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Standard Specification for RIGID URETHANE FOAM¹

This standard is issued under the fixed designation D 2341; 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 a class of rigid cellular materials known as urethane foam or rigid cellular materials made from urethane raw materials where other types of repeated structural units are present such as polycarbodiimide or polyisocyanurate. Urethane foam may be generally defined as an expanded cellular product produced by a catalyzed reaction of polyisocyanates with polyhydroxy compounds. The detail requirements of this specification apply to the core material of the sprayed, laminated, molded, or foamed part. In the event that the product does not lend itself to testing of the core, specific test samples shall be agreed upon by the seller and the purchaser.

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

NOTE 1—For specific applications refer to ASTM Committee D-10 on Packaging, C-16 on Thermal and Cryogenic Insulating Materials, (in particular ASTM Specification C 591 for Rigid Preformed Cellular Urethane Insulation), and F-7 on Aerospace Industry Methods.

2. Applicable Documents

2.1 ASTM Standards:

- C 177 Test for Thermal Conductivity of Materials by Means of the Guarded Hot Plate²
- C 203 Test for Breaking Load and Calculated Flexural Strength of Preformed Block-Type Thermal Insulation³
- C 273 Shear Test in Flatwise Plane of Flat Sandwich Constructions or Sandwich Cores⁴
- C 355 Test for Water Vapor Transmission of Thick Materials³
- C 518 Test for Steady-State Thermal Transmission Properties by Means of Heat Flow Meter³

D 149 Test for Dielectric Breakdown Voltage and Dielectric Strength of Electrical Insulating Materials at Commercial Power Frequencies⁵

D 257 Tests for D-C Resistance or Conductance of Insulating Materials⁵

D 790 Test for Flexural Properties of Plastics and Electrical Insulating Material⁵

D 1621 Test for Compressive Properties of Rigid Cellular Plastics⁶

D 1622 Test for Apparent Density of Rigid Cellular Plastics⁶

D 1623 Test for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics⁶

D 1673 Test for Dielectric Constant and Dissipation Factor of Expanded Cellular Plastics Used for Electrical Insulation⁶

D 1898 Recommended Practice for Sampling of Plastics⁶

D 2126 Test for Response of Rigid Cellular Plastics to Thermal and Humid Aging⁶

D 2842 Test for Water Absorption of Rigid Cellular Plastics⁶

D 2856 Test for Open Cell Content of Rigid Cellular Plastics by the Air Pycnometer⁶

D 2863 Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)⁵

D 3892 Practice for Packaging/Packing of Plastics⁵

¹ This specification is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D 20.22 on Cellular Plastics.

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² Annual Book of ASTM Standards, Parts 18, 35, and 44.

³ Annual Book of ASTM Standards, Part 18.

⁴ Annual Book of ASTM Standards, Part 25.

⁵ Annual Book of ASTM Standards, Part 35.

⁶ Annual Book of ASTM Standards, Part 36.



2.2 Military Standard:

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes⁷

3. Classification

3.1 The rigid urethane foam covered in this specification shall be designated by a type number, composed by listing the desired cell limit for each property (Note 2) in the order shown in Table 1.

NOTE 2—For properties that are affected by the anisotropy of the foam, the direction of measurement shall be specified in the test method or as agreed upon by the seller and the purchaser.

NOTE 3—A product is specified by a ten-digit number, the first digit representing level 0 to 9 of property 1, density; the second, level 0 to 9 of property 2, compressive strength; and so on. Thus a material specified as Type 3306056490 would have the following requirements:

Density	0.033 g/cm ³ , max
Compressive strength	103 kN/m ² (15 psi), min
Burning rate	unspecified
Closed cells (porosity)	90 % min
Water absorption	unspecified
Water vapor permeability	3.0 perm-in., max

Dimensional stability:

After 7 days at $-29 \pm 3^\circ\text{C}$	5 % max linear change
After 7 days at $38 \pm 1^\circ\text{C}$ and 90 to 100 % RH	10 % max linear change
After 7 days at $70 \pm 1^\circ\text{C}$	1 % max linear change
Flexural strength	unspecified

NOTE 4—Although the table theoretically indicates the possibility of many different combinations and products, these cannot all exist due to interactions between properties. For example, as density increases, compressive strength increases, and it is therefore not simultaneously possible to have maximum strength and minimum density. Similarly, most of the other properties listed “improve” with increasing density.

NOTE 5—Other properties, such as shear strength, tensile strength, electrical properties, etc., may be added to the specification, as agreed upon by the seller and purchaser.

NOTE 6—The physical properties of a foam are not represented by the values in any given vertical column. Refer to Notes 2 and 3 for interpretation and designation of foam requirements.

4. General Requirements

4.1 These plastic compositions shall be uniform and shall conform to the requirements prescribed in this specification. The color and form of material shall be as agreed upon by the seller and the purchaser. Odor shall not be objectionable.

4.2 All materials and workmanship shall be in accordance with good commercial practice

and the resulting cellular urethane foam shall be free of defects affecting serviceability.

5. Detail Requirements

5.1 The structure of rigid urethane foam consists of a network of cells. It is manufactured in sheet, block, molded, or specific shapes and is prepared by batch, machine, or spray techniques.

5.2 Test properties shall conform to individual requirements as agreed upon between the seller and the purchaser as described in Table 1 and indicated by the type designation. Tests other than those shown in Table 1 shall be as agreed upon by the seller and the purchaser.

6. Sampling

6.1 When possible, a core sample (Note 7) shall be used for the test specified. Representative samples of the lot being examined shall be selected at random as required.

NOTE 7—A core specimen equal to 12.7 mm (0.5 in.) minimum trim from a skin surface is recommended.

6.2 When it is necessary or advisable to obtain specimens from the article, as in those cases where the entire sample is not required or adaptable for testing, the method of cutting and the exact position from which specimens are to be taken shall be specified.

6.3 When the finished product does not lend itself to testing or to the taking of specimens because of complicated shape, small size, metal or fabric inserts, adhesion to metal, or other reasons, test slabs as agreed upon between the seller and the purchaser shall be prepared.

6.4 When differences due to the difficulty in obtaining suitable specimens from the finished part arise, the seller and the purchaser may agree on acceptable deviations. This can be done by comparing the results of standard specimens and those obtained on actual parts.

6.5 The frequency of sampling shall be in accordance with accepted statistical practices and as agreed upon between the seller and the purchaser.

7. Test Methods

7.1 The properties enumerated in this specification shall be determined in accordance

⁷ Available from Naval Publications and Forms Center, 5801 Tabor Rd., Phila., Pa. 19120.