

AEROSPACE MATERIAL SPECIFICATION

SAE AMS7276

REV. H

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Superseding AMS7276G

Rubber: Fluorocarbon (FKM)
High-Temperature-Fluid Resistant
Low Compression Set
For Seals In Fuel Systems and Specific Engine Oil Systems

RATIONALE

AMS7276H results from a Five Year Review and update of this specification. HTS oils have been defined. Acceptance tests have been defined for seal sizes other than those listed in Table 3.

1. SCOPE

1.1 Form

This specification covers a fluorocarbon (FKM) rubber in the form of O-rings, compression seals, O-ring cord, and molded-in-place gaskets.

1.2 Application

These products have been used typically as sealing rings, compression seals, O-ring cord, and molded-in-place gaskets in contact with air and a wide variety of fuels, lubricants, and specific hydraulic fluids from -20 to +400 °F (-29 to +204 °C), but usage is not limited to such applications. Each application should be considered individually. This class of fluoroelastomers may not be suitable for use in some high temperature stabilized, "HTS", engine oils. Each "HTS" oil should be evaluated separately. Examples of "HTS" oils are those oils conforming to MIL-PRF-23699 Class HTS, MIL-PRF-7808 Grade 4, and AS5780 Class HPC.

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.

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2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS2817	Packaging and Identification, Preformed Packings
AMS3023	Fluid, Reference for Testing Polyol Ester (and Diester) Resistant Material
AS568	Aerospace Size Standard for O-rings
AIR851	O-Ring Tension Testing Calculations
AS871	Manufacturing and Inspection Standards for Preformed Packings (O-Rings)
AS3208	Packing, Preformed - AMS 7276 - Seal
AS3209	Packing, Preformed - AMS 7276, "O" Ring
AS5752	Aerospace - Visual Inspection Standard for Elastomeric Sealing Elements Other than O-Rings
PD2000	Procedures for an Industry Qualified Product Management Process

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D 297	Rubber Products - Chemical Analysis
ASTM D 395	Rubber Property - Compression Set
ASTM D 471	Rubber Property - Effect of Liquids
ASTM D 573	Rubber - Deterioration in an Air Oven
ASTM D 1329	Evaluating Rubber Property - Retraction at Lower Temperatures (TR Test)
ASTM D 1414	Rubber O-Rings
ASTM D 2240	Rubber Property - Durometer Hardness

2.3 ISO Publications

Available from International Organization for Standardization (ISO), Case Postale 56, CH-1211 Geneva, Switzerland or www.iso.org

ISO 3601-1 Fluid Power Systems – O-Rings – Part 1: Inside Diameters, Cross-sections, Tolerances and Designation Codes

ISO 3601-3 Fluid Power Systems – O-Rings – Part 3: Quality Acceptance Criteria

3. TECHNICAL REQUIREMENTS

3.1 Material

Shall be a compound, based on a fluorocarbon (FKM) elastomer, suitably cured to produce sealing rings, compression seals and moded-in-place gaskets meeting the requirements of 3.2 and 3.3. A dihydroxy/bisphenol cure system shall be used. Material shall be based on 100% virgin fluorocarbon (FKM) elastomer. No reprocessed or non-fluorocarbon polymer is acceptable.

3.1.1 Color

Shall be black or brown. No other color shall be acceptable.

3.2 Properties

Rings shall conform to the requirements shown in Table 1. Brown colored rings shall also conform to the requirements shown in Table 2. Tests shall be performed in accordance with ASTM D 1414 unless otherwise indicated. Calculations of tensile strength and elongation may be made in accordance with AIR851.

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TABLE 1 - PROPERTIES

Paragraph	Property	Requirement	Test Method
3.2.1	Hardness, Durometer "A" or equivalent	75 ± 5	ASTM D 2240
3.2.2	Tensile Strength, min	1400 psi (9.65 MPa)	
3.2.3	Elongation, min	125%	
3.2.4	Density	Preproduction Value ±0.02	
3.2.5	Aromatic Fuel Resistance		ASTM D 471 Medium: ASTM Ref. Fuel B Temperature: 73 °F ± 5 (23 °C ± 2) Time: 70 hours ± 0.5
3.2.5.1	Hardness Change, Durometer "A" or equivalent	-5 to +5	
3.2.5.2	Tensile Strength Change, max	-20%	
3.2.5.3	Elongation Change, max	-20%	
3.2.5.4	Volume Change	0 to +5%	
3.2.6	Synthetic Lubricant Resistance		ASTM D 471 (Note A) Medium: AMS3023 Temperature: 392 °F ± 5 (200 °C ± 3) Time: 70 hours ± 0.5
3.2.6.1	Hardness Change, Durometer "A" or equivalent	-15 to 0	
3.2.6.2	Tensile Strength Change, max (based on area before immersion)	-35%	
3.2.6.3	Elongation Change, max	-20%	
3.2.6.4	Volume Change	+1 to +25%	
3.2.6.5	Compression Set, Percent of Original Deflection, max		ASTM D 395 Method B
	Ring Cross Section Diameter		
	0.066 to 0.110, inch	30	
	(1.68 to 2.79 mm), incl	10	
	Over 0.110 inch (2.79 mm)		
3.2.7	Dry Heat Resistance		ASTM D 573 Temperature: 518 °F ± 5 (270 °C ± 3) Time: 70 hours ± 0.5
3.2.7.1	Hardness Change, Durometer "A" or equivalent	-5 to +10	
3.2.7.2	Tensile Strength Change, max	-35%	
3.2.7.3	Elongation Change, max	-15%	
3.2.7.4	Weight Loss, max	10%	4.6.1

TABLE 1 - PROPERTIES (CONTINUED)

Paragraph	Property	Requirement	Test Method
3.2.8	Compression Set, Percent of Original Deflection, max Ring Cross Section Diameter, 0.066 to 0.110, inch (1.68 to 2.79 mm), incl Over 0.110 inch (2.79 mm)	20 15	ASTM D 395 Method B Temperature: 392 °F ± 5 (200 °C ± 3) Time: 22 hours ± 0.5
3.2.9	Long-Term Compression Set, Percent of Original Deflection, max Ring Cross Section Diameter, 0.066 to 0.110, inch (1.68 to 2.79 mm), incl Over 0.110 inch (2.79 mm)	45 40	ASTM D 395 Method B Temperature: 392 °F ± 5 (200 °C ± 3) Time: 336 hours ± 0.5
3.2.10	Low-Temperature Resistance, Temperature Retraction, TR ₁₀ , Point, max	+5 °F (-15 °C)	ASTM D 1329

(Note A) Do not dip specimen in acetone; blot dry residual oil from specimen.

3.3 Properties After Humidity Aging of Brown Seals Only

The properties shown in Table 2 shall be determined on brown seals that have been aged for 28 days ± 2 hours at 77 °F ± 4 (25 °C ± 2) and 95% ± 3 relative humidity.

TABLE 2 - HUMIDITY AGED PROPERTIES

	Property	Requirement	Test Method
3.3.1	Tensile Strength, min	1400 psi (9.65 MPa)	
3.3.2	Elongation, min	125%	
3.3.3	Tensile Strength Change, max ⁽¹⁾	-15%	
3.3.4	Elongation Change, max ⁽¹⁾	-15%	
3.3.5	Synthetic Lubricant Resistance		ASTM D 471 (Note A) Medium: AMS3023 Temperature: 392 °F ± 5 (200 °C ± 3) Time: 70 hours ± 0.5
3.3.5.1	Tensile Strength Change, max ⁽²⁾	-35%	
3.3.5.2	Elongation Change, max ⁽²⁾	-20%	
3.3.5.3	Compression Set, Percent of Original Deflection, max	10%	ASTM D 395 Method B
3.3.6	Dry Heat Resistance		ASTM D 573 Temperature: 518 °F ± 5 (270 °C ± 3) Time: 70 hours ± 0.5
3.3.6.1	Tensile Strength Change, max	-35%	
3.3.6.2	Elongation Change, max	-25%	

TABLE 2 - HUMIDITY AGED PROPERTIES (CONTINUED)

	Property	Requirement	Test Method
3.3.7	Compression Set, Percent of Original Deflection, max	15%	ASTM D 395 Method B Temperature: 392 °F ± 5 (200 °C ± 3) Time: 22 hours ± 0.5

(Note A) Do not dip specimen in acetone; blot dry residual oil from specimen.

- (1) Shall be based on the original tensile strength and elongation found when tested to the requirements of Table 1.
- (2) Shall be based on the tensile strength and elongation found after aging 28 days ± 2 hours at 77 °F ± 5 (25 °C ± 2) and 95% ± 3 relative humidity.

TABLE 3 - SUITABLE TEST SIZE (SEE 3.2)

1/8 inch Spool	
CS 0.070	-011 to -014
1/4 inch Spool	
CS 0.070	-015 to -021
0.103	-113 to -119
0.139	-211 to -213
1/2 inch Spool	
CS 0.070	-022 to -050
0.103	-120 to -163
0.139	-214 to -258

- 3.4 Product, as received by purchaser, shall be uniform in quality and condition, smooth, as free from foreign materials as commercially practicable, and free from internal imperfections detrimental to the usage of the seals. Unless otherwise specified, surface imperfections shall be no greater than permitted by ISO3601-3 Grade CS. Unless otherwise specified, compression seals other than o-rings shall meet AS5752 Type 1 requirements.

3.5 Sizes and Tolerances

Shall be as specified on the drawing. Inspection for conformance to dimensional requirements shall be made in accordance with ISO3601-1.

4. QUALITY ASSURANCE PROVISIONS

4.1 Qualification

- 4.1.1 Seals that qualify are placed on a Qualified Product List (QPL) maintained by the QPL agency. To qualify, seals shall meet the tests specified in Tables 1 and 2, performed in accordance with the provisions of 8.2.
- 4.1.2 Qualification shall be in accordance with the provisions of 4.1.4 and 4.1.5.
- 4.1.3 Recertification of qualification is required every three years. Recertification consists of complete qualification tests in accordance with the requirements listed in Table 1. Brown colored rings shall also conform to the requirements shown in Table 2.
- 4.1.4 Qualification testing, review of test results, approval, reapproval, and recertification of qualification for QPL listing shall be in accordance with PD2000 or equivalent and the instructions from the responsible QPL agency.

- 4.1.5 Seals furnished to this specification will be listed or approved for listing on the qualified products list (QPL) in accordance with the provisions of 8.2 and 8.3. Changes in the product formulation, basic methods of manufacturer, or plant site, for qualified fluorocarbon rubber seals listed or approved for listing on the "QPL", are not permitted without first notifying the responsible QPL agency to assess the need for requalification and/or revision to the QPL.

4.2 Responsibility for Inspection

The manufacturer of product shall supply all samples and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that product conforms to specified requirements.

4.3 Classification of Tests

4.3.1 Acceptance Tests for O-rings

Requirements shown in Table 4 are acceptance tests and shall be performed on each lot. Acceptance tests shall be performed on the rings supplied and in accordance with ASTM D 1414. O-ring sizes that are suitable for test are shown in Table 3.

For all other sizes compression set (3.2.8) and specific gravity (3.2.4) tests shall be conducted on the end item or a section removed from the end item. Testing performed on a size -214 O-ring of the same batch and state of cure shall satisfy the remaining acceptance tests as long as the testing was performed within 90 days of the manufacture of the subject lot.

NOTE: O-rings from the same lot which have not passed visual inspection but are otherwise expected to meet the physical properties of this specification may be used for specific gravity and compression set testing.

TABLE 4 - ACCEPTANCE REQUIREMENTS

Requirement	Paragraph
Hardness	3.2.1
Tensile Strength	3.2.2
Elongation	3.2.3
Specific Gravity	3.2.4
Compression Set	3.2.8
Quality	3.4
Sizes and Tolerances	3.5

4.3.2 Acceptance Tests for All Other Seal Geometries

For all other seal geometries synthetic lubricant volume change (3.2.6.4) and specific gravity (3.2.4) tests shall be conducted on the end item or a section removed from the end item. Testing performed on a size -214 O-ring of the same batch and state of cure shall satisfy the remaining acceptance tests as long as the testing was performed within 90 days of the manufacture of the subject lot.

NOTE: Parts from the same lot which have not passed visual inspection but are otherwise expected to meet the physical properties of this specification may be used for specific gravity testing.

4.3.3 Qualification Tests

All technical requirements are qualification tests and shall be performed, and approved by the QPL agency, prior to or on the initial shipment of the product by the manufacturer, when a change in ingredients and/or processing requires reapproval as in 4.5.1.

4.4 Sampling and Testing

Shall be as follows.

4.4.1 Acceptance Tests

Sufficient product shall be taken at random from each lot to perform all the required tests in Table 4. 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, except as otherwise specified in 4.4.1.3.

4.4.1.1 A lot shall be all rings of the same size, from the same batch of compound processed in one continuous run and presented for manufacturer's inspection at one time.

4.4.1.2 A batch shall be the quantity of compound run through a mill or mixer at one time. Mixing of batches of previously compounded material is not permitted.

4.4.1.3 A statistical sampling plan acceptable to the purchaser may be used in lieu of sampling as in 4.4.1. Sample size for visual and dimensional requirements shall be as shown in Table 5; sample unit shall be one molded part and acceptance based on zero defects.

4.4.1.4 End of Manufacturing Process Inspection

Each individual seal shall be inspected according to AS871 under 1X magnification minimum. Entire seal surface shall be manually or electronically inspected.

4.4.1.5 Final Inspection Sampling Plan

The sample unit shall be one molded part. The sample size for both visual and dimensional inspection shall be as shown in Table 5. Acceptance is based on zero defects. Sample size for visual and dimensional requirements shall be as shown in Table 5.

TABLE 5 - VISUAL AND DIMENSIONAL INSPECTION

Lot Size		Sample Size
2 to	8	Entire Lot
9 to	90	8
91 to	150	12
151 to	280	19
281 to	500	21
501 to	1200	27
1201 to	3200	35
3201 to	10 000	38
10,001 to	35 000	46
35,001 to	150 000	56
150 001 and Over		65

4.4.2 Qualification Tests

Samples shall consist of 50 AS568 - 214 O-rings from one production lot. Eight 1-inch (25 mm) nominal diameter by 1/4 inch (6.4 mm) minimum thickness hardness buttons shall be supplied from the same lot.