter hole unless otherwise specified

TABLE 3 Examination of Sheeting for Defects in Color, Appearance, and Workmanship

Examine	Defects
Appearance	not uniform texture, finish, or color any pits, blisters, cracks, dents, waviness, heat marks, or scratches
Workmanship	surface not polished and straight edges not smooth and straight any delaminations or porosity on edges

11.3 *Shrinkage*—Test in accordance with Test Method D 1204, using a minimum oven time of 30 min, and an oven temperature of $130 \pm 2^\circ\text{C}$ ($266 \pm 3.6^\circ\text{F}$) for Types I and II Polyethylene (Specification D 1248) and of $140 \pm 2^\circ\text{C}$ ($284 \pm 3.6^\circ\text{F}$) for Types III and IV Polyethylene (Specification D 1248). If previous tests on the same grade and nominal thickness of sheeting have shown that the use of talc or paper is unnecessary to provide free shrinkage, these refinements may be modified or omitted.

11.4 *Warpage and Twist*—Determine warpage or twist using two sheets tested in accordance with Method 6051 of Fed. Std. No. 406 except for the following: a straightedge 1 m (36 in.) long shall be used. Move the straightedge over the sheet and rotate it along the sheet length about an axis perpendicular to the plane of the sheet without permitting an end of the straightedge to extend beyond the edge of the sheet. Measure and report the maximum distance from the sheet to the straightedge. Make the measurement with the sheet lying with its surface of maximum convexity in contact with a horizontal flat surface. The straightedge shall be light in weight and no pressure shall be exerted on it that might tend to reduce the warpage or twist during the measurement.

11.4.1 *Calculation*—Calculate the warpage or twist as follows:

$$W = \frac{D \times 100}{L} \quad (1)$$

where:

W = warpage or twist, %

D = maximum deviation, mm (in.), and

L = length of the sheet along the straightedge, mm (in.)

11.4.2 *Precision*—No data is available for a precision statement.

11.5 *Thickness*—The thickness of the sheeting covered in this specification shall meet the tolerances given in Table 1 when tested as follows: Determine the thickness ordinarily by

the method described in 11.5.1-11.5.3. In cases of disagreement use the Arbitration Method given in the test method section of Specification D 2103.

11.5.1 *Apparatus*—A deadweight dial micrometer with a flat anvil of 0.635-cm ($\frac{1}{4}$ -in.) diameter or larger in area and a 0.476-cm ($\frac{3}{16}$ -in.) diameter flat surface on the presser foot spindle. The total weight applied by the spindle shall be 113.6 g (4 oz). Unless otherwise specified herein, the micrometer shall meet the requirements of the apparatus in Method C of Test Methods D 374.

NOTE 2—Standard commercial apparatus with foot sizes from 4.76 to 9.52 mm ($\frac{3}{16}$ to $\frac{3}{8}$ in.) in diameter and effective pressure on the foot from 0.021 to 0.17 MPa (3 to 25 psi) give essentially the same values.

11.5.2 *Test Specimens*—Prepare five test specimens, at least 5 by 5 cm (2 by 2 in.) in area, taken randomly across the width of the roll. Take at least one set of test specimens from each roll being tested.

11.5.3 *Procedure*—Unless otherwise specified, the procedure shall be in accordance with Test Method C of Test Methods D 374. The surfaces of the anvil, the presser foot spindle, and the specimens shall be clean and dry. Place the specimen on the anvil and lower the presser foot spindle onto it slowly. Take one measurement on each specimen. Average the measurements of all the specimens of a sample to obtain the thickness of the sample.

12. Certification and Inspection

12.1 Certification and lot acceptance of the material may be made as agreed upon between the supplier and the user, or as a part of the purchase contract.

12.2 Periodic check inspection shall consist of the tests agreed upon between the supplier and the user.

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

13. Packaging, Packing, and Marking

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

14. Keywords

14.1 dielectric sheet; general purpose sheet; polyethylene; recycled plastics; sheeting; sheeting specification; thick gage; thick sheet; thickness >25 mil; weather-resistant sheet

S1. QUALITY ASSURANCE PROVISIONS FOR GOVERNMENT/MILITARY PROCUREMENT

These requirements apply *only* to Federal/Military procurement, not domestic sales or transfers. S1.1 Unless otherwise specified in a purchase order or contact, sampling for inspection and testing shall be in accordance with the recommendations of Practice D 1898.

S1.2 Selection of Acceptable Quality Level (AQL) and of Inspection Level (IL) shall be made, with consideration of the specific use requirements. This is discussed in Practice D 1898 in the sections “Means and Standard Deviations,” and “Comparison of Sampling Plans,” with reference to MIL-STD-105.

S1.3 In the absence of contrary requirements, the following values shall apply:

	IL	AQL
Defects in material and workmanship	II	2.5
Defects of preparation for delivery	S-2	2.5
Testing (products)	S-1	1.5
Testing (polymer, unfabricated)	S-1 ^A	...

^A Samples shall be drawn from the required number of units, and pooled for preparation of molded samples for mechanical properties evaluation.

S2. PACKAGING PROVISIONS FOR GOVERNMENT/MILITARY PROCUREMENT

S2.1 All packing, packaging, and marking provisions of Practice D 3892 shall apply to this specification.

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