Designation: D1869 – 15

Standard Specification for Rubber Rings for Fiber-Reinforced Cement Pipe[1]

This standard is issued under the fixed designation D1869; 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 rubber rings used to seal the joints of asbestos-cement pipe conforming to Specifications C296, C428, C668, and non-asbestos fiber-cement pipe conforming to Specification C1449.

1.2 A specification is given for (*1*) natural or synthetic rubber rings, or both, where resistance to oil or solvents is not required, and (*2*) synthetic rubber rings for services involving resistance to oil or solvents.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 **Warning—**Breathing of asbestos dust is hazardous. Asbestos and asbestos products present demonstrated health risks for users and for those with whom they come into contact. In addition to other precautions, when working with asbestos-cement products, minimize the dust that results. For information on the safe use of chrysotile asbestos, refer to "Safe Use of Chrysotile: A Manual on Preventive and Control Measures."[2]

1.5 The following safety hazards caveat pertains only to the test methods portion, Section 9, of this standard: *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

C296 Specification for Asbestos-Cement Pressure Pipe

C428 Specification for Asbestos-Cement Nonpressure Sewer Pipe

C668 Specification for Asbestos-Cement Transmission Pipe

C1449 Specification for Non-Asbestos Fiber-Cement Nonpressure Sewer Pipe

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

D865 Test Method for Rubber—Deterioration by Heating in Air (Test Tube Enclosure)

D1415 Test Method for Rubber Property—International Hardness

D2137 Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics

D2240 Test Method for Rubber Property—Durometer Hardness

2.2 *Other Document:*[4]

Rubber Manufacturers Association (RMA), Rubber Handbook MO-1—Molded, Extruded, Lathe-Cut and Cellular Products

3. Composition and Manufacture

3.1 The ring shall consist of a properly vulcanized virgin rubber compound. Virgin rubber is defined as one containing no scrap, reclaim, or rubber substitutes.

3.2 If a joint is used in the manufacture of the ring, the strength of the spliced joint shall be such that the ring will withstand the stretch test described in 9.8 with no visible separation or peeling.

4. Physical Requirements

4.1 Sample rings taken from the shipment shall conform to the requirements for physical properties prescribed in Table 1 when tested in accordance with the test methods specified in Section 9.

[1] This specification is under the jurisdiction of ASTM Committee D11 on Rubber and is the direct responsibility of Subcommittee D11.37 on Coated Fabrics, Rubber Threads and Seals.

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[2] Available from The Asbestos Institute, http://www.chrysotile.com/en/sr_use/manual.htm.

[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.

[4] Available from Rubber Manufacturers Association (RMA), 1400 K St., NW, Suite 900, Washington, DC 20005, http://www.rma.org.

TABLE 1 Physical Requirements of Rubber Rings for Asbestos-Cement Pipe

Test	Type of Rubber Ring	
	Nonoil-Resistant	Oil-Resistant
Original Properties:		
Tensile strength, min, MPa (psi):		
Average of three specimens	14.0 (2000)	10.5 (1500)
Lowest individual	12.5 (1800)	9.0 (1300)
Elongation, min, %:		
Average of three specimens	350	325
Lowest individual	325	300
Hardness number[A]	nominal ±5	nominal ±5
Stress at 300 % elongation, MPa (psi):		
Max	16.0 (2300)	16.0 (2300)
Min	8.4 (1200)	7.0 (1000)
Compression set, max, %	16	25
Low-temperature flexibility	no cracks	no cracks
After Oven Aging:		
Tensile strength, average decrease, max, %	15	20
Elongation, average decrease, max, %	25	30
Hardness, average increase, max, points	7	15
After Water Aging:		
Volume change, max, %	12	12
Appearance change	no surface degradation	no surface degradation
After Oil Aging:		
Tensile strength, average decrease, max, %	...	35
Elongation, average decrease, max, %	...	40
Hardness, average change, points	...	−10 to + 2
Volume change, average, %	...	−1 to + 15

[A] Nominal hardness shall be from 50 to 60 as specified by the pipe manufacturer.

5. Dimensions and Tolerances

5.1 The rings shall conform to the dimensions specified by the manufacturer of the pipe in which the rings are to be used, with an RMA Class 3 (see 2.2) tolerance of ±0.25 up to 25 mm (±0.010 up to 1 in.) on all cross-section dimensions, and ±1 % on all diametral dimensions, unless otherwise agreed upon by the pipe manufacturer and the ring supplier.

NOTE 1—The design and tolerances of fiber-reinforced cement pipe are not sufficiently standardized to permit interchangeability of rings in many cases from pipe of one manufacturer to that of another.

6. Workmanship

6.1 The surface shall be smooth and free of pitting, cracks, blisters, air marks, and any other imperfection that would affect its behavior in service. The body shall be free of porosity and air pockets.

6.2 The flash thickness shall not exceed 0.4 mm (0.015 in.), nor the flash width 0.8 mm (0.03 in.) at any point in the ring.

6.3 Offset, or failure of the mold to register accurately, shall not exceed 0.4 mm (0.015 in.).

7. Sampling

7.1 A number of sample rings shall be drawn at random from each shipment of rings in accordance with Table 2.

TABLE 2 Sampling Plan for Stretch Test for Visual Inspection

Number of Rings in Shipment	Number of Rings in Sample	Maximum Number of Defectives for Acceptance
Up to 800	75	4
801 to 3 200	150	8
3 201 to 8 000	225	11
8 001 to 22 000	300	14

7.2 These shall be stretched and examined as specified in 9.8. A sufficient additional number of rings shall be drawn at random for the tests specified in Table 1.

8. Precision and Bias

8.1 This is a performance specification establishing limits for commercial product quality. No precision or bias statements are required.

9. Test Methods

9.1 *Tensile Strength, Elongation, and Stress at 300 % Elongation*—Test Methods D412:

9.1.1 Cut samples for tensile strength, elongation, and stress at 300 % elongation tests from circumferential sections of the ring itself.

9.1.2 From these samples stamp dumbbell test specimens using a standard ASTM Type C dumbbell conforming to Fig. 1 of Test Methods D412.

9.1.3 The sections from which the dumbbells are cut shall be prepared by sectioning a sample ring held rigidly in a jig, which in turn is mounted in a chuck of a machinist's lathe. A sharp, thin cutting knife shall be mounted in the lathe holder and the cut made at a right angle to the jig face. The cutting site shall be lubricated at all times by a jet of cool water.

9.1.4 These sections shall be buffed lightly prior to cutting into dumbbell specimens in order to bring them to a uniform thickness for testing.

9.2 *Hardness:*

9.2.1 Test Method D1415 shall be used as the referee method.

9.2.2 Test Method D2240 may be used for quality control.

9.2.3 Hardness readings for guidance purposes may be taken directly on the ring, recognizing that those may vary slightly from those taken on dumbbell specimens.

9.3 *Air Aging: Tensile Strength, Elongation, and Hardness:*

9.3.1 Test Methods D865 (preferred) or D573, in conjunction with Test Methods D412 and D1415 or D2240. Prepare test specimens in accordance with 9.1.

9.3.2 Age nonoil-resistant specimens for 166 ± 2 h at 70 ± 2°C.

9.3.3 Age oil-resistant specimens for 70 ± 0.7 h at 100 ± 2°C.

9.4 *Water Aging: Volume and Appearance Change:*

9.4.1 Cut one specimen 50 ± 3 mm (2.0 ± 0.1 in.) long and not less than 13 mm^2 (0.2 $in.^2$) in cross section from each of three rings.

9.4.2 Totally immerse the specimens in the siphon cup of an insulated 3-dm^3 extraction apparatus, and hold at a temperature of 100 ± 2°C for 20 consecutive days. Suspend the specimens at least 50 mm (2 in.) beneath the surface of the water in such a manner that they do not contact one another or the surface of the cup.

9.4.3 Immediately after removal from the boiling water, blot the specimens, weigh and calculate the volume increase in accordance with Test Method D471.

9.4.4 Average the values obtained for the three specimens.

9.5 *Compression Set:*

9.5.1 Method B of Test Methods D395, except cut three specimens from separate rings about 75 mm (3 in.) in length and the full cross-sectional area of the ring in a compression device 50 mm long.

9.5.1.1 Place the specimens in the compression device with the inside and outside circumference sides in contact with the compression plates.

9.5.1.2 If this is impractical because of the size or shape of the specimens, they shall be placed in the compression device in a manner that will give the most accurate values.

9.5.2 Make a reference measurement at any convenient point where the section is solid and compress the specimen 50 % at the reference point, using spacers.

9.5.3 Oven age nonoil-resistant specimens for 22 ± 0.25 h at 70 ± 2°C.

9.5.4 Oven age oil-resistant specimens for 22 ± 0.25 h at 100 ± 1°C.

9.6 *Low-Temperature Flexibility:*

9.6.1 Test Methods D2137.

9.6.2 Prepare test specimens in accordance with 9.1.2 – 9.1.4. The temperature of test shall be -25 ± 2°C.

9.7 *Oil Aging: Tensile Strength, Elongation, Hardness, and Volume Change:*

9.7.1 Test Method D471.

9.7.2 Prepare test specimens for tensile strength, elongation, and hardness tests in accordance with 9.1.2 – 9.1.4.

9.7.3 Prepare specimens for the volume change test in accordance with 9.4.1.

9.7.4 Immerse the specimens in ASTM Oil No. 3 for 70 ± 0.7 h at 100 ± 2°C.

9.8 *Stretch Test for Visual Examination:*

9.8.1 Stretch the rings until the circumference has increased 50 %.

9.8.2 Inspect each ring visually for defects in accordance with 3.2 and 6.1.

9.8.3 The number of rings to be examined and the maximum number of defective rings for acceptance of the lot is shown in Table 2.

10. Product Marking

10.1 Each ring shall be marked with clearly legible letters, the size of which shall not exceed 6 mm (¼ in.).

10.2 The markings shall include the ring manufacturer's name or symbol, the pipe manufacturer's name or symbol, the pipe size and pressure rating, and the year of manufacture.

10.3 Each oil-resistant synthetic rubber ring shall be marked with a color stripe, dot, or other identifying mark to distinguish this ring from the nonoil-resistant type.

10.3.1 The shape and color of the mark shall be as specified by the manufacturer of the pipe in which the ring is to be used.

11. Keywords

11.1 asbestos-cement pipe; fiber-cement pipe; non-oil resistant; oil-resistant; rubber rings