

RINGS, SEALING, BUTADIENE-ACRYLONITRILE (NBR) RUBBER
Oil 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: Sealing rings for use at temperatures as low as -55°C (-65°F), where resistance to hot petroleum-base lubricating oil is required. The cross-section of such rings is usually not over 0.275 in. (7.0 mm) in diameter or thickness. Standard sizes are as shown in AS 568.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications, Aerospace Standards, and Aerospace Information Reports shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

- 2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2817 - Packaging and Identification, Preformed Packings

2.1.2 Aerospace Standards:

AS 568 - Aerospace Size Standard for O-Rings
AS 871 - Manufacturing and Inspection Standards for Preformed Packings (O-Rings)

2.1.3 Aerospace Information Reports:

AIR 851 - O-Ring Tension Testing Calculations

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2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D471 - Rubber Property - Effect of Liquids
ASTM D1414 - 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 following requirements; tests shall be performed on the rings supplied and, except as otherwise specified, in accordance with ASTM D1414, insofar as practicable. Tensile strength testing 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 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 of tensile strength and elongation may be made in accordance with AIR 851.

3.2.1 As Received:

3.2.1.1	Hardness, Durometer "A" or equiv.	70 \pm 5
3.2.1.2	Tensile Strength, min	1500 psi (10.5 MPa)
3.2.1.3	Elongation, min	150%
3.2.1.4	Corrosion	Nil
3.2.1.5	Specific Gravity	Preproduction Value \pm 0.02

3.2.2 Lubricating Oil Resistance: (Immediate Deteriorate Properties)

3.2.2.1	Hardness Change, Durometer "A" or equiv.	-5 to +10
3.2.2.2	Tensile Strength Change, max (See 3.2.2.7)	-60%
3.2.2.3	Elongation Change, max	-50%
3.2.2.4	Volume Change	0 to +10
3.2.2.5	Decomposition	None

Medium:	ASTM Oil No. 1 (ASTM D471)
Temperature:	150°C \pm 3 (300°F \pm 5)
Time:	96 hr \pm 0.5

3.2.2.6 Surface Tackiness None

3.2.2.7 If impracticable to determine tensile strength of rings 0.50 in. (12.5 mm) and under in nominal ID after oil immersion, the rings shall withstand, without cracking, closing flat.

3.2.3 Processing Oil Resistance:
(Immediate Deteriorated Properties)

Medium: ASTM Oil No. 3
(ASTM D471)
Temperature: 150°C + 3
(300°F + 5)
Time: 70 hr ± 0.5

3.2.3.1 Hardness Change, Durometer "A" or equiv. -20 to 0

3.2.3.2 Volume Change +25 to +45%

3.2.3.3 Decomposition None

3.2.3.4 Surface Tackiness None

3.2.4 Dry Heat Resistance:

Temperature: 100°C + 1
(212°F + 2)
Time: 70 hr ± 0.5

3.2.4.1 Hardness Change, Durometer "A" or equiv. 0 to +10

3.2.4.2 Tensile Strength Change, max -25%

3.2.4.3 Elongation Change, max -40%

3.2.4.4 Bend (Flat) No cracking or checking

3.2.5 Compression Set:

3.2.5.1 Percent of Original Deflection, max
Ring Cross Section Diameter
0.066 to 0.110 in.
(1.68 to 2.75 mm),
incl 85
Over 0.110 in. (2.75 mm) 75

Temperature: 125°C + 2
(257°F + 4)
Time: 70 hr ± 0.5

3.2.6 Low-Temperature Brittleness:
(After Aging in Lubricating Oil)

3.2.6.1 The specimen for rings 2 in. (50 mm) and under in nominal ID shall be a complete ring; the specimen for rings over 2 in. (50 mm) in nominal ID shall be a piece 3 in. (75 mm) long cut from a ring. The specimen shall be immersed in lubricating oil in accordance with 3.2.2 and, after cooling in air to room temperature, shall be placed in a refrigerator at -40°C + 1 (-40°F + 2) and held at that temperature for 5 hr ± 0.1. At the end of the refrigeration time, the specimen, while in the

refrigerator or within 10 sec after removal from the refrigerator, shall withstand, without cracking, bending as follows: The complete ring shall be ovalized until the minor axis is equal to 50% of the original ID, and the 3-in. (75-mm) specimen shall be bent around to form a circle.

3.3 Quality: Rings, as received by purchaser, shall be uniform in quality and condition, clean, 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 AS 871 for minor defects.

3.4 Sizes and Tolerances: Shall be as specified on the drawing. Inspection for conformance to dimensional requirements shall be made in accordance with AS 871.

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. Results of such tests shall be reported to the purchaser as required by 4.6. 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 to determine conformance to the following requirements are classified as acceptance tests and shall be performed on each lot:

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, as received	3.2.1.5
Volume Change in lubricating oil	3.2.2.4
Decomposition in lubricating oil	3.2.2.5
Surface Tackiness in lubricating oil	3.2.2.6
Compression Set	3.2.5

- 4.2.2 Periodic Tests: Tests to determine conformance to the following requirements are classified as periodic tests and shall be performed at a frequency selected by the vendor or unless frequency of testing is specified by purchaser:

Requirement	Paragraph Reference
Corrosion, as received	3.2.1.4
Hardness Change in lubricating oil	3.2.2.1
Tensile Strength Change in lubricating oil	3.2.2.2
Elongation Change in lubricating oil	3.2.2.3
Hardness Change in processing oil	3.2.3.1
Volume Change in processing oil	3.2.3.2
Decomposition in processing oil	3.2.3.3
Surface Tackiness in processing oil	3.2.3.4
Hardness Change after dry heat exposure	3.2.4.1
Tensile Strength Change after dry heat exposure	3.2.4.2
Elongation Change after dry heat exposure	3.2.4.3
Bend after dry heat exposure	3.2.4.4
Low-Temperature Brittleness	3.2.6

- 4.2.3 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the first-article shipment of rings to a purchaser, when a change in material, processing, or both 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, the contracting officer, or the request for procurement.

- 4.3 Sampling: 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 lb (90 kg), whichever is the greater mass.

- 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 and acceptance quality level (AQL) have 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 4.5 shall state that such plan was used.