Designation: D1056 – 20

Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber[1,2]

This standard is issued under the fixed designation D1056; 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 U.S. Department of Defense.

1. Scope*

1.1 This specification covers flexible cellular rubber products known as sponge rubber and expanded rubber, but does not apply to latex foam rubber or ebonite cellular rubber. The base material for an open/closed cellular product may be made of synthetic, natural, or reclaimed rubber, or a mixture, and may contain other polymers or chemicals, or both, which may be modified by organic or inorganic additives. These elastomeric materials have properties similar to those of vulcanized rubber, namely (1) the ability to be converted from a thermoplastic to a thermosetting state by crosslinking (vulcanization) or (2) the substantial recovery of their original shapes when strained or elongated, or both.

1.2 Extruded or molded shapes of sizes too small for cutting standard test specimens are difficult to classify or test by these methods and will usually require special testing procedures.

1.3 In case of conflict between the provisions of this general specification and those of detailed specifications or test methods for a particular product, the latter shall take precedence. Reference to the test methods in this specification should specifically state the particular test or tests desired.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 The following safety hazards caveat pertains only to the test methods portions 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—ISO 6916-1 is similar to this specification.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D395 Test Methods for Rubber Property—Compression Set
D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
D471 Test Method for Rubber Property—Effect of Liquids
D573 Test Method for Rubber—Deterioration in an Air Oven
D575 Test Methods for Rubber Properties in Compression
D624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
D832 Practice for Rubber Conditioning For Low Temperature Testing
D883 Terminology Relating to Plastics
D1171 Test Method for Rubber Deterioration—Surface Ozone Cracking Outdoors (Triangular Specimens)
D2632 Test Method for Rubber Property—Resilience by Vertical Rebound
D3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets
D3183 Practice for Rubber—Preparation of Pieces for Test Purposes from Products
D5132 Test Method for Horizontal Burning Rate of Polymeric Materials Used in Occupant Compartments of Motor Vehicles

[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.

This standard has been approved for use by agencies of the Department of Defense to replace Methods 12001, 12005, 12011, 12021, 12031, 12041, 12151, and 12411 of Federal Test Method Standard No. 601.

This standard has been approved for use by agencies of the Department of Defense to replace MIL-STD-670 and MIL-STD-C 3133, which were discontinued in 1986.

Current edition approved Oct. 1, 2020. Published November 2020. Originally approved in 1949. Last previous edition approved in 2014 as D1056 - 14. DOI: 10.1520/D1056-20.

[2] This version supersedes all prior versions of this specification.

[3] 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.

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

E456 Terminology Relating to Quality and Statistics

E2935 Practice for Conducting Equivalence Tests for Comparing Testing Processes

2.2 *ISO Standard:*[4]

ISO 6916-1 Flexible Cellular Polymeric Materials: Sponge and Expanded Cellular Rubber Products—Specification Part 1 Sheet

3. Terminology

3.1 *Definitions*—Terms used in this standard are defined in accordance with Terminology D883, unless otherwise specified. For terms relating to precision and bias and associated issues, the terms used in this standard are defined in accordance with Terminology E456.

3.2 *Definitions of Terms Specific to This Standard:*

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

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

3.2.3 *expanded rubber, n*—cellular rubber having closed cells made from a solid rubber compound.

3.2.4 *flexible cellular material, n*—a cellular polymer that will not visibly rupture within a specified time when a specimen is bent around a 25.4 mm (1.0 in.) mandrel 180 degrees within an agreed upon period of time and at a predetermined temperature.

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

3.2.6 *rubber, n*—a material that is capable of recovering from large deformations quickly and forcibly, and can be, or already is, modified to a state in which it is essentially insoluble (but can swell) in boiling solvent (such as benzene, methyl ethyl ketone, and ethanol-toluene azeotrope).

3.2.6.1 *Discussion*—A rubber in its modified state, free of diluents, retracts within 1 min to less than 1.5 times its original length after being stretched at room temperature 68 to 80.6°F to twice its length and held for 1 min before release.

3.2.7 *skin, n*—the textured outer surface on the material formed during manufacture by contact with molds, cover plate, air, or other curing medium.

3.2.7.1 *Discussion*—Normally, this skin is formed by contact with the mold or cover plates during manufacture. Molded open-cell (sponge) parts usually have a skin on all surfaces, except when cut to length from longer strips. Parts made by cutting from open-cell (sponge) sheets usually have skin on two faces and open cells at the cut edges. Closed-cell (expanded) rubber sheets are frequently split from thicker pieces and consequently do not have the skin faces. On some products it is desirable to add a solid rubber skin coating. The use to which the cellular rubber product is to be put determines the thickness of added skin required. Products subject to abrasion or open-cell (sponge) rubber that must withstand absorption of water or transmission of gases will ordinarily require an applied skin coating. Closed-cell (expanded) rubber does not usually require an added skin for these reasons.

3.2.8 *sponge rubber, n*—cellular rubber consisting predominantly of open cells made from a solid rubber compound.

4. Classification (Types, Classes, and Grades)

4.1 *Types*—These specifications cover two types of cellular rubber designated by the prefix numbers 1 and 2.

4.1.1 *Type 1*—Open-cell rubber.

4.1.2 *Type 2*—Closed-cell rubber.

4.1.3 See Section 3 for definitions of open and closed cell.

4.2 *Classes*—Both types are divided into four classes designated by the letters A, B, C, and D added to the number prefix. Basic requirements for classes are found in Tables 1 and 2.

4.2.1 *Class A*—Cellular rubber made from synthetic rubber, natural rubber, reclaimed rubber, or rubber-like materials, alone or in combination, where specific resistance to the action of petroleum base oils is not required.

4.2.2 *Class B*—Cellular rubber made from synthetic rubber or rubber-like materials alone or in combination, having specific requirements for oil resistance with low mass change.

4.2.3 *Class C*—Cellular rubber made from synthetic rubber or rubber-like materials alone or in combination, having specific requirements for oil resistance with medium mass change.

4.2.4 *Class D*—Cellular rubber made from synthetic rubber or rubber-like materials alone or in combination having specific requirements for extreme temperature resistance −103 to 347°F (−75 to 175°C); but specific resistance to the action of petroleum-base oils is not required.

4.3 *Grades*—Each type and class has been divided into a number of different grades. Each grade is based on a specific range of firmness as expressed by compression-deflection (see Sections 18 to 22). Grades are designated by digit; the softer grades being identified with the lower numbers and the higher grades being identified with the higher numbers.

4.3.1 *Grade 0*—For Types 1 and 2 cellular rubber, a compression-deflection range from 0 to 2 psi (0 to 13.8 kPa).

4.3.2 *Grade 1*—For Types 1 and 2 cellular rubber, a compression-deflection range from 2 to 5 psi (13.8 to 34.5 kPa).

4.3.3 *Grade 2*—For Types 1 and 2 cellular rubber, a compression-deflection range from 5 to 9 psi (34.5 to 62.1 kPa).

4.3.4 *Grade 3*—For Types 1 and 2 cellular rubber, a compression-deflection range from 9 to 13 psi (62.1 to 89.6 kPa).

4.3.5 *Grade 4*—For Types 1 and 2 cellular rubber, a compression-deflection range from 13 to 17 psi (89.6 to 117.2 kPa).

4.3.6 *Grade 5*—For Types 1 and 2 cellular rubber, a compression-deflection range from 17 to 25 psi (117.2 to 172.4 kPa).

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

NOTE 2—For conversion of types, classes, and grades to previous versions of Specification D1056, see Appendix X1.

5. Materials and Manufacture

5.1 *Sponge Rubber*—Sponge rubber is made by incorporating into the compound a blowing agent, such as sodium bicarbonate, that gives off a gas which expands the mass during the vulcanization process. Sponge rubber is manufactured in sheet, strip, molded, or special shapes. Unless otherwise specified, sheet and strip sponge rubber shall have a natural skin on both the top and bottom surfaces. Fabric surface impressions are ordinarily not objectionable. The coarseness of the impressions shall be agreed upon between the parties concerned.

5.2 *Expanded Rubber*—Closed-cell rubber is made by incorporating gas-forming ingredients in the rubber compound, or by subjecting the compound to high-pressure gas, such as nitrogen. Expanded rubber is manufactured in sheet, strip, molded, tube, cord, and profile shapes by molding or extruding. Unless otherwise specified, the presence of skin on the top or bottom surfaces of sheet and strip expanded rubber shall be optional. Extruded shapes have skin on all surfaces except cut ends.

TABLE 1 Physical Requirements of Cellular Rubbers, Type 1, Open-Cell Sponge

Grade Number	Basic Requirements							
	Compression Deflection, 25 % Deflection (Limits), psi (kPa)	Compression Deflection after Oven Aging, Change from Original		Oil-Aged 22 h at 158°F (70°C), Change in Volume in ASTM Oil No. 3 (IRM 903) (Limits),%	Compression Set, 50 % Deflection, max,%		Low-Temperature Flex, 5 h at –67°F (–55°C)
		168 h at 158°F (70°C)	22 h at 302°F (150°C)		22 h at 158°F (70°C)	22 h at 212°F (100°C)	
	Class A, Non-Oil-Resistant						
1A0	less than 2 (13.8)	±20[A]	...	...	15	...	...
1A1	2 to 5 (13.8 to 34.5)	±20	...	...	15	...	...
1A2	5 to 9 (34.5 to 62.1)	±20	...	...	15	...	...
1A3	9 to 13 (62.1 to 89.6)	±20	...	...	15	...	...
1A4	13 to 17 (89.6 to 117.2)	±20	...	...	15	...	...
1A5	17 to 25 (117.2 to 172.4)	±20	...	...	15	...	...
	Class B, Oil-Resistant, Low Mass Change[B]						
1B0	less than 2 (13.8)	±20[A]	...	–25 to + 10	40	...	...
1B1	2 to 5 (13.8 to 34.5)	±20	...	–25 to + 10	40	...	...
1B2	5 to 9 (34.5 to 62.1)	±20	...	–25 to + 10	40	...	...
1B3	9 to 13 (62.1 to 89.6)	±20	...	–25 to + 10	40	...	...
1B4	13 to 17 (89.6 to 117.2)	±20	...	–25 to + 10	40	...	...
1B5	17 to 25 (117.2 to 172.4)	±20	...	–25 to + 10	40	...	...
	Class C, Oil-Resistant, Medium Mass Change[B]						
1C0	less than 2 (13.8)	±20[A]	...	+ 10 to + 60	50	...	...
1C1	2 to 5 (13.8 to 34.5)	±20	...	+ 10 to + 60	50	...	...
1C2	5 to 9 (34.5 to 62.1)	±20	...	+ 10 to + 60	50	...	...
1C3	9 to 13 (62.1 to 89.6)	±20	...	+ 10 to + 60	50	...	...
1C4	13 to 17 (89.6 to 117.2)	±20	...	+ 10 to + 60	50	...	...
1C5	17 to 25 (117.2 to 172.4)	±20	...	+ 10 to + 60	50	...	...
	Class D, High-Temperature-Resistant						
1D0	less than 2 (13.8)	...	±5	...	...	50	pass
1D1	2 to 5 (13.8 to 34.5)	...	±5	...	...	50	pass
1D2	5 to 9 (34.5 to 62.1)	...	±5	...	...	30	pass
1D3	9 to 13 (62.1 to 89.6)	...	±5	...	...	30	pass
1D4	13 to 17 (89.6 to 117.2)	...	±5	...	...	30	pass
1D5	17 to 25 (117.2 to 172.4)	...	±5	...	...	30	pass

[A] If this grade after aging still falls within the compression-deflection requirement of <2 psi (13.8 kPa), it shall be considered acceptable even though the change from the original is greater than ±20 %.
[B] Terminology was changed in 1997 from low swell to low mass change to better reflect the data obtained.

TABLE 2 Physical Requirements of Cellular Rubbers, Type 2, Closed-Cell Expanded

Grade Number	Basic Requirements								
	Compression Deflection, 25 % Deflection (Limits), psi (kPa)	Oven-Aged, Change from Original Compression Deflection Values (Limits), %		Water Absorption, max, Change in Weight, %		Fluid Immersion, 7 Days at 73.4°F (23°C), max %[B]		Compression Set, 50 % Constant Deflection, 22 h at 212°F (100°C), max %	Low-Temperature Flex, 5 h at –67°F (–55°C)
		168 h at 158°F (70°C)	22 h at 302°F (150°C)	Density over 10 lb/ft^3 (160 kg/m^3)	Density of 10 lb/ft^3 (160 kg/m^3) or less	Density over 10 lb/ft^3 (160 kg/m^3)	Density of 10 lb/ft^3 (160 kg/m^3) or less		
	Class A, Nonfuel-Resistant								
2A0	less than 2 (13.8)	±30[A]	...	5	10	...	...	...	...
2A1	2 to 5 (13.8 to 34.5)	±30	...	5	10	...	...	...	...
2A2	5 to 9 (34.5 to 62.1)	±30	...	5	10	...	...	...	...
2A3	9 to 13 (62.1 to 89.6)	±30	...	5	10	...	...	...	...
2A4	13 to 17 (89.6 to 117.2)	±30	...	5	10	...	...	...	...

2A5	17 to 25 (117.2 to 172.4)	±30	...	5	10	...	...	...	...
				Class B, Fuel-Resistant, Low Mass Change[C]					
2B0	less than 2 (13.8)	±30[A]	...	5	10	50	100	...	...
2B1	2 to 5 (13.8 to 34.5)	±30	...	5	10	50	100	...	...
2B2	5 to 9 (34.5 to 62.1)	±30	...	5	10	50	100	...	...
2B3	9 to 13 (62.1 to 89.6)	±30	...	5	10	50	100	...	...
2B4	13 to 17 (89.6 to 117.2)	±30	...	5	10	50	100	...	...
2B5	17 to 25 (117.2 to 172.4)	±30	...	5	10	50	100	...	...
				Class C, Fuel-Resistant, Medium Mass Change[C]					
2C0	less than 2 (13.8)	±30[A]	...	5	10	150	250	...	...
2C1	2 to 5 (13.8 to 34.5)	±30	...	5	10	150	250	...	...
2C2	5 to 9 (34.5 to 62.1)	±30	...	5	10	150	250	...	...
2C3	9 to 13 (62.1 to 89.6)	±30	...	5	10	150	250	...	...
2C4	13 to 17 (89.6 to 117.2)	±30	...	5	10	150	250	...	...
2C5	17 to 25 (117.2 to 172.4)	±30	...	5	10	150	250	...	...
				Class D, High-Temperature-Resistant					
2D0	less than 2 (13.8)	...	±5	5	10	...	...	80	pass
2D1	2 to 5 (13.8 to 34.5)	...	±5	5	10	...	...	80	pass
2D2	5 to 9 (34.5 to 62.1)	...	±5	5	10	...	...	60	pass
2D3	9 to 13 (62.1 to 89.6)	...	±5	5	10	...	...	60	pass
2D4	13 to 17 (89.6 to 117.2)	...	±5	5	10	...	...	60	pass
2D5	17 to 25 (117.2 to 172.4)	...	±5	5	10	...	...	60	pass

[A] If this grade after aging still falls within the compression-deflection requirement of <2 psi (13.8 kPa), it shall be considered acceptable even though the change from the original is greater than ±30 %.

[B] This test (see Sections 27 – 34) of weight change in Reference Fuel B is used in place of the usual oil-resistance test of volume change of No. 3 oil for the following reason: Oil or solvent immersion of flexible closed cellular materials usually causes loss of gas, by diffusion through the softened cell walls, that results in some shrinkage of the test sample. This shrinkage counteracts the swell that would normally occur, therefore invalidating test data based on volume change. Reference Fuel B is used because it produces a wider and more consistent differentiation among the A, B, and C classes than does the No. 3 oil.

[C] Standard oil resistance test methods give inconsistent results on closed cellular materials. This test gives a general indication of oil resistance, but more reliable information should be obtained by testing in actual or simulated service conditions.

The values of 150 % maximum Class C and 50 % maximum Class B apply to cellular materials having densities of more than 10 lb/ft^3 (160 kg/m^3). For cellular materials with densities of 10 lb/ft^3 or less, the values of maximum mass change allowed are 250 % for Class C and 100 % for Class B.

Terminology was changed in 1997 from low swell to low mass change to better reflect the data obtained.

6. Physical Properties

6.1 The various grades of cellular rubber shall conform to the basic requirements as to physical properties in Table 1 and Table 2. Any additional requirements desired by the end user shall be indicated by adding suffix letters from Table 3 to the grade designations as described in Section 4.

TABLE 3 ASTM Test Methods

NOTE 1—See Table 1 or Table 2 for established requirements for open or closed cell forms respectively.

NOTE 2—Test Methods D412 was intended for testing dense rubber samples. It requires a sample thickness of between 0.060 and 0.120 in. (1.5 and 3 mm). This thickness is difficult to achieve on some foam products. In addition, foam samples, particularly low-compression deflection products can be difficult to measure gauge. There is also no mention of allowance for skin or no skin samples. For these reasons, tensile samples tested in accordance with Specification D1056 are allowed to be up to 0.250 in. (6.35 mm) thick and should be tested with or without skin as used in the application.

Basic Requirements and Suffix Number Requirement or Suffix Letter	Basic Requirements	Suffix Number 1	Suffix Number 2	Suffix Number 3	Suffix Number 4
Compression deflection	Specification D1056, Sections 16 – 22				
Heat resistance	Specification D1056, Sections 15 – 22, change in compression deflection after aging 7 days at 158°F (70°C)				
Fluid resistance (1B and 1C rubber only)	Specification D1056, Sections 23 – 34, 22 h at 158°F (70°C)				
Fluid resistance[A] (2B and 2C)	Specification D1056 Sections 27 – 34, 7 days at 73.4°F (23°C)				

TABLE 3 *Continued*

Basic Requirements and Suffix Number Requirement or Suffix Letter	Basic Requirements	Suffix Number 1	Suffix Number 2	Suffix Number 3	Suffix Number 4
Compression set (1A, 1B, and 1C)	Specification D1056, Sections 50 – 56, 22 h at 158°F (70°C), 50 % deflection, 30-min recovery at 73.4°F (23°C)				
Compression set (1D and 2D rubber only)	Specification D1056, Sections 50 – 56, 22 h at 212°F (100°C), 50 % deflection, 30-min recovery at 73.4°F (23°C)				
Water absorption (2A, 2B, 2C, and 2D)	Specification D1056, Sections 43 – 49				
Optional Requirements					
Suffix A, heat resistance		Specification D1056, Sections 15 – 22, change in compression deflection after aging 22 h at 212°F (100°C), Limits ±30 %	Specification D1056, Sections 15 – 22, change in compression deflection after aging 22 h at 257°F (125°C), Limits ±30 %	Specification D1056, Sections 15 – 22, change in compression deflection after aging 22 h at 302°F (150°C), Limits ±30 %	Specification D1056, Sections 15 – 22, change in compression deflection after aging 22 h at 350°F (175°C), Limits ±30 %
Suffix B, compression set (B1 for 1A, 1B, and 1C only) (B2 & B3 for 2A, 2B, 2C, 2D only)		Specification D1056, Sections 50 – 68, 22 h at 158°F (70°C), 50 % deflection, 30-min recovery at 73.4°F (23°C), 25 % max	Specification D1056, Sections 50 – 68, 22 h at 73.4°F (23°C), 50 % deflection, 24-h recovery at 73.4°F (23°C), 25 % max	Specification D1056, Sections 50 – 68, 22 h at 73.4°F (23°C), 50 % deflection, 24-h recovery at 73.4°F (23°C) 35 %, max	
Suffix C, ozone or weather resistance[B]		Test Method D1171, ozone chamber exposure, Method A. Exposure rating (Exposure Method A or B)	Test Method D1171, outdoor exposure, Method A: Exposure Rating	Test Method D1171, ozone exposure (ozone chamber or outdoor), Test Method B: Quality Retention Rating	
Suffix D, load deflection[C]					
Suffix E, fluid resistance[C]					
Suffix F, Low-temperature resistance		Specification D1056, Sections 57 – 61, 5 h at −40°F (−40°C)	Specification D1056, Sections 57 – 61, 5 h at −67°F (−55°C)	Specification D1056, Sections 57 – 61, 5 h at −103°F (−75°C)	
Suffix G, tear resistance[B]		Test Method D624 Die C			
Suffix J, abrasion resistance[C]					
Suffix K, adhesion capability[C]		Rubber compound must be suitable for, and able to accept adhesive bonding.			
Suffix L, water absorption[C]					
Suffix M, combustion characteristics[D]		Test Method D5132 4 in./min, max (100 mm/min, max)			
Suffix N, impact resistance[C]					
Suffix P, staining resistance[C]					
Suffix R, resilience[B]		Test Method D2632 (Shore Rebound)			
Suffix T, Tensile/Elongation[B]		Test Method D412 except specimen thickness, see Note 2			
Suffix W, density[B]		Specification D1056 Sections 62 – 68			
Suffix Z, special requirements[C]					

[A] See Table 2 for materials having densities of 10 lb/ft^3 (160 kg/m^3) or less.
[B] Ratings to be arranged between the purchaser and the supplier.
[C] Test method and values to be arranged between the purchaser and the supplier.
[D] Specimen to be at application thickness.

TABLE 4 Tolerances on Dimensions of Cellular Rubber Products for General Applications

Form	Thickness		Length and Width	
	Dimension, in. (mm)	Tolerance, ±, in. (mm)	Dimension, in. (mm)	Tolerance, ±, in. (mm)
	Sponge Rubber			
Sheet and strip	0.125 (3.2) and under	0.016 (0.4)	6 (152) and under	0.063 (1.6)
	Over 0.125 (3.2) to 0.50 (12.7), incl	0.032 (0.8)	Over 6 (152) to 18 (457), incl	0.125 (3.2)
	Over 12.7 (0.50)	0.047 (1.2)	Over 18 (457)	0.5 %
Molded or special shapes	0.250 (6.4) and under	0.032 (0.8)	0.250 (6.4) and under	0.032 (0.8)
	Over 0.250 (6.4) to 3 (76.2), incl	0.063 (1.6)	Over 0.250 (6.4) to 3 (76), incl	0.063 (1.6)

TABLE 4 *Continued*

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

7. Tolerances on Dimensions

7.1 Tolerances on dimensions of cellular rubber products shall be as specified in Table 4.

8. Color

8.1 Unless otherwise specified, the color of cellular rubber shall be black.

9. Workmanship, Finish, and Appearance

9.1 Cellular rubber furnished under this specification shall be manufactured from synthetic rubber, natural rubber, or rubber-like materials together with added compounding ingredients of such nature and quality that the finished product complies with the specification requirements. In permitting choice in use of those materials by the producer, it is not intended to imply that the different rubber materials are equivalent in respect to all physical properties. Any special characteristics other than those prescribed in this specification that may be desired for specific applications shall be specified in the product specifications, as they may influence the choice of the type of rubber material or other ingredients used. All materials and workmanship shall be in accordance with good commercial practice, and the resulting cellular rubber shall be free from defects affecting serviceability.

10. Test Methods

10.1 Unless specifically stated otherwise, all tests shall be made in accordance with the methods specified in Sections 13 – 68 and Table 3.

11. Sampling

11.1 When possible, the completed manufactured product shall be used for the tests specified. Representative samples of the lot being examined shall be selected at random as required.

11.2 When it is necessary or advisable to obtain test 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. The apparent density and the state of cure may vary in different parts of the finished product, especially if the article is of complicated shape or of varying thickness, and these factors affect the physical properties of the specimens. Also, the apparent density is affected by the number of cut surfaces as opposed to the number of skin-covered surfaces on the test specimen.

11.3 When the finished product does not lend itself to testing or to the taking of test specimens because of complicated shape, small size, metal or fabric inserts, solid covers, adhesion to metal, or other reasons, standard test slabs shall be prepared. When differences due to the difficulty in obtaining suitable test specimens from the finished part arise, the manufacturer and the purchaser may agree on acceptable deviations. This can be done by comparing results of standard test specimens and those obtained on actual parts.

12. Inspection and Rejection

12.1 All tests and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified. The manufacturer shall afford the inspector all reasonable facilities for tests and inspection.

12.2 The purchaser may make the tests and inspection to govern acceptance or rejection of the material at his own laboratory or elsewhere. Such tests and inspection shall be made not later than 15 days after receipt of the material.

12.3 All samples for testing, provided as specified in Section 11, shall be visually inspected to determine compliance with the material, workmanship, and color requirements.

12.4 Any material that fails in one or more of the test requirements may be retested. For this purpose, two additional tests shall be made for the requirement in which failure occurred. Failure of either of the retests shall be cause for final rejection.

12.5 Rejected material shall be disposed of as directed by the manufacturer.

GENERAL TEST METHODS

13. Scope

13.1 Except as otherwise specified in these test methods, the following ASTM test methods and the various test methods in Table 3, applicable in general to vulcanized rubber, shall be complied with as required and are hereby made a part of these test methods:

13.1.1 *General Physical Test Requirements*—Practices D3182 and D3183.

13.1.2 *Aging Test*—Test Method D573, with modifications as described in Sections 15 – 22 .

13.1.3 *Compression Set, Suffix B*—Test method described in Sections 50 – 56.

13.1.4 *Fluid Immersion, Suffix E*—Test Method D471 and Sections 23 – 34.

13.1.5 *Low-Temperature Test, Suffixes F1, F2, and F3*—Test method described in Sections 57 – 61. Suitable low-temperature cabinets and conditioning procedures are described in Practice D832.

13.2 In case of conflict between provisions of the test methods referenced in 13.1.1 – 13.1.5 and the procedures specifically described herein for cellular rubbers, the latter shall take precedence.

14. Test Specimens and Slabs

14.1 *Test Specimens*—Standard test specimens shall be disks 1.129 ± 0.02 in. (28.67 ± 0.50 mm) in diameter, which yields a 1-in.^{2} (645.16-mm^2) specimen. The specimens may be cut with a revolving die[5] using a soap solution as a lubricant. If a lubricant is used, the specimens shall be thoroughly dried before proceeding with the testing. In some cases, it may be necessary to freeze the cellular rubber to obtain parallel cut edges. Samples shall not be compression die cut because this process distorts the sample, which will affect the final properties. The thickness shall be measured as described in 14.3.2. The minimum thickness of test specimens is 0.250 in. (6.35 mm). Plied-up samples may be used as indicated in the test methods for compression set and compression deflection (see Note 3 in 18.2).

14.2 *Test Slabs*—Where specially prepared standard test slabs of expanded rubber are required, they shall be made using the same process that was used for the product to be represented by the test slab. The specimens shall be prepared to have approximately the same density, and shall be vulcanized under conditions of time and temperature chosen to produce the same state of cure in the standard slabs as in the finished products they represent.

14.3 *Measurements of Test Specimens:*

14.3.1 The length and width shall be measured to 0.02 in. (0.5 mm). Care shall be taken not to distort the cellular rubber.

14.3.2 Thicknesses up to and including 1 in. (25.4 mm) shall be measured using a dial-type gauge having a maximum stem and foot mass of 25 g and a foot 1.25 in. (31.75 mm) in diameter. (See Section 69.) Thicknesses over 1.0 in. (25.4 mm) shall be measured using a sliding caliper gauge. When a sliding caliper gauge is employed, the gauge setting shall be made with the gauge out of contact with the cellular rubber. The sample shall be passed through the previously set gauge and the proper setting shall be the one in which the measuring faces of the gauge contact the surfaces of the article without compressing it.

14.3.3 The steel scale or tape used to measure length or width shall be graduated to 0.039 in. (1 mm). The dial gauge for measuring thickness shall be graduated to 0.001 in. (0.025 mm). The calipers used for measuring thickness shall be graduated to 0.005 in. (0.127 mm).

14.3.4 Results shall be reported as the average of three measurements. If the results vary between the specimens more than 10 %, two additional specimens should be taken into the average.

ACCELERATED AGING TESTS

15. Test Specimen

15.1 The test specimen used in any of the aging tests shall be of the size and shape as specified by the appropriate called-out test method.

COMPRESSION-DEFLECTION TESTS

16. Scope

16.1 This test method consists of measuring the force necessary to produce a 25 % deflection on a test specimen.

17. Apparatus

17.1 An apparatus capable of compressing the specimen between a flat supporting plate and a flat compression foot that is larger than the specimen to be tested, at a uniform rate of speed of 1.25 ± 0.5 in/min (31.75 ± 12.7 mm/min). The apparatus shall be capable of measuring the force required to produce the specified compression and the displacement of the compression foot.

18. Test Specimens

18.1 Standard test specimens can be used for this test.

18.2 Test specimen size may vary provided the indenter foot of the apparatus used is larger than the sample. Test specimens may be cylindrical or square. They shall be cut so that opposite edges are parallel, either from the finished product or in a manner agreed upon between the parties concerned. The thickness of the test specimens may vary, but shall be measured and stated in the report.

NOTE 3—In sponge rubbers, using the same compound, thin sections under 0.25 in. (6.35 mm) do not blow in the same manner as those over 0.25 in. (6.35 mm). The thinner sections are usually higher in compression deflection and density. However, in closed-cell (expanded) rubbers where thin sheet is split from thicker sheets there is usually very little difference between the thin sheet and thicker sheets.

19. Procedure

19.1 In accordance with 14.3, measure the width and length or diameter of the specimen to obtain the area of the specimen. Measure the thickness of the specimen. Preflex the specimen by compressing the specimen between the parallel metal plates of the machine until the thickness has been reduced 25 %. Decompress the specimen at the same rate until the separation between the compression plate and base plate is equal to the original specimen thickness. Allow the specimen to rest for a period of 8 ± 2 seconds after the preflex. Repeat the compression again until the specimen thickness has been reduced 25 % and immediately read the load.

20. Calculation

20.1 Load (lbs) / Area (in.^{2}) = psi

[5] A satisfactory die and its method of application are described in Section 4 of Test Methods D575.