SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS7259 REV. E

Issued 1983-01
Revised 2013-05

Superseding AMS7259D

Rubber: Fluorocarbon (FKM)
High Temperature/Fluid Resistant
Low Compression Set/ 85 to 95 Hardness
For Seals In Fuel Systems and Specific Engine Oil Systems

RATIONALE

AMS7259E results from a five year review and update of this specification to align with the O-ring template.

1. SCOPE

1.1 Form

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

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 but usage is not limited to such applications. Each application should be considered individually. This class of fluoroelastomers is not recommended for use in high temperature stabilized, "HTS", engine oils. Each "HTS" oil should be evaluated separately. This fluorocarbon rubber has a typical service temperature range of -20 to +400 °F (-29 to +204 °C) in air.

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 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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS7259E

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
AIR851	O-Ring Tension Testing Calculations
AS3581	Packing, Preformed - O-ring Seal, AMS 7259
AS568	Aerospace Size Standard for O-rings
AS5752	Visual Inspection Standard for Elastomeric Sealing Elements Other than O-rings
AS871	Manufacturing and Inspection Standards for Preformed Packings (O-Rings)

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 D297	Rubber Products - Chemical Analysis
ASTM D395	Rubber Property - Compression Set
ASTM D471	Rubber Property - Effect of Liquids
ASTM D573	Rubber - Deterioration in an Air Oven
ASTM D1329	Rubber Property - Retraction at Lower Temperatures (TR Test)
ASTM D1414	Rubber O-Rings
ASTM D2240	Rubber Property - Durometer Hardness

2.3 ISO Publications

Available from International Organization for Standardization (ISO), 1, ch. De la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland or www.iso.org

ISO 3601-1	Fluid Power Systems- O-rings – Part 1: Inside diameter, cross sections, tolerances and size identification code
ISO 3601-3	Fluid Power Systems – O-rings – Part 3: Quality Acceptance Criteria

2.4 PRI Publications

Available from Performance Review Institute (PRI), 161 Thorn Hill Road, Warrrendale, PA 15086-7257, Tel: 724-772-1616, www.pri-network.org.

PD2000 Procedures for an Industry Qualified Product Management Process

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 molded-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; tests shall be performed on the rings supplied and in accordance with ASTM D1414, insofar as practicable. O-ring sizes that are suitable for test are shown in Table 3. For all other sizes, and products, tests shall be conducted on a size -214 O-ring of identical batch and state of cure as the end item. Compression set and specific gravity tests shall be conducted on the end item if possible. Calculations of tensile strength and elongation may be made in accordance with AIR851.

TABLE 1 - PROPERTIES

Property	Requirement	Test Method
3.2.1 Hardness, Durometer “A” or equivalent	90 ± 5	ASTM D2240
3.2.2 Tensile Strength, min	1400 psi (9.65 MPa)	ASTM D1414
3.2.3 Elongation, min	100%	ASTM D1414
3.2.4 Specific Gravity	Preproduction Value ±0.02	ASTM D297 (Hydrostatic Method)
3.2.5 Aromatic Fuel Resistance		ASTM D471 ASTM Ref. Fuel B 73 °F ± 5 (23 °C ± 2) 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%	

TABLE 1 - PROPERTIES (CONTINUED)

Property	Requirement	Test Method
3.2.6 Synthetic Lubricant Resistance		ASTM D471 (See Note A) AMS3023 392 °F ± 5 (200 °C ± 3) 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 D395 Method B
Ring Cross Section Diameter		
0.066 to 0.110, inch (1.68 to 2.79 mm), incl	35	
Over 0.110 inch (2.79 mm)	20	
3.2.7 Dry Heat Resistance		ASTM D573 518 °F ± 5 (270 °C ± 3) 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	-45%	
3.2.7.3 Elongation Change, max	-20%	
3.2.7.4 Weight Loss, max	10%	4.5.1
3.2.8 Compression Set, Percent of Original Deflection, max		ASTM D395 Method B 392 °F ± 5 (200 °C ± 3) 22 hours ± 0.5
Ring Cross Section Diameter,		
0.066 to 0.110, inch (1.68 to 2.79 mm), incl	35	
Over 0.110 inch (2.79 mm)	25	

TABLE 1 - PROPERTIES (CONTINUED)

	Property	Requirement	Test Method
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)	 65 60	ASTM D395 Method B 392 °F ± 5 (200 °C ± 3) 336 hours ± 0.5
3.2.10	Low-Temperature Resistance, Temperature Retraction, TR_{10} Point, max	+5 °F (-15 °C)	ASTM D1329
(Note A) Do not dip specimen in acetone; blot dry residual oil from specimen.			

3.3 Properties After Humidity Aging on 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)	ASTM D1414
3.3.2	Elongation, min	100%	ASTM D1414
3.3.3	Tensile Strength Change, max(1)	-15%	ASTM D1414
3.3.4	Elongation Change, max(1)	-15%	ASTM D1414
3.3.5	Synthetic Lubricant Resistance		ASTM D471 (Note A) AMS3023 392 ° ± 5 (200 °C ± 3) 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	15	

TABLE 2 - HUMIDITY AGED PROPERTIES (CONTINUED)

	Property	Requirement	Test Method
3.3.6	Dry Heat Resistance After Humidity Age		ASTM D573 518 °F ± 5 (270 °C ± 3) 70 hours ± 0.5
3.3.6.1	Tensile Strength Change, max	-45%	
3.3.6.2	Elongation Change, max	-25%	
3.3.7	Compression Set, Percent of Original Deflection, max	25	ASTM D395 Method B 392 °F ± 5 (200 °C ± 3) 22 hours ± 0.5

Note A Do not dip specimens 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 after aging 28 days ± 2 hours at 77 °F ± 5 (25 °C ± 2) and 95% ± 3 relative humidity.

TABLE 3 - SUITABLE TEST SIZES (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 Quality

Product, 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 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 Dimensions and Tolerances

Dimensions and tolerances shall be as specified in the parts standard, drawing or purchase document. If not specified, o-rings standard sizes and tolerances are shown in AS568. The procedures outlined in Annex B of ISO 3601-1 shall be followed for dimensional inspection.

3.6 3.6 Toxicological Formulations

The material shall have no adverse effects on the health of personnel when used for its intended purpose in accordance with manufacturer's instructions and with appropriate handling procedures.

3.7 Qualification

Products sold to this specification shall be listed on the PRI qualified products list, (QPL). The qualified products list shall be in accordance with PD2000 (see 8.2).

3.7.1 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

3.7.2 Qualification shall be in accordance with the provisions of 3.7.4 and 3.7.5.

3.7.3 Recertification of qualification is required every three years. Recertification consists of complete qualification tests in accordance with the requirements listed in Tables 1 and 2.

3.7.4 Qualification testing, review of results, approval, reapproval and recertification of qualification for QPL listing shall be in accordance with PD 2000 or equivalent and the instructions from the responsible QPL agency.

3.7.5 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 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. QUALITY ASSURANCE PROVISIONS

4.1 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 the specified requirements.

4.2 Classification of Tests

4.2.1 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 testing are shown in Table 3.

For all other sizes compression set and specific gravity 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

4.2.2 Acceptance tests for all other seal geometries: Specific gravity and volume swell (Section 3.2.4 and 3.2.6.4) 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 and volume swell testing.

4.2.3 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 4.4.1 and when purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing

Shall be as follows.

4.3.1 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 4.3.1.3.

4.3.1.1 A lot shall be a quantity of one size of product processed and packaged as one production entity from a single batch.

4.3.1.2 A batch shall be the quantity of compound run through a mill or mixer at one time. Excluded from the definition is mixing of batches of previously compounded material.

4.3.1.3 A statistical sampling plan acceptable to the purchaser may be used in lieu of sampling as in 4.3.1. 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.