Designation: F 1909 – 98 (Reapproved 2004)

Standard Specification for Preformed Open–Cell Sponge Rubber Pail and Drum Gaskets[1]

This standard is issued under the fixed designation F 1909; 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 preformed open–cell sponge rubber gaskets of the following classes for use in new or reconditioned pails or drums.

1.1.1 *Class A*—Non–Oil Resistant.

1.1.2 *Class B*—Oil Resistant.

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

1.3 The following safety hazards caveat pertains only to Section 10, General Test Methods. *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.*

NOTE 1—*ISO Equivalency Statement*—This proposed specification was found to be *not equivalent*.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 395 Test Methods for Rubber Property—Compression Set

D 471 Test Method for Rubber Property—Effect of Liquids

D 573 Test Method for Rubber—Deterioration in an Air Oven

D 575 Test Methods for Rubber Properties in Compression

D 1056 Specification for Flexible Cellular Materials—Sponge or Expanded Rubber

D 3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets

D 3183 Practice for Rubber—Preparation of Pieces for Test Purposes from Products

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *cellular material*—a generic term for materials containing many open cells dispersed throughout the mass.

3.1.2 *flexible cellular material*—a flexible, cellular material that will not rupture within 60 s when a specimen 200 by 25 by 25 mm (8 by 1 by 1 in.) is bent around a 25 mm (1 in.) diameter mandrel at a uniform rate of one lap in 5 s in the form of a helix at a temperature between 18 and 29°C (65 and 85°F).

3.1.3 *natural skin*—a relatively dense layer at the surface of a cellular material. Normally, this natural skin is formed by contact with the mold during manufacture. Parts made by cutting from open–cell (sponge rubber) sheets usually have natural skin on two faces and open cells at the cut edges.

3.1.4 *rubber*—a material that is capable of recovering from large deformations quickly and forcibly.

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

4. Classification

4.1 *Classes*—Cellular rubbers are divided into two classes, which are designated by the letters A and B added to the number prefix.

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

4.1.2 *Class B*—Cellular rubbers made from synthetic rubber or rubber-like materials, alone or in combination, having specific requirements for oil resistance.

4.2 *Grades*—Each class is divided into three different grades. Each grade is based on a specific range of firmness as expressed by a 25 % compression. Grades are designated by digit, the softer grades being identified with the lower numbers and the harder grades being identified with the higher numbers.

4.2.1 *Grade 1*—A compression deflection range from 15 to 50 kPa (2 to 7 psi).

[1] This specification is under the jurisdiction of ASTM Committee F03 on Gaskets and is the direct responsibility of Subcommittee F03.60 on Specifications for Gasket Materials.

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[2] 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.

TABLE 1 Physical Requirements of Open–Cell Sponge Rubber Pail and Drum Gaskets

Class/ Grade Number	Requirements: Compression at 25 % Deflection (Limits), kPa (psi)	Oil Immersion 22 h at 70°C (158°F), Change in Volume in ASTM Oil IRM 903 (Limits), %	Heat Aged 7 Days at 70°C (158°F), Change in Original Compression Values (Limits), %	Compression Set, 22 h at 70°C (158°F) 50 % Deflection, Max %
Class A, Non-Oil Resistant				
A1	15–50 (2–7)	—	±20	15
A2	50–85 (7–12)	—	±20	15
A3	85–120 (12–17)	—	±20	15
Class B, Oil-Resistant, Medium Swell				
B1	15–50 (2–7)	+10 to +60	±20	50
B2	50–85 (7–12)	+10 to +60	±20	50
B3	85–120 (12–17)	+10 to +60	±20	50

4.2.2 *Grade 2*—A compression deflection range from 50 to 85 kPa (7 to 12 psi).

4.2.3 *Grade 3*—A compression deflection range from 85 to 120 kPa (12 to 17 psi).

5. Materials and Manufacture

5.1 Sponge rubber gaskets are made by incorporating a blowing agent into the compound, such as sodium bicarbonate, that gives off a gas which expands the mass during the vulcanization process.

5.2 Sponge rubber gaskets are manufactured to specified dimensions. Unless otherwise specified, gasket sponge rubber shall have a natural skin on both the top and bottom surfaces. Fabric surface impressions are not objectionable.

6. Physical Properties

6.1 The various grades of cellular rubber shall conform to the requirements as to physical properties in Table 1 and Table 2.

TABLE 2 Tolerances on Dimensions for Open–Cell Sponge Rubber Pail or Drum Gaskets

Thickness				
mm	(in.)	Tolerance ±	mm	(in.)
4.8	(0.188)		1.5	(0.062)
6.4	(0.250)		1.5	(0.062)
7.9	(0.313)		1.5	(0.062)
9.5	(0.375)		1.5	(0.062)
11.1	(0.438)		1.5	(0.062)
12.7	(0.500)		1.5	(0.062)
Width				
mm	(in.)	Tolerance ±	mm	(in.)
4.8	(0.188)		1.5	(0.062)
6.4	(0.250)		1.5	(0.062)
7.9	(0.313)		1.5	(0.062)
9.5	(0.375)		1.5	(0.062)
11.1	(0.438)		1.5	(0.062)
12.7	(0.500)		1.5	(0.062)
Length				
Dimension mm (in.)				
As Required—Circular open–cell sponge rubber pail and drum gaskets are manufactured to fit specified pail or drum flanges by cutting to the specified length and sealing the cut ends together.				

6.2 *Color*—Unless otherwise specified, the color of cellular rubber gaskets shall be tan or black.

7. Tolerances on Dimensions

7.1 Tolerances on dimensions of cellular rubber gaskets shall be as specified in Table 2.

7.2 *Measurements of Test Specimens*—Thickness and width shall be measured using a dial–type gage[3], having a maximum stem and circular foot mass of 25 g and a circular foot 31.8 mm (1.250 in.) in diameter.

8. Workmanship, Finish and Appearance

8.1 Cellular rubber gaskets under this specification shall be manufactured from natural rubber, synthetic 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 the use of 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 that may be desired for specific applications other than those prescribed in this specification, shall be stated 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 rubbers shall be free from defects affecting serviceability.

9. Sampling

9.1 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.

9.2 When the finished product does not lend itself to testing or to the taking of test specimens because of complicated shape 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, manufacturer and purchaser may agree on acceptable deviations. Agreement on acceptable deviations can be achieved by comparing results of standard test specimens with those obtained on actual parts.

10. General Test Methods

10.1 Except as otherwise specified in these test methods for open-cell rubber, the following test methods shall be complied with as required and are hereby made a part of this specification.

10.1.1 *General Physical Test Requirements*—Practices D 3182 and D 3183.

10.1.2 *Compression Deflection Test*—Specification D 1056 and Section 12 of this specification.

10.1.3 *Oil Immersion*—Test Method D 471 and Section 13 of this specification.

10.1.4 *Heat Aging Test*—Test Method D 573, with modifications as described in Section 14 of this specification.

[3] A gage similar to Federal Products Co. No. 57 B-1Y7692 is satisfactory for this purpose.

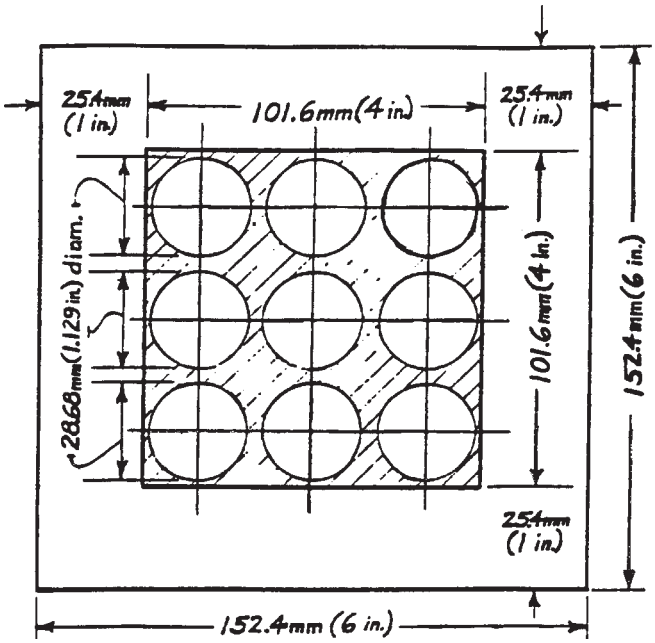

FIG. 1 Location From Which Standard Test Specimens Are to be Cut When Testing Standard Test Slabs or Commercial Flat Sheets

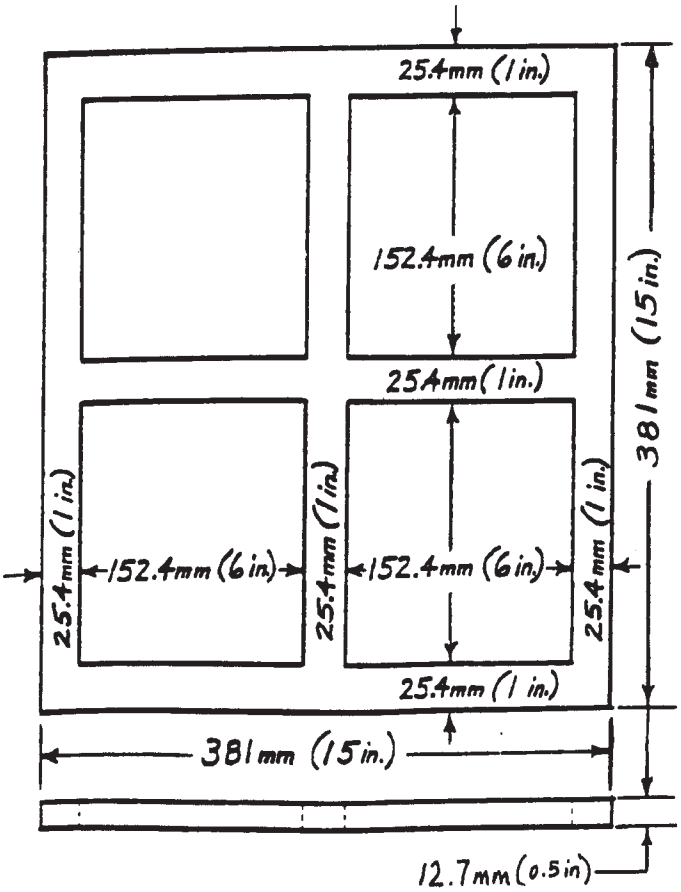

FIG. 2 Four-Cavity Frame for Standard Test Slabs of Cellular Rubbers

10.1.5 *Compression Set*—Test Methods D 395 as described in Section 15 of this specification.

10.2 In case of conflict between provisions of the above test methods and the procedures herein specifically described for open-cell rubber, the latter shall take precedence.

11. Test Specimens and Slabs

11.1 *Test Specimens*—Standard test specimens shall be circular with a diameter of 28.68 ± 0.57 mm (1.131 ± 0.02 in.). The specimens may be cut with a revolving die,[4] 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 die cut because this process distorts the sample, which will affect the final properties. When cut from standard test slabs, samples shall be cut from the center area as shown in Fig. 1. The thickness shall be measured as described in 11.3.2.

11.2 *Test Slabs*—Standard test slabs of all types of cellular rubber shall be pieces that are 150 ± 5 mm (nominally 6 in.) square and 12.5 ± 0.5 mm (nominally 0.5 in.) thick, that are made from the same compound, and that have the same apparent density and state of cure as the product they represent. In all cases the natural surface skin shall be left intact on both top and bottom faces of the test slab.

11.2.1 When specially prepared standard test slabs of open-cell sponge rubber are required, they shall be made using the frame shown in Fig. 2 together with top and bottom plates that are each approximately 12.7 mm (0.50 in.) thick. The frame and plates shall be made of aluminum or steel. The stock shall be in sheet form cut into squares slightly smaller than the frame cavities. To fill the molding cavities, the thickness of the square sheets shall give the required apparent density when the material is expanded during cure. They shall then be placed in the frame, and fabric sheeting shall be applied on the top and bottom between the frame and the plates to allow venting of gases produced during the cure. This fabric shall be a commercial sheeting with a mass of approximately 135 g/m^2 (4 oz/yd^2), having approximately 2.75 ends/mm (70 ends/in.) and 2.36 picks/mm (60 picks/in.). The specimens shall be vulcanized in a platen press 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.

11.3 *Measurements of Test Specimens*:

11.3.1 The width shall be measured to 0.5 mm (0.020 in.). Care shall be taken not to distort the cellular rubber.

11.3.2 Thicknesses up to and including 12.7 mm (0.500 in.) shall be measured using a dial-type gage[3] having a maximum stem and foot mass of 25 g and a foot 31.8 mm (1.250 in.) in diameter. The gage shall be graduated to 0.02 mm (0.001 in.).

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

[4] A satisfactory die and its method of application are described in Section 4 on Significance and Use in Test Methods D 575.

12. Compression-Deflection Test

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

12.1.1 *Apparatus*—Any compression machine that meets the following requirements will be satisfactory. The machine shall be capable of compressing the specimen at a rate of 12.5 to 50.8 mm/min (0.5 to 2 in./min) gently without impact. The machine may be motor- or hand-driven. It shall be equipped with a gage to measure the deflection caused by the increase in load. The rate of compression of the specimen is specified rather than the rate of the compressing platform of the machine. This consideration is important when scales are used because open-cell sponges of various compression-deflection characteristics will require different times to compress 25 % due to the travel of the scale platform under varying loads.

12.2 The deflection shall be read on a dial gage graduated in 0.02 mm (0.001 in.) increments. No gage is necessary if the machine automatically compresses the specimen 25 %.

12.3 *Test Specimens*—Standard test specimens can be used for this test. 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 in a manner agreed upon by the parties concerned or, as shown in Fig. 1, from the standard test slab. The thicknesses of the test specimens may vary, but they shall be measured and stated in the report.

12.4 *Procedure*—Compress the standard test specimen between the parallel metal plates of the machine until the thickness has been reduced 25 %, then take the reading of the load immediately. Repeat the test with the same specimen until the load readings do not change more than 5 %.

12.5 *Report*—The unit load required for the last reading, expressed in kilopascals (or pounds) per square inch, shall be reported as the result of the compression-deflection test.

12.6 *Requirements*—See Table 1 for requirements.

13. Oil-Immersion Test

13.1 *Test Specimens*—Standard test specimens approximately 12.5 mm (0.500 in.) thick shall be used for this test. The diameter and thickness shall be measured before and after immersion in ASTM IRM 903 oil for 22 h at 70°C (158°F) and the percent change in volume calculated. Three specimens shall be run on each test, and the average of the three values shall be reported.

13.2 *Procedure*—Follow the procedure of Test Method D 471, using ASTM IRM 903 oil.

13.3 *Requirements*—See Table 1 for requirements.

14. Oven Aging Test

14.1 The air-oven aging test as described in Test Method D 573 shall be used, except that sample size shall be appropriate for compression-deflection testing. Deterioration shall be expressed as percent change of compression-deflection values.[5] No relation between accelerated aging tests and natural aging is given or implied.

14.2 *Report*—The report should include time and temperature of test, original and final compression deflection data, percent change for three specimens, and percent change average of three specimens.

14.3 *Requirements*—See Table 1 for requirements.

15. Compression Set Under Constant Deflection (Calculations Based on Amount of Deflection)

15.1 *Test Specimens*—Standard test specimens shall be used for this test. They shall be cut so that opposite edges are parallel, either from the finished product in a manner agreed upon by the parties concerned or, as shown in Fig. 1, from standard test slabs or from commercial flat sheets. The thicknesses of the test specimens may vary, but they shall be measured and stated in the report. A standard test specimen may be used if agreed upon between the manufacturer and the purchaser.

15.2 *Procedure*—The apparatus and procedure shall be the same as that prescribed in Method B of Test Method D 395, except as follows: Compress test specimens to 50 % of their original thicknesses. Release the load at the end of 22 h and measure the thicknesses after 30-min rest at room temperature, as described in 11.3.2. 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 will not deflect measurably under the load necessary for deflection of the specimen may be used.

15.3 *Calculation*—Calculate percent compression set as follows:

$$\text{Compression set, \%} = [(t0 - t1) / (t0 - ts)] \times 100$$

where:

$t0$ = original thickness,
$t1$ = thickness of specimen after specified recovery period, and
ts = thickness of spacer bar used.

15.4 *Report*—The report should include time and temperature of test, original and final thicknesses for three specimens, percent set for each specimen, and the average percent set for the specimens.

15.5 *Requirements*—See Table 1 for requirements.

16. Precision and Bias

16.1 All of the above test methods are being tested for precision and bias within Specification D 1056.

17. Packaging and Package Marking

17.1 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.

18. Keywords

18.1 gaskets; rubber; sponge

[5] The compression-deflection test should be based on the original (before aging) sample thickness.