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SURFACE VEHICLE STANDARD

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ϕ LATEX FOAM RUBBERS

[This SAE Standard was formulated by the SAE-ASTM Technical Committee on Automotive Rubber.]

1. ***Scope***—These specifications and methods of testing apply to cellular-rubber products known as latex foam rubbers but do not apply to sponge and expanded rubbers. The base material used in their manufacture may be natural rubber, reclaimed rubber, synthetic rubber, or rubberlike materials, alone or in combination. In case of conflict between the provisions of these general specifications and those of detailed specifications or methods of test for a particular product, the latter shall take precedence. Reference to methods for testing cellular-rubber products should specifically state the particular test or tests desired.

2. *Description of Terms*

2.1 Flexible Cellular Rubber—A cellular organic polymeric material that will not rupture when a specimen 200 x 25 x 25 mm (8 x 1 x 1 in) is bent around a 25 mm (1 in) diameter mandrel at a uniform rate of 1 lap in 5 s at a temperature between 18 and 29°C (65 and 85°F). In the case of latex foam rubbers, these cells are open and interconnecting.

2.2 Cellular Rubbers—Cellular-rubber products all contain cells or small hollow receptacles. In the case of latex foam rubbers, these cells are open and interconnecting.

2.3 Rubber—The term rubber is used to include both natural and synthetic types.

2.4 Skin—The smooth surface of the latex foam rubber product, formed by contact with mold or cover plates, is defined as a natural skin.

3. *Manufacture*

3.1 Latex Foam Rubbers—The structure of latex foam rubbers consists of a network of open or interconnecting cells. Latex foam rubbers are made from rubber latices or liquid rubbers. They are manufactured in sheet, strip, molded, or specific shapes. Latex foam rubbers shall have a vulcanized cellular structure with a porous surface. The cells shall be interconnecting and of a uniform character. Latex form rubbers may be either cored or solid. Size, shape, and distribution of coring shall be at the producer's opinion but subject to the approval of the purchaser.

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4. ***Grades of Latex Foam Rubbers***—Latex foam rubbers shall have their grade numbers designated by two letters which identify the kind of latex foam rubber as follows:

RC—Latex foam rubbers, cored and
RU—Latex foam rubbers, uncored

Digits following the letters are used to indicate the degree of firmness, the softer grades being identified with the lower numbers and the firmer grades with the higher numbers (see Table 1).

Suffix letters may be added singly or in combination after any grade numbers to indicate additional requirements beyond those specified in Table 1 as basic requirements.

The significance of the approves suffix letters are shown below. The test methods and values must be arranged by agreement between the purchaser and supplier.

C	Weather Resistance.
D	Load Deflection.
E	Oil Resistance. Note that there are no requirements for oil resistance in these specifications.
F1	Low temperature at –40°C (–40°F). Required with values as specified in Table 1.
F2	Low Temperature at –55°C (–67°F).
G	Tear Resistance.
H	Flexing Resistance. Test required with values as specified in Table 1.
J	Abrasion Resistance.
K1	Adhesion to Metal—Bond made during vulcanization.
K2[1]	Adhesion—Cemented bond made after vulcanization.
L	Water Resistance.
M	Flammability Resistance.
N	Impact Resistance.
P	Staining Test Required.
R	Resilience.
Z	Optional Requirements.

Example—Grade RC20 F1H denotes soft, cored latex foam rubber made from natural, reclaim synthetic, or a blend with a load deflection value of 89 ± 18 N (20 ± 4 lb) and requiring, in addition to the basic tests, a low temperature test at –40°C (–40°F) and a flexing test.

[1] Suffix K2 denotes that the finished vulcanized part will be adhered to a rigid surface sometime after vulcanization and that all surface imperfections and/or the use of materials which might be on or bloom to the surface and be detrimental to obtaining good bonds must be avoided.

TABLE 1—PHYSICAL REQUIREMENT OF LATEX FOAM RUBBERS

Grade Number	Basic Requirements: Indentation of 325 cm^2 (50 in^2) (0.03 m^2), 25% Deflection[a] (Limits) N	Basic Requirements: Indentation of 325 cm^2 (50 in^2) (0.03 m^2), 25% Deflection[a] (Limits) lb	Basic Requirements: Air Oven Aged 22 h at 100°C (212°F) Change from Original Load Deflection or Indentation Value (Limits), %	Basic Requirements: Constant Deflection Compression Set, 22 h at 70°C (158°F), 50% Deflection, max, % C_h[b]	Basic Requirements: Constant Deflection Compression Set, 22 h at 70°C (158°F), 50% Deflection, max, % C_d[b]	Requirements Added by Suffix Letters: Suffix F Low Temperature Test, Change from Original Deflection, max, %	Requirements Added by Suffix Letters: Suffix H Flexing Test Compression Set, max, % C_h[b]	Requirements Added by Suffix Letters: Suffix H Flexing Test Compression Set, max, % C_d[b]
Latex Foam Rubbers (Cored)								
RC 5	22 ± 13	5 ± 3	±20	10	20	75	5	10
RC10	44 ± 13	10 ± 3	±20	10	20	75	5	10
RC 15	67 ± 18	15 ± 4	±20	10	20	75	5	10
RC 20	89 ± 18	20 ± 4	±20	10	20	75	5	10
RC 25	111 ± 22	25 ± 5	±20	10	20	75	5	10
RC 30	133 ± 27	30 ± 6	±20	10	20	75	5	10
RC 40	178 ± 31	40 ± 7	±20	10	20	75	5	10
RC 50	222 ± 36	50 ± 8	±20	10	20	75	5	10
RC 60	267 ± 40	60 ± 9	±20	10	20	75	5	10
RC 70	311 ± 53	70 ± 12	±20	10	20	75	5	10
RC 90	400 ± 62	90 ± 14	±20	10	20	75	5	10
Latex Foam Rubbers (Uncored)								
RU 11	49 ± 18	11 ± 4	±20	10	20	75	5	10
RU 20	89 ± 22	20 ± 5	±20	10	20	75	5	10
RU 35	156 ± 44	35 ± 10	±20	10	20	75	5	10
RU 55	245 ± 44	55 ± 10	±20	10	20	75	5	10
RU 80	356 ± 67	80 ± 15	±20	10	20	75	5	10
RU 150	667 ± 245	150 ± 55	±20	10	20	75	5	10

[a] Rubber Manufacturers Association buyers' specification designation.

[b] As defined in section on compression set.

5. ***Material and Workmanship***—Latex foam rubbers furnished under these specifications shall be manufactured from natural rubber, synthetic rubber, or rubberlike 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 these specifications which may be desired for specific applications shall be specified in the product specifications as they may influence the choice of the type of rubber materials 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.

   Because of manufacturing conditions, material may have to be altered or repaired. This repaired or altered material will be acceptable under these specifications provided the material used in such repairs or alterations shall be of the same composition and quality as the original product and provided such alterations do not affect the serviceability, size, and shape beyond tolerances as provided herein.

6. ***Color***—Unless otherwise specified, the color of latex foam rubbers shall be optional with the manufacturer.

7. ***Physical Properties***—The various grades of latex foam rubber shall conform to the requirements as to physical properties prescribed in Table 1, together with any additional requirements indicated. When subjected to the static fatigue test, the latex foam specimen shall show no cracking at the folded edge.

8. ***Methods of Testing***—Unless specifically stated otherwise, all tests shall be made in accordance with the methods specified for the following:

8.1 Basic Tests

8.1.1 Accelerated Aging Tests.

8.1.2 Compression Set Under Constant Deflection.

8.1.3 Indentation Test.

8.2 Suffix Tests

8.2.1 H—Flexing Test.

8.2.2 F—Low Temperature Test.

9. Tolerances on Dimensions—Tolerances on dimensions of latex-foam-rubber products are given in the Appendix, Tables 2 and 3. These tolerances are published as information for guidance only and shall not be considered as a part of these specifications.

10. Packaging and Marketing—The material shall be properly and adequately packaged. Each package or container shall be legibly marked with the name of the material, name or trademark of the manufacturer, and any required purchaser's designations.

11. Inspection and Rejection—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.

The purchaser may make the tests and inspection to govern acceptance or rejection of the material at any chosen laboratory.

All samples for testing, provided as specified in Section 13, Sampling, shall be visually inspected to determine compliance with the material, workmanship, and color requirements.

Any material which 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.

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

12. General Methods—Except as otherwise specified in the methods of testing latex foam rubbers given in ASTM D 1055, the following methods of test of the American Society for Testing and Materials, applicable in general to vulcanized rubber, shall be complied with as required and hereby made a part of these test methods.

12.1 Aging Test—See ASTM D 572, ASTM D 573, and ASTM D 454.

12.2 Compression Set, Suffix B—See ASTM D 395.

12.3 Low Temperature Test, Suffix F1 and F2—See method described in ASTM D 1055.

TABLE 2—TOLERANCES ON DIMENSIONS OF LATEX FOAM RUBBER PRODUCTS FOR GENERAL APPLICATIONS

Type	Dimension	Tolerance Plus	Tolerance Minus	Dimension	Tolerance Plus	Tolerance Minus
	Thickness, mm			Thickness, in		
Cored	0 to 76, incl.	3	2	0 to 3, incl.	1/8	1/16
	76 to 127, incl.	5	3	3 to 5, incl.	3/16	1/8
	127 and over	6	5	5 and over	1/4	3/16
Uncored	Up to and including 12.7	2	2	Up to and including 1/2	1/16	1/16
	From 12.7 to 25.4, incl.	3	2	From 1/2 to 1, incl.	1/8	1/16
	Over 25.4	3	5	Over 1	1/8	3/16
	Length and Width, mm			Length and Width, in		
Cored	0 to 152, incl.	5	2	0 to 6, incl.	3/16	1/16
	152 to 305, incl.	10	3	6 to 12 incl.	3/8	1/8
	305 to 610, incl.	13	6	12 to 24, incl.	1/2	1/4
	610 to 914, incl.	16	10	24 to 36, incl.	5/8	3/8
	914 to 1219, incl.	19	13	36 to 48, incl.	3/4	1/2
	1219 to 1524, incl.	22	16	48 to 60, incl.	7/8	5/8
	1524 to 1829, incl.	25	19	60 to 72, incl.	1	3/4
	1829 and over	29	22	72 and over	1-1/8	7/8
Uncored	0 to 152, incl.	8	2	0 to 6, incl.	5/16	1/16
	152 to 305, incl	13	3	6 to 12, incl.	1/2	1/8
	305 to 610, incl.	18	6	12 to 24, incl.	11/16	1/4
	610 to 914, incl.	22	10	24 to 36, incl.	7/8	3/8
	914 to 1219, incl.	29	13	36 to 48, incl.	1-1/16	1/2
	1219 to 1524, incl.	35	16	48 to 60, incl.	1-1/4	5/8
	1524 to 1829, incl.	38	19	60 to 72, incl.	1-3/8	3/4
	1829 and over	41	22	72 and over	1-1/2	7/8

TABLE 3—TOLERANCES FOR SPECIAL APPLICATIONS OF LATEX FOAM RUBBERS, SUCH AS AUTOMOTIVE TOPPER PADS, SPRING COVERINGS, ETC.

Type	Dimension	Tolerance Plus	Tolerance Minus	Dimension	Tolerance Plus	Tolerance Minus
	Thickness, mm			Thickness, in		
Cored	0 to 76, incl.	5	2	0 to 3, incl.	3/16	1/16
	76 to 127, incl.	6	3	3 to 5, incl.	1/4	1/8
	127 and over	8	5	5 and over	5/16	3/16
Uncored	Up to and including 12.7	2	2	Up to and including 1/2	1/16	1/16
	From 12.7 to 25.4, incl.	3	2	From 1/2 to 1, incl.	1/8	1/16
	Over 25.4	3	3	Over 1	1/8	1/8
	Length and Width, mm			Length and Width, in		
Cored and Uncored	0 to 152, incl.	8	2	0 to 6, incl.	5/16	1/16
	152 to 305, incl.	13	3	6 to 12 incl.	1/2	1/8
	305 to 610, incl.	18	6	12 to 24, incl.	11/16	1/4
	610 to 914, incl.	22	10	24 to 36, incl.	7/8	3/8
	914 to 1219, incl.	29	13	36 to 48, incl.	1-1/8	1/2
	1219 to 1524, incl.	35	16	48 to 60, incl.	1-3/8	5/8
	1524 to 1829, incl.	38	19	60 to 72, incl.	1-1/2	3/4
	1829 and over	41	22	72 and over	1-5/8	7/8

12.4 **Compression—Deflection**—See ASTM D 575, ASTM D 1055, and the Indentation Test in this SAE Standard. In case of conflict between provisions of the above methods and the procedures herein specifically described for latex foam rubbers, the latter shall take precedence. In case of conflict between the procedure herein described for latex foam rubbers and the methods of a particular specification or for a particular latex-foam-rubber product, the latter shall take precedence.

13. ***Sampling***—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.

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, more 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.

When the finished product does not lend itself to testing or to the taking of test specimens because of complicated shape or other reasons, manufacturer and purchaser shall agree on the preparation of a suitable test specimen. When differences due to the difficulty in obtaining suitable test specimens from the finished part arise, manufacturer and purchaser may agree on acceptable deviations. This can be done by comparing results of standard test specimens and those obtained on actual parts.

14. ***Measurement of Test Specimens***—Test specimens are to be measured in accordance with ASTM D 1055.

15. ***Accelerated Aging Tests***

15.1 **Test Specimens**—The test specimen used in any of the aging tests shall be that required by the latex-foam-rubber methods for the particular determination which is to be employed for measuring the effect of the aging exposure.

15.2 **Procedure**—Either the oxygen-pressure-chamber aging test as described in ASTM D 572, the air-oven aging test as described in ASTM D 573, or the air-pressure heat test as described in ASTM D 454, respectively, may be used for latex foam rubbers as specified, except that in the air-pressure heat test, an air pressure of 415 ± 15 kPa (60 ± 2 psig) shall be used in place of the 550 ± 15 kPa (80 ± 2 psig) prescribed in ASTM D 454. Deterioration may be expressed as a percent change of compression-deflection values, or the results may be determined by visual observation. No relation between accelerated aging tests and natural aging is given or implied.

16. ***Compression Set Under Constant Deflection (Calculation Based on Amount of Deflection)***

16.1 **Test Specimens**—The specimens for this test shall have parallel top and bottom surfaces. A cylinder 209 mm (1.129 in) in diameter shall be suitable for slab or uncored stock. Cored stock specimens may be round or rectangular. The minimum dimension on the top and bottom surfaces must be greater than the height of the sample and the surface shall have a minimum area of 0.01 m^2 (16 in^2). The thickness of the test specimen may vary, but shall not be less than 19 mm (0.75 in) for slab or uncored stock. The thickness shall be measured and stated in the report.

16.2 Procedure—The apparatus and procedure shall be the same as prescribed in Method B of ASTM D 395, except as follows: Test specimens shall be compressed 50% of their original thickness. The load shall be released at the end of the test period and the thickness measured after 30 min rest at room temperature. Thickness measurements shall be made as described in Section 14, Measurement of Test Specimens. The temperature of the test shall be 70 ± 2°C (158 ± 3.6°F). The time of the test shall be as specified. Chromium-plated metal plates are not required. Aluminum plates, or any stiff plates that are clean and smooth and that will not deflect measurably under load necessary for deflection of the specimen, may be used.

16.3 Calculations—Calculate the constant deflection compression set, expressed as a percentage of the original height as follows:

$$C_h = \frac{t_0 - t_1}{t_0} \times 100$$

where: C_h = compression set expressed as a percentage of the original height
t_0 = original height of test specimen
t_1 = height of test specimen 30 min + 10 or –0 min after removal from the apparatus

Calculate the constant deflection compression set, expressed as a percentage of the original deflection as follows:

$$C_d = \frac{t_0 - t_1}{t_0 - t_s} \times 100$$

where: C_d = compression set expressed as a percentage of the original deflection
t_0 = original height of test specimen
t_s = height of spacer bar used
t_1 = height of test specimen 30 min + 10 or –0 min after removal from apparatus

17. Indentation Test

17.1 Scope—This test consists of measuring the load necessary to produce at 25% indentation in the latex-foam-rubber product.

17.2 Apparatus—An apparatus having a flat circular indentor foot 0.03 m^2 (50 in^2) in area, connected to a force measuring device by means of a ball-and-socket joint, and mounted in such a manner that the product or specimen can be deflected at a rate of 0.2-10 mm/s (0.5-25.0 in/min) shall be used for this test. A maximum radius of 2 mm (0.07874 in) is allowable on the edge of the indentor foot. The apparatus shall be arranged to support the specimen on a level horizontal plate which is perforated with 6 mm (0.25 in) holes on 20 mm (0.75 in) centers to allow for rapid escape of air during the test.

NOTE: When testing products with parallel top and bottom surfaces, the ball-and-socket joint is not required.

17.3 Test Specimens—The test specimen shall consist of the entire product sample or a suitable portion of it, except that in no case shall the surface for indentation have dimensions less than 300 x 300 mm (12 x 12 in). The full thickness of the product shall be used.

17.4 Procedure—The procedure for identation test should be made in accordance with ASTM D 1055. In cases of dispute, the compression readings shall be performed at a temperature of 23 ± 1.1°C (73.4 ± 2°F) and in an atmosphere having a relative humidity of 50 ± 2%. The product shall be conditioned undeflected and undistorted at this temperature and humidity for at least 12 h before being tested. Ordinarily only one test will be made, but in case of dispute the result shall be expressed as the average of a minimum of three tests.

18. Flexing Test (Suffix H)

18.1 Scope—The flexing test consists of subjecting the test specimen to repeated compression and noting the effect on the cellular structure.

18.2 Test Specimens—The test specimen shall consist of the entire product sample or a suitable portion of it as agreed upon by manufacturer and purchaser. The full thickness of the product shall be used.

18.3 Procedure—Flexing test shall be made in accordance with ASTM D 1055.

19. Low-Temperature Test (Suffix F1, –40°C (–40°F); Suffix F2, –55°C (–67°F))

19.1 Apparatus—The apparatus shall consist of two parallel plates at least 38 mm (1.5 in) in diameter, one of which is movable and the other one stationary, a means of applying a load and a means of accurately measuring the distance between the parallel plates.

19.2 Test Specimens—Cylinders 29 mm (1.129 in) in diameter shall be used for this test. The minimum thickness shall be 19 mm (0.75 in). They shall be dried in a desiccator for not less than 16 h before testing. The thickness shall be measured and recorded.

19.3 Procedure—The compression deflection of the specimen shall first be measured at room temperature and the load in N/m^2 (psi) necessary to obtain a 25% deflection recorded. The specimen shall then be placed in the cold box for 5 h at the specified temperature, at the end of which time the previously determined load shall be applied as rapidly as possible while the specimens are still in the cold box and the deflection recorded 30 s later.

19.4 Calculation—The percent change in deflection shall be calculated as follows:

$$C = \frac{D - E}{D} \times 100$$

where: C = % change in deflection
D = deflection at room temperature
E = deflection at temperature of test

20. Static Fatigue Test

20.1 Procedure