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400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 7272F

Issued JUL 1957
Revised OCT 1991
Reaffirmed AUG 2001

Superseding AMS 7272E

Rings, Sealings, Butadiene-Acrylonitrile (NBR) Rubber Synthetic Lubricant Resistant 65 - 75

1 SCOPE:

1.1 Form:

This specification covers a butadiene-acrylonitrile (NBR) rubber in the form of molded rings.

1.2 Application:

These rings have been used typically as sealing rings in contact with diester synthetic lubricants in service up 150 °C (302 °F), but usage is not limited to such applications. The cross-section of such rings is usually not over 0.275 inch (6.98 mm) in diameter or thickness.

1.3 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
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SAE WEB ADDRESS: http://www.sae.org

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2817	Packaging and Identification, Preformed Packings
AS568	Aerospace Size Standard for O-Rings
AS871	Manufacturing and Inspection Standards for Preformed Packings (O-Rings)
AIR851	O-Ring Tension Testing Calculations

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM D 471	Rubber Property - Effect of Liquids
ASTM D 1414	Testing Rubber O-Rings

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Shall be a compound, based on a butadiene-acrylonitrile (NBR) elastomer, suitably cured to produce sealing rings meeting the requirements of 3.2.

3.2 Properties:

Rings shall conform to the requirements shown in Table 1; tests shall be performed on the rings supplied and, except as otherwise specified herein, in accordance with ASTM D 1414, insofar as practicable. Testing for tensile strength and tensile stress is not required on rings which are too small to permit assembly on rollers and are, after cutting, too short to permit testing as a single strand. Eliminating testing for tensile strength and tensile stress does not eliminate testing for elongation; elongation test can be made by stretching a ring over a mandrel of a size which will stretch the ring sufficiently to produce the required elongation when figured on the ID of the ring. Calculations for tensile strength, elongation, and tensile stress may be made in accordance with AIR851.

TABLE 1 - Properties

Paragraph	Property	Requirement	Method of Testing
3.2.1	As Received:		
3.2.1.1	Hardness, Durometer "A" or equivalent	70 ± 5	
3.2.1.2	Tensile Strength, minimum	1500 psi (10.3 MPa)	
3.2.1.3	Elongation, minimum	250%	
3.2.1.4	Tensile Stress at 100% Elongation, minimum	500 psi (3.45 MPa)	
3.2.1.5	Corrosion	Nil	
3.2.1.6	Specific Gravity	Preproduction Value ± 0.02	
3.2.2	Synthetic Lubricant Resistance: (Immediate Deteriorated Properties)		Medium: ASTM Service Fluid No. 101 (ASTM D 471) Temperature: 150°C ± 3 (302°F ± 5) Time: 70 hours ± 0.5 Prepare specimens as in 4.5.1
3.2.2.1	Tensile Strength Change, maximum	-70%, but actual strength shall be not lower than 600 psi (4.14 MPa)	
3.2.2.2	Elongation Change, maximum	-70%	
3.2.2.3	Volume Change	0 to +15%	
3.2.2.4	Decomposition	None	
3.2.2.5	Surface Tackiness	None	
3.2.3	Aromatic Fuel Resistance: (Immediate Deteriorated Properties)		Medium: ASTM Ref. Fuel B (ASTM D 471) Temperature: 20° - 30°C (68° - 86°F) Time: 70 hours ± 0.5

TABLE 1 - Properties (Continued)

Paragraph	Property	Requirement	Method of Testing	
3.2.3.1	Tensile Strength Change, maximum (based on area before immersion)	-60%		
3.2.3.2	Elongation Change, maximum	-55%		
3.2.3.3	Volume Change	0 to +35%		
3.2.3.4	Volume Change after 70 hours ± 0.5 immersion in 30% aromatic fuel followed by 48 hours ± 0.5 drying at 70°C ± 1 (158°F ± 2), maximum (based on unimmersed volume)	-10%		
3.2.4	Dry Heat Resistance:		Temperature:	125°C ± 2 (257°F ± 4)
3.2.4.1	Tensile Strength Change, maximum	-25%	Time:	70 hours ± 0.5
3.2.4.2	Elongation Change, maximum	-50%		
3.2.4.3	Bend (flat)	No cracking or checking		
3.2.5	Compression Set:		Temperature:	125°C ± 2 (257°F ± 4)
3.2.5.1	Percent of Original Deflection, maximum		Time:	70 hours ± 5
	Ring Cross Section Diameter,			
	0.066 to 0.110 inch (1.68 to 2.79 mm), incl	85		
	Over 0.110 inch (2.79 mm)	75		
3.2.6	Low-Temperature Resistance:			
3.2.6.1	Temperature Retraction TR_{10} point, maximum	-26°C (-15°F)		

3.3 Quality:

Rings, as received by purchaser, shall be uniform in quality and condition, smooth, as free from foreign material as commercially practicable, and free from internal imperfections detrimental to usage of the rings. Surface imperfections shall be no greater than permitted by AS871 for minor defects.

3.4 Sizes and Tolerances:

Shall be as specified on the drawing. Standard sizes are as shown in AS568. Inspection for conformance to dimensional requirements shall be made in accordance with AS871.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of rings shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the rings conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for requirements shown in Table 2 are acceptance tests and shall be performed on each lot.

TABLE 2 - Acceptance Tests

Requirement	Paragraph Reference
Hardness, as received	3.2.1.1
Tensile Strength, as received	3.2.1.2
Elongation, as received	3.2.1.3
Specific Gravity	3.2.1.6
Volume Change in Synthetic Lubricant	3.2.2.3
Decomposition in Synthetic Lubricant	3.2.2.4
Surface Tackiness in Synthetic Lubricant	3.2.2.5
Compression Set	3.2.5
Quality	3.3
Sizes and Tolerances	3.4

4.2.2 Periodic Tests: Tests for requirements shown in Table 3 are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

TABLE 3 - Periodic Tests

Requirement	Paragraph Reference
Tensile Stress, as received	3.2.1.4
Corrosion, as received	3.2.1.5
Tensile Strength Change in Synthetic Lubricant	3.2.2.1
Elongation Change in Synthetic Lubricant	3.2.2.2
Tensile Strength Change in Aromatic Fuel	3.2.3.1
Elongation Change in Aromatic Fuel	3.2.3.2
Volume Change in Aromatic Fuel	3.2.3.3 and 3.2.3.4
Tensile Strength Change after dry heat exposure	3.2.4.1
Elongation Change after dry heat exposure	3.2.4.2
Bend after dry heat exposure	3.2.4.3
Temperature Retraction, TR_{10} point	3.2.6.1

4.2.3 Preproduction Tests: Tests for all technical requirements are preproduction tests and shall be performed prior to or on the first-article shipment of rings to a purchaser, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.3.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient rings shall be taken at random from each lot to perform all required tests; the number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

4.3.1.1 A lot shall be all rings of the same nominal size from the same batch of compound processed in one continuous run and presented for vendor's inspection at one time but shall not exceed 1000 rings or 200 pounds (91 kg), whichever is the greater mass. A lot may be packaged in smaller quantities and delivered under the basic lot approval provided lot identification is maintained.

4.3.1.2 A batch shall be the quantity of compound run through a mill or mixer at one time.

4.3.1.3 When a statistical sampling plan has been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6 shall state that such plan was used.

4.3.2 For Periodic Tests: As in 4.3.1.

4.3.3 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample rings shall be approved by purchaser before rings for production use are supplied, unless such approval be waived by purchaser. Results of test on production rings shall be essentially equivalent to those on the approved samples.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production rings which are essentially the same as those used on the approved sample rings. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in ingredients and/or, processing and, when requested, sample rings. Production rings made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Synthetic Lubricant Resistance: Place 140 mL of ASTM Service Fluid No. 101 (ASTM D 471) in 38 mm OD X 300 mm long test tubes at room temperature. Immerse test tubes in the heating medium so that 2 inches (51 mm) of each tube extends above the level of the heat transfer oil in oil bath heaters or so that 1 inch (25 mm) of each tube extends above the top insulation of aluminum block or air well heaters. Heat the test fluid to 150°C ± 3 (302°F ± 5). For rings 1 inch (25 mm) and under in nominal ID, hang three rings in each tube from corrosion-resistant steel wire or wires so that the top points of the rings will be 1, 2-1/2, and 4 inches (25, 63.5, and 102 mm) below the surface of the test fluid. For rings over 1 inch (25 mm) but not over 3 inches (76 mm) in nominal ID, cut segments from each of three rings, form to 1-inch (25-mm) ID rings, securing the ends of the segments with corrosion-resistant steel wire, and hang as for complete rings. For sizes over 3 inches (76 mm) in nominal ID, cut 5-inch (127-mm) long segments from each of three rings. Hang each segment by a corrosion-resistant steel wire so that the segments do not touch each other or the walls of the test tube and so that the mid-length of each segment is at the approximate mid-depth of the test fluid. Stopper the test tubes with new, bare cork stoppers 1.5 inches (38 mm) thick having two 8-mm OD glass tubes through the cork, one 3 inches (76 mm) long extending 1 inch (25 mm) below the bottom of the cork and one 5.5 inches (140 mm) long extending 3.5 inches (89 mm) above the top of the cork. Force the wire or wires from which the rings are hung into the bottom of the cork before inserting in the test tube. After the immersion period, suspend the rings in fresh test fluid at room temperature and allow to cool in this fluid for approximately 30 minutes, remove the rings, rinse them briefly in acetone, and blot lightly with filter paper. Determine changes in properties as required in 3.2.2, using the water displacement method for measuring volume change. Record results as the average of the properties for the three specimens.