



Designation: D 4225 – 97

Standard Specification for Styrene-Butadiene Sheeting¹

This standard is issued under the fixed designation D 4225; 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 styrene-butadiene sheeting in thicknesses of 0.25 mm (0.01 in.) and greater. Sheeting conforming to this specification is intended for use in instrument housings and applications requiring resistance to impact. Methods of fabrication may require that the sheet be drawn or bent.

1.2 This specification covers natural and colored sheeting.

1.3 This specification covers quality requirements that include degree of orientation, amount of warpage or twist, dimensions, tolerances, and workmanship.

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

1.5 This specification allows for the use of recycled plastics as defined in Guide D 5033.

1.6 The following precautionary statement pertains to the test method portion only, Section 12, of this specification: *This standard does not purport to address 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 256 Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials²
- D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing²
- D 638 Test Method for Tensile Properties of Plastics²
- D 883 Terminology Relating to Plastics²
- D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer²

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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² *Annual Book of ASTM Standards*, Vol 08.01.

D 1525 Test Method for Vicat Softening Temperature of Plastics²

D 1898 Practice for Sampling of Plastics²

D 2732 Test Method for Unrestrained Linear Thermal Shrinkage of Plastic Film and Sheeting³

D 3892 Practice for Packaging/Packing of Plastics³

D 4549 Specification for Polystyrene Molding and Extrusion Materials (PS)⁴

D 5033 Guide for the Development of Standards Relating to the Proper Use of Recycled Plastics⁴

2.2 *Federal Standard*.⁵

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

2.3 *Military Standard*.⁶

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

3. Terminology

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

4. Classification

4.1 The styrene-butadiene sheeting in accordance with this specification is classified by Type (see Table 1) as follows:

4.1.1 *Type I*—Low shrinkage.

4.1.2 *Type II*—Intermediate shrinkage.

4.1.3 *Type III*—High shrinkage.

4.2 The styrene-butadiene sheeting is further divided into classes as follows:

4.2.1 Class 1 - Natural

4.2.2 Class 2 - As specified by user

4.3 Sizes

4.3.1 Size A: .05 by 1m.

4.3.2 Size B: as specified by user.

4.4 The sheeting covered by this specification shall be

³ *Annual Book of ASTM Standards*, Vol 08.02.

⁴ *Annual Book of ASTM Standards*, Vol 08.03.

⁵ Available from Superintendent of Documents, U.S. Government Printing Office, North Capital and H Sts., NW, Washington, DC 20401.

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

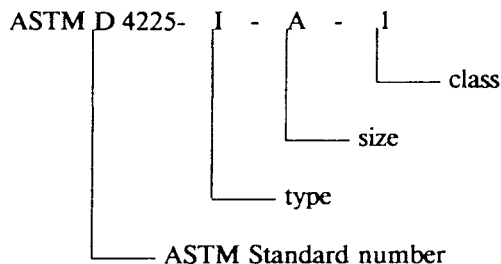


TABLE 1 Orientation (Percent Shrinkage)^A

Sheet Thickness mm (in.)	Type I %	Type II %	Type III %
0.25 to 0.50 (0.01 to 0.019)	less than 30	30 to 60	greater than 60
0.50 to 1.0 (0.020 to 0.039)	less than 20	20 to 50	greater than 50
1.0 to 1.50 (0.040 to 0.059)	less than 20	20 to 40	greater than 40
1.50 to 2.00 (0.060 to 0.079)	less than 10	10 to 30	greater than 30
2.00 to 2.54 (0.080 to 0.10)	less than 5	5 to 20	greater than 20

^A Shrinkage in the sheets is an indication of orientation. The higher the shrinkage, the higher the orientation.

identified by a document-based part numbering system as follows:



where:

- I = Type I (low shrinkage),
- A = Size (0.5 by 1 m),
- 1 = Class (natural color), and
- D 4225 = ASTM standard designation number.

5. Ordering Information

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

- 5.1.1 Title, number, and date of this specification.
- 5.1.2 Classification according to Specification D 4549 of the material to be used to manufacture the sheet (see 6.1).
- 5.1.3 Length and width of sheets (see section 7.5).
- 5.1.4 Thickness of sheets (see section 7.5).
- 5.1.5 Color (see 7.4).
- 5.1.6 Requirements for packaging, packing, and marking (see 15.1).

6. Materials and Manufacture

6.1 *Materials*—The sheeting shall be manufactured from styrene-butadiene thermoplastic material of the classification specified in 5.1.2. The supplier shall furnish, for the material used, data for the four classification properties as follows:

- 6.1.1 *Impact Strength*, Method A (Izod) of Test Methods D 256.
- 6.1.2 *Vicat Softening Temperature*, Test Method D 1525, Rate B.
- 6.1.3 *Flow Rate*, Test Method D 1238, Condition G.
- 6.1.4 *Tensile Yield Stress*, Test Method D 638, Speed B.

6.2 *Manufacture*—Sheeting shall be formed by extrusion molding and press polished. Sheeting shall be annealed if necessary to assure compliance with the orientation requirement of 7.2.

7. Specific Requirements

7.1 *Form*—The material shall be furnished in the form of flat rectangular sheeting of the dimensions specified.

7.2 *Orientation*—The sheeting, when tested as specified in 12.2, shall conform to the requirements of Table 1.

7.3 *Warpage or Twist*—Applicable only to sheets having diagonals of 1 m (36 in.) or more in length. Warpage or twist shall not exceed the values shown in Table 2, when measured in accordance with 12.3.

7.4 *Color*—The color shall be as specified by the user.

7.5 *Dimensions and Tolerances*—Unless otherwise specified, the standard size of sheets shall be 0.5 by 1 m (20 by 40 in.), and the tolerances on the width, length and thickness shall be as shown in Table 3.

7.6 *Workmanship*:

7.6.1 *Uniformity*—All sheets in the lot shall, when subjected to visual examination, satisfy the color and surface finish requirements of this specification.

7.6.2 *Surface Finish*—The surface shall be free from defects as described in Table 4.

7.6.3 *Internal Defects*—The edges and cut sections shall show none of the defects as described in Table 4.

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 should consist of all items of one type, size, and class offered for delivery at one time on one contract or order.

9. Testing

9.1 The sheet shall be tested for the applicable characteristics listed in Table 1 and Table 2 in accordance with the test methods specified herein, for each lot submitted for inspection.

10. Specimen Preparation

10.1 Test specimens shall be molded as specified in the test methods of the *ASTM Book of Standards* or as specified by the sheet supplier.

11. Conditioning

11.1 Condition the test specimen at $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) and $50 \pm 5\%$ relative humidity for not less than 40 h prior to testing in accordance with Procedure A of Practice D 618.

12. Test Methods

12.1 Testing shall be conducted at $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) and $50 \pm 5\%$ relative humidity, after conditioning in accordance with Procedure A of Practice D 618.

TABLE 2 Warpage or Twist

Thickness of Sheet, mm (in.)	Warpage or Twist, %, max
0.25 to 3 (0.010 to 0.125)	1.0
>3 to 6 (>0.125 to 0.250)	0.7
>6 to 19 (>0.25 to 0.75)	0.5
>19 (>0.75)	0.3



TABLE 3 Examination of Sheets for Defects in Dimensions

Examine	Defects
Width	Varies by more than ± 3 mm (± 0.125 in.) from width specified.
Length	Varies by more than + 6 mm (+ 0.25 in.), - 0 mm (-0 in.).
Thickness	Varies by more than + 10 % or - 5 % from the specified thickness.

TABLE 4 Examination of Sheets for Defects in Appearance and Workmanship

Examine	Defect
Appearance	Not uniform texture, finish, or color. Any pits, blisters, cracks, dents, waviness, heat marks, or scratches.
Workmanship	Surface not press polished and straight; edges not smooth and straight. Any delaminations or porosity on edges.

12.2 Orientation shall be determined as percent shrinkage using Test Method D 2732 at a temperature of $151.6 \pm 2.8^\circ\text{C}$ ($305 \pm 5^\circ\text{F}$). The immersion time for specimens 25.4 mm (1 in.) and under in thickness shall be 10 to 10.5 min. Specimens over 25.4 mm (1 in.) thickness shall be immersed for 16 to 16.5 min.

12.3 Warpage or twist shall be determined using two sheets tested in accordance with Method 6051 of Fed. Std. No. 406 except for the following: a straight edge 1-m (36-in.) long shall be used. The straight edge shall be moved over the sheet and rotated along the sheet length about an axis perpendicular to the plane of the sheet without permitting an end of the straight edge to extend beyond the edge of the sheet. The maximum distance from the sheet to the straight edge shall be measured and reported. The measurement shall be made with the sheet lying with its surface of maximum convexity in contact with a horizontal flat surface. The straight edge 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.

12.3.1 *Calculations*—The warpage or twist shall be calculated 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 in millimetres (inches) along the straight edge.

13. Certification and Inspection

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

13.2 Periodic check inspection shall consist of the tests agreed to by the supplier and user.

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

14. Rejection and Rehearing

14.1 Material that fails to conform to the requirements as agreed upon by the user and supplier may be rejected. If any failure occurs, the materials may be retested to establish conformity in accordance with agreement between user and supplier. Rejection should be reported to the supplier promptly and in writing. In case of dissatisfaction with the results of the test, the supplier may make claim for a rehearing.

15. Packaging, Packing, and Marking

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

16. Keywords

16.1 sheeting; styrene-butadiene

SUPPLEMENTARY REQUIREMENTS

QUALITY ASSURANCE PROVISIONS FOR GOVERNMENT/MILITARY PROCUREMENT

These requirements apply *only* to Federal/Military procurement, not domestic sales or transfers.

S1. Sampling for inspection and testing shall be carried out in accordance with the recommendations of Practice D 1898.

S2. 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 Sections 7 and 8 of the above document, with reference to MIL-STD-105.

S3. 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.



PACKAGING PROVISIONS FOR GOVERNMENT/MILITARY PROCUREMENT

S1. All packing, packaging, and marking provisions of Practice D 3892 shall apply to this specification.

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