

Submitted for recognition as an American National Standard

RINGS, SEALING, FLUOROCARBON RUBBER  
High Temperature Fluid Resistant, Low Compression Set  
FKM Type  
70 - 80

1. SCOPE:

1.1 Form: This specification covers a high-temperature fluid resistant, low compression set fluorocarbon (FKM) rubber in the form of molded rings.

1.2 Application: Sealing rings for use in contact with air or a variety of fuels, lubricants, and specific hydraulic fluids from  $-15^{\circ}\text{C}$  to  $+260^{\circ}\text{C}$  ( $+5^{\circ}$  to  $+500^{\circ}\text{F}$ ). Rings may be suitable for use at temperatures appreciably lower than the brittle point as determined by common tests. 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. The low compression set of these rings gives longer life than rings of other fluorocarbon rubbers, such as AMS 7278, at equal temperatures.

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  
AMS 3021 - Reference Fluid for Testing Di-Ester (Polyol) Resistant  
Materials

2.1.2 Aerospace Standards:

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

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### 2.1.3 Aerospace Information Reports:

AIR 851 - O-Ring Tension Testing Calculations

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

ASTM D471 - Rubber Property - Effects of Liquids

ASTM D1414 - Testing Rubber O-Rings

### 3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be a compound based on a low compression set fluorocarbon (FKM) elastomer, suitably cured to produce a product 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 in accordance with ASTM D1414, insofar as practicable. Testing for tensile strength 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 may be made in accordance with AIR 851.

#### 3.2.1 As Received:

3.2.1.1 Hardness, Durometer "A" 75  $\pm$  5

3.2.1.2 Tensile Strength, min 1400 psi (9.65 MPa)  
 $\varnothing$

3.2.1.3 Elongation, min 125%

3.2.1.4 Corrosion Nil

3.2.1.5 Specific Gravity Preproduction  
Value  $\pm$  0.02

3.2.2 Aromatic Fuel Resistance:  
(Immediate Deteriorated  
Properties)

Medium: ASTM Ref. Fuel B  
(ASTM D471)

Temperature: 20° - 30°C  
(68° - 86°F)

3.2.2.1 Hardness Change,  
Durometer "A" -5 to +5

Time: 70 hr  $\pm$  0.5

3.2.2.2	Tensile Strength Change, max	-15%		
3.2.2.3	Elongation Change, max	15%		
3.2.2.4	Volume Change	0 to +5%		
3.2.3	<u>Synthetic Lubricant Resistance:</u>		Medium:	AMS 3021 (See 8.2)
∅	(Immediate Deteriorated Properties)		Temperature:	175°C + 3° (350°F +5°)
3.2.3.1	Hardness Change, Durometer "A"	0 to -15	Time:	70 hr + 0.5
3.2.3.2	Tensile Strength Change, max (based on area before immersion)	-30%		
3.2.3.3	Elongation Change, max	-20%		
3.2.3.4	Volume Change	0 to +20%		
3.2.4	<u>Dry Heat Resistance:</u>		Temperature:	250°C + 3 (480°F + 5)
3.2.4.1	Hardness Change Durometer "A"	0 to + 10	Time:	70 hr ± 0.5
3.2.4.2	Tensile Strength Change, max	-20%		
3.2.4.3	Elongation Change, max	-20%		
3.2.4.4	Weight Loss, max	5%		
3.2.4.5	Bend (flat)	No cracking or checking		

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**3.2.5 Compression Set:**Percent of Original  
Deflection, maxTemperature: 200°C + 3°  
(390°F + 5°)  
Time: 70 hr ± 0.5

Ring Cross Section Diameter

Inch

Millimetres

0.066 to 0.110, incl  
Over 0.1101.68 to 2.75, incl  
Over 2.7535%  
30%**3.2.6 Long-Time Compression Set:**Percent of Original  
Deflection, maxTemperature: 200°C + 3°  
(390°F + 5°)  
Time: 336 hr ± 2

Ring Cross Section Diameter

Inch

Millimetres

0.066 to 0.110, incl  
Over 0.1101.68 to 2.75, incl  
Over 2.7560%  
55%**3.2.7 Room-Temperature Compression Set:**

Percent of Original Deflection, max

Temperature: 20° to 30°C  
(68° to 86°)  
Time: 70 hr

Ring Cross Section Diameter

Inch

Millimetres

0.066 to 0.110, incl  
Over 0.1101.68 to 2.75, incl  
Over 2.7520%  
15%**3.2.8 Low-Temperature Resistance:**Temperature Retraction,  
TR<sub>10</sub> point, max

-15°C (+5°F)

**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 their performance. 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 4.5. 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 oil	3.2.2.4
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 unless frequency is specified by purchaser:

Requirement	Paragraph Reference
Corrosion, as received	3.2.1.4
Tensile Strength Change in oil	3.2.3.2
Elongation Change in oil	3.2.3.3
Volume Change in oil	3.2.3.4
Hardness Change after dry heat exposure	3.2.4.1
Bend after dry heat exposure	3.2.4.5
Room Temperature Compression Set	3.2.7
Temperature Retraction, TR <sub>10</sub> point	3.2.8

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 selected 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 of operations and presented for vendor's inspection at one time but shall not exceed 1000 rings or 300 lb (135 kg), whichever is the greater mass. A lot may be packaged and delivered in smaller quantities 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 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 in 4.3.1 and the report of 4.5.1 shall state that such plan was used.

4.3.2 For Periodic Tests and 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 tests on production rings shall be essentially equivalent to those on the approved samples.

4.4.2 Vendor shall establish, for each size of ring, parameters for the process control factors which will produce rings meeting the technical requirements of this specification. These shall constitute the approved procedures and shall be used for manufacturing production rings. If necessary to make any change in parameters for the process control factors, vendor shall submit for reapproval a statement of the proposed changes in material, processing, or both and, when requested, sample rings. Production rings incorporating the revised procedures shall not be shipped prior to receipt of reapproval.

4.4.2.1 Control factors for producing rings include, but are not limited to, the following:

- Compound ingredients or proportions thereof within established limits
- Sequence of mixing compound ingredients
- Type of mixing equipment
- Method and equipment for preparing preforms
- Basic molding procedure (compression, transfer, injection)
- Curing time and pressure (variations of  $\pm 10\%$  are premissable)
- Basic and minimum curing temperatures
- Finishing methods
- Methods of inspection