



Designation: D 6576 – 00

Standard Specification for Flexible Cellular Rubber Chemically Blown¹

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This standard has been approved for use by agencies of the Department of Defense. Replaces MIL-R-6130.

1. Scope

1.1 This specification establishes requirements for chemically blown cellular rubber.

1.2 In the case of conflict between the provisions of this specification and those of detailed specifications or test methods for a particular product, the latter shall take precedence.

1.3 Unless specifically stated otherwise, by agreement between the purchaser and the supplier, all test methods shall be performed in accordance with the test methods specified in this specification.

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

1.5 *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.*

1.6 This specification and ISO 6916 are not equivalent.

NOTE 1—This specification was revised using the updated test methods and specification in Specification D 1056 – 98.

2. Referenced Documents

2.1 ASTM Standards:

- D 297 Test Methods for Rubber Products—Chemical Analysis²
- D 471 Test Method for Rubber Property—Effect of Liquids²
- D 635 Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position³
- D 883 Terminology Relating to Plastics³
- D 1055 Specifications for Flexible Cellular Materials—Latex Foam³
- D 1056 Specification for Flexible Cellular Materials—

Sponge or Expanded Rubber³

D 3575 Test Methods for Flexible Cellular Materials Made from Olefin Polymers⁴

2.2 SAE Standard:⁵

SAE J 1351-1993 Hot Odor Test for Insulation Materials

2.3 Military Standards/Specifications:⁶

MIL STD 105 Sampling Procedures and Tables for Inspection by Attributes

MIL STD 129 Marking for Shipment and Storage

MIL STD 293 Visual Inspection Guide for Cellular Rubber Items

MIL R 6130 C Standard Specification for Flexible Cellular Rubber Chemically Blown

2.4 Federal Standards/Specifications:⁶

PPP-B576 Box, Wood, Cleated, Veneer, Paper Overlaid

PPP-B591 Box, Fiberboard, Wood-Cleated

PPP-B601 Box, Wood, Cleated Plywood

PPP-B621 Box, Wood, Nailed and Lock-Corner

PPP-B636 Box, Shipping, Fiberboard

2.5 ISO Standards:

ISO 6916 Flexible Cellular Polymeric Materials⁷

3. Terminology

3.1 For definitions of technical terms pertaining to cellular flexible rubber used in this specification, refer to Terminology D 883.

3.2 Definitions:

3.2.1 *cellular material*—a generic term for materials containing many cells (either open or closed, or both) dispersed throughout the mass.

3.2.2 *closed cell*—a product whose cells are totally enclosed by its walls and hence not interconnecting with other cells.

3.2.3 *open cell*—a product whose cells are not totally enclosed by its walls and open to the surface, either directly or by interconnecting with other cells.

¹ This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.22 on Cellular Materials—Plastics and Elastomers.

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² *Annual Book of ASTM Standards*, Vol 09.01.

³ *Annual Book of ASTM Standards*, Vol 08.01.

⁴ *Annual Book of ASTM Standards*, Vol 08.02.

⁵ Available from SAE World Headquarters, 400 Commonwealth Dr., Warrendale, PA 15096-0001.

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

⁷ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

4. Classification

4.1 *Types*—This specification covers two types of cellular rubber designated as follows:

4.1.1 *Type I*—Open cell (sponge rubber).

4.1.2 *Type II*—Closed cell (expanded rubber).

4.2 *Grades*—Both types are divided into three grades designated by the letters A, B, and C added to the roman numeral prefix.

4.2.1 *Grade A*—Oil- and flame-resistant.

4.2.2 *Grade B*—No requirements for oil, flame resistance, or low temperature.

4.2.3 *Grade C*—Low-temperature resistant (oil and flame resistance not required).

4.3 *Conditions*—Each type and class has been divided into three different conditions. Each condition is based on a specific range of firmness as expressed by compression deflection as follows:

4.3.4	Condition—Super soft	a compression deflection range of	> 0 to ≤14 kPa (>0 to ≤2 psi)
4.3.2	Condition—Soft	a compression deflection range of	>14 to ≤35 kPa (>2 to ≤5 psi)
4.3.3	Condition—Soft-medium	a compression deflection range of	>35 to ≤63 kPa (>5 to ≤9 psi)
4.3.4	Condition—Medium	a compression deflection range of	>63 to ≤91 kPa (> 9 to ≤13 psi)
4.3.5	Condition—Medium-firm	a compression deflection range of	>91 to ≤119 kPa (>13 to ≤17 psi)
4.3.6	Condition—Firm	a compression deflection range of	>119 to ≤175 kPa (>17 to ≤25 psi)

5. Significance and Use

5.1 This specification is a revision of MIL R 6130C retaining most of the MIL R 6130C material designations and property requirements while conforming to ASTM form and style. It is intended to establish requirements for chemically blown cellular rubber used by government and industry, and is intended as a direct replacement for MIL R 6130C.

6. Materials and Manufacture

6.1 *Materials*—The materials shall be homogeneous. Except for the following production allowances:

6.1.1 Tears and edge cracks that do not interfere with specified product yield.

6.1.2 Depression and pock marks not exceeding 1 in.

6.1.3 Splices and butt splices.

6.1.4 Laminating sheets to achieve thickness.

6.2 The material shall not include the following:

6.2.1 Cemented, bonded, shredded, or reprocessed cellular rubber.

6.2.2 Grade A cellular rubber shall not contain natural rubber.

6.3 *Form*—Chemically blown cellular rubber shall be furnished as sheets, rolls, or molded shapes as specified, and shall have a uniform cell structure, with thin skin or rind surfaces. Cut or split sheets void of skin or rind surfaces may be furnished only for Type II material when specified.

6.4 *Skin or Rind*—The surface formed by contact with the mold shall be considered a skin or rind. It shall be of the same compound, and vulcanized integrally with the cellular structure. Type I shall have skin or rind. Type II may or may not have skin or rind.

6.5 *Cut or Split Sheets (Type II Only)*—When two or more sheets are derived from one thick sheet, the cut or split sheets shall not be required to possess a skin or rind on either major surface.

6.6 *Surfacing*—Cellular rubber shall be backed or surfaced with fabric, adhesive, or other materials, when and as specified in the contract or order or by applicable drawings.

7. Physical Properties

7.1 The various types and grades of cellular rubber shall conform to the physical properties listed in Table 1 together with any additional requirements indicated by suffix letters in the grade designations as described in Section 4 and Table 2.

8. Tolerances on Dimensions

8.1 Tolerances on dimensions of flexible cellular rubber materials are given in Table 3.

8.2 *Molded Shapes*—Tolerance requirements for molded shapes shall be as specified in drawings, contracts, or by the procuring activity.

8.3 *Sheets and Rolls*—Unless otherwise specified, the tolerance requirements for thickness, lengths and width of sheets shall be as specified in Table 3.

9. Test Methods

9.1 Unless specifically stated otherwise, all test methods shall be in accordance with the test methods specified in Sections 10-18.

9.2 *Precision and Bias*—The repeatability standard deviations for each test method has been determined. The reproducibility of these test methods is being determined and will be available on or before March 2006.

NOTE 2—One laboratory tested one closed-cell, flame-resistant, non-oil resistant, 96-kg/m³, 14-35-kPa product as a representative sample. This sample was used for shrinkage, recovery, and oil-resistance testing.

10. Test Conditions

10.1 *Standard Conditions*—Unless otherwise specified herein, conduct the test method at 23 ± 2°C (73.4 ± 3.6°F) and a relative humidity of 50 ± 5 %

10.2 *Specimen Conditioning*—Unless otherwise specified, condition all test specimens at standard conditions for at least 22 h prior to testing.

11. Compression Deflection

11.1 Test in accordance with Sections 17 to 22 of Specification D 1056.

12. Low-Temperature Flex Resistance

12.1 Test in accordance with Sections 56 to 60 of Specification D 1056. Exposure temperatures shall be in accordance with Table 4.

13. Accelerated Aging

13.1 Test in accordance with Sections 34 to 41 of Specification D 1056.

14. Recovery

14.1 Measure the thickness of each test specimen to 0.0254 mm (0.001 in.).

TABLE 1 Physical Properties^A

Property		Type I Basic Requirements (Open Cell)	Type II Basic Requirements (Closed Cell)	Test Method, Section
Compression deflection, kPa (psi), 25 % deflection	super soft	>0 to ≤14 (>0 to ≤2)	>0 to ≤14 (>0 to ≤2)	11
	soft	>14 to ≤35 (>2 to ≤5)	>14 to ≤35 (>2 to ≤5)	
	soft-medium	>35 to ≤63 (>5 to ≤9)	>35 to ≤63 (>5 to ≤9)	
	medium	>63 to ≤91 (>9 to ≤13)	>63 to ≤91 (>9 to ≤13)	
	medium-firm	>91 to ≤119 (>13 to ≤17)	>91 to ≤119 (>13 to ≤17)	
	firm	>119 to ≤175 (>17 to ≤25)	>119 to ≤175 (>17 to ≤25)	
Low-temperature resistance, flex, 180° bend	Grade A -40°C (-40°F)	pass	pass	12
	Grade B -40°C (-40°F)	pass	pass	
	Grade C -55°C (-67°F)	pass	pass	
Accelerated aging, % retention of original 25 % deflection after 7 days at 158°F	all grades and conditions	±20 %	±30 %	13
Recovery, min, %, after 50 % deflection	all grades and conditions	90	70	14
Flame resistance, max, s	Grade A	30	30	15
	Grade B	not required	not required	
	Grade C	not required	not required	
Shrinkage, max, %, 7 days at 158°F	All grades and conditions	not required	10	16
Water Absorption, max, %	all grades and conditions	not required	10 % max for densities 10 lb/ft ³ and under 5 % max for densities over 10 lb/ft ³	17
Oil aging, % change in volume, IRM Oil 902	Grade A	-15 to +30	-15 to +30	18
	Grade B	not required	not required	
	Grade C	not required	not required	
Color	all grades and conditions	as manufactured unless otherwise specified	as manufactured unless otherwise specified	visual

^AUnless otherwise specified, the basic requirements listed are for all types, grades, and conditions.

TABLE 2 Optional Requirements Added by Suffix Letters

Property		Type I Optional Requirements (Open Cell)	Type II Optional Requirements (Closed Cell)	Test Method Section
Suffix H: Flexing, max, % set	all grades and conditions	10	10	Appendix X1
Suffix O: Odor in accordance with SAE J-1351	all grades and conditions	rating to be determined	rating to be determined	Appendix X1
Suffix W: Density in accordance with Test Methods D 3575 or Specification D 1056	all grades and conditions	density to be determined	density to be determined	
Suffix Y: Sulfur Content, max, % by weight	all grades and conditions	0.60	0.60	Appendix X1

14.2 Compress the specimen to 50 % of the original thickness for a period of 46 ± 0.5 h.

14.3 Remeasure the thickness of each specimen 5 ± 1 min after removal from the compression apparatus.

14.4 Calculate the recovery as follows:

$$\text{recovery, \%} = \frac{B}{A} \times 100 \quad (1)$$

where:

A = original thickness, and

B = thickness 5 ± 1 min after removal from apparatus.

TABLE 3 Dimensions and Tolerances of Cellular Rubber Products for General Applications

Sponge Rubber				
Form	Thickness Dimension, mm (in.)	Thickness Tolerance, mm (in.)	Length and Width Dimension, mm (in.)	Length and Width Tolerance, mm (in.)
Sheet and strip	3.2 (0.125) and under over 3.2 (0.125) to 12.7 (0.50), incl over 12.7 (0.50)	0.4 (0.016)	152 (6) and under	1.6 (0.063)
		0.8 (0.032)	over 152 (6) to 457 (18), incl	3.2 (0.125)
		1.2 (0.047)	over 457 (18)	0.5 %
Molded or special shapes	6.4 (0.250) and under over 6.4 (0.250) to 76.2 (3), incl	0.8 (0.032)	6.4 (0.250) and under	0.8 (0.032)
		1.6 (0.063)	over 6.4 (0.250) to 76 (3), incl	1.6 (0.063)
			over 76 (3) to 457 (18), incl	3.2 (0.125)
			over 457 (18)	0.5 %
Expanded Rubber				
Sheet and strip	12.7 (0.50) and under over 12.7 (0.50)	1.6 (0.063)	152 (6) and under	6.4 (0.250)
		2.4 (0.094)	over 152 (6) to 305 (12), incl over 305 (12)	9.6 (0.375) 3 %
Molded or special shapes	3.2 (0.125) to 12.7 (0.50), incl over 12.7 (0.50) to 38.1 (1.50), incl over 38.1 (1.50) to 76.2 (3), incl	1.6 (0.063)	152 (6) and under	6.4 (0.250)
		2.4 (0.094)	over 152 (6) to 305 (12), incl	9.6 (0.375)
		3.2 (0.125)	over 305 (12)	3 %

TABLE 4 Low-Temperature Flex-Resistance Temperatures

Type	Grade	Temperature
I	A and B	-40 ± 1°C (-40 ± 2°F)
I	C	-55 ± 1°C (-67 ± 2°F)
II	A and B	-40 ± 1°C (-40 ± 2°F)
II	C	-55 ± 1°C (-67 ± 2°F)

14.5 The repeatability standard deviation has been determined to be 0.0029 %. The reproducibility of this test method is being determined and will be available on or before March 2006.

	Recovery, %
1	88.80
2	89.70
3	89.50
4	89.60
5	89.40
6	89.30
7	89.80
8	89.70
9	89.70
10	89.60
Average	89.51 %
Standard Deviation	0.00292309 %

15. Flame Resistance

15.1 Test in accordance with Test Method D 635 with the following exceptions:

15.2 Test three specimens and record average propagation time.

15.3 *Specimen Size*: 7.0 ± 1 mm (0.275 ± 0.04 in.) thick by 12.7 ± 1 mm (0.5 ± 0.04 in.) wide by 125 ± 5 mm (4.92 ± 0.2 in.) in length.

15.4 Clamp the specimen on one end with its longitudinal axis horizontal.

15.5 The blue flame shall be 38 mm (1.49 in.) in height.

15.6 Apply the flame for 60 ± 1 s.

15.7 Remove the flame after 60 ± 1 s and record the average propagation time in seconds.

16. Shrinkage

16.1 *Scope*—This test method covers the evaluation of shrinkage of flexible cellular elastomeric materials.

16.2 *Significance and Use*—This test method provides a relatively simple and short-term evaluation of in-use performance with regard to shrinkage.

16.3 *Apparatus*—Air-circulating oven equipped with a control to maintain a temperature of 70 ± 1°C (158 ± 2°F) during the test and having an expanded metal shelf, and a steel rule, graduated in millimetres (inches), capable of measuring to increments of 1.0 mm (0.05 in.).

16.4 *Test Specimen*—Use three specimens approximately 300 by 75 mm (12 by 3 in.) cut from each of the test samples.

16.5 *Procedure*—At each of two points, approximately 250 mm (10 in.) apart on the centerline of each specimen, place a benchmark. Condition the specimen 24 h at a temperature of 23 ± 2°C (73 ± 3.6°F) and measure the distance between the benchmarks to the nearest 1.0 mm (0.05 in.). Place the specimens on an expanded metal shelf in an oven operating at a temperature of 70 ± 1°C (158 ± 2°F). After 7 days ± 2 hours, remove the specimens from the oven, condition for at least 2 h at 23 ± 2°C, and remeasure.

16.6 *Calculation*—Calculate percent shrinkage as follows:

$$\text{change in length, \%} = \frac{L_1 - L_2}{L_1} \times 100 \quad (2)$$

where:

L_1 = original length, and

L_2 = length after oven-aging.

16.7 *Report*—Report the shrinkage as the change in length between the two benchmarks expressed as a percentage of the length originally measured.