



AEROSPACE MATERIAL SPECIFICATION

AMS7257**REV. E**

Issued 1985-04
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Revised 2014-09

Superseding AMS7257D

Perfluorocarbon (FFKM)
Engine Oil, Fuel and Hydraulic Fluid Resistant
70 to 80 Hardness
For High Temperature Seals in Engine Oil Systems, Fuel Systems and Hydraulic
Systems

RATIONALE

This document requires revision to correct formatting errors contained in AMS7257D that are causing confusion in Manufacturer Acceptance Tests.

1. SCOPE

1.1 Form

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

1.2 Application

These products have resistance to a variety of fluids, but usage is not limited to such applications. Each application should be considered separately. This perfluorocarbon (FFKM) has a typical service temperature range of +5 to 554 °F (-15 to 290 °C).

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.

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<http://www.sae.org/technical/standards/AMS7257E>**

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.

AIR851	O-Ring Tension Testing Calculations
AMS2817	Packaging and Identification, Preformed Packings
AMS3085	Reference for Testing AS5780 HPC Class (Polyol) resistant material
ARP3050	Suitable Test Sizes for O-ring Specifications
AS568	Aerospace Size Standard for O-Rings
AS5752	Aerospace Visual Inspection Standard for Elastomeric Sealing Elements Other than O-rings
AS1241	Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft

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 - Effects of Liquids
ASTM D 573	Rubber Property - Deterioration in an Air Oven
ASTM D 1329	Rubber Property - Retraction at Lower Temperatures (TR Test)
ASTM D 1414	Rubber Property- Testing O-Rings
ASTM D 2240	Rubber Property - Durometer Hardness

2.3 ISO Publications

Available from International Organization for Standardization, 1, rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland, Tel: +41-22-749-01-11, 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

2.4 PRI Publications

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

PD2000	Procedures for an Industry Qualified Product Management Process
PD2102	Aerospace Quality Assurance, Product Standards, Qualification Procedure, Elastomeric Seal

3. TECHNICAL REQUIREMENTS

3.1 Material

Shall be prepared from ingredients as necessary to achieve the requirements detailed in this standard and shall be a compound, based on a perfluoroelastomer (FFKM), suitably cured to produce product meeting the requirements of 3.2. Material used shall be based on 100% virgin perfluoroelastomer (FFKM). No reprocessed or non-perfluoroelastomer (FFKM) polymer is acceptable.

3.2 Properties

The product shall conform to the requirements shown in Table 1; Calculations of tensile strength and elongation may be made in accordance with AIR851.

TABLE 1 – PROPERTIES

Paragraph	Property	Requirements	Test Method
3.2.1	As Received		
3.2.1.1	Hardness, Durometer "A"	75 ± 5	ASTM D 2240
3.2.1.2	Tensile Strength, min	1500 psi (10.3 MPa)	ASTM D 1414
3.2.1.3	Elongation, min	120%	ASTM D 1414
3.2.1.4	Specific Gravity	Preproduction Value ± 0.02	ASTM D 297 Hydrostatic method
3.2.1.5	Low Temperature Resistance Temperature Retraction (TR ₁₀), max	+41 °F (+5 °C)	ASTM D 1329 Use test slab as Specimen
3.2.2	Aromatic Fuel Resistance		ASTM D 471 ASTM Reference Fuel B 73 °F ± 5 (23 °C ± 2) 70 hours ± 0.5
3.2.2.1	Hardness Change, Durometer "A"	-5 to +5	
3.2.2.2	Tensile Strength Change, max	-20%	
3.2.2.3	Elongation Change, max	-15%	
3.2.2.4	Volume Change, max	0 to +5%	
3.2.3	Turbine Engine Oil Resistance		ASTM D 471 AMS3085 392 °F ± 5 (200 °C ± 2) 70 hours ± 0.5
3.2.3.1	Hardness Change, Durometer "A"	-5 to +5	
3.2.3.2	Tensile Strength Change, max	-10%	
3.2.3.3	Elongation Change, max	-15%	
3.2.3.4	Volume Change, max	0 to +5%	
3.2.3.5	Compression Set, max	25%	ASTM D 395 Method B AMS3085 392 °F ± 5 (200 °C ± 2) 70 hours ± 0.5
3.2.4	Hydraulic Fluid Resistance		ASTM D 471 AS1241 Type IV Class 1 or 2 257 °F ± 5 (125 °C ± 2) 70 hours ± 0.5
3.2.4.1	Hardness Change, Durometer "A"	-15 to 0	
3.2.4.2	Tensile Strength Change, max	-40%	
3.2.4.3	Elongation Change, max	-15%	
3.2.4.4	Volume Change, max	0 to +15%	

TABLE 1 – PROPERTIES (CONTINUED)

3.2.5	Dry Heat Resistance		ASTM D 573 554 °F ± 5 (290 °C ± 2) 70 hours ± 0.5
3.2.5.1	Hardness Change, Durometer “A”	-5 to +5	
3.2.5.2	Tensile Strength Change, max	-20%	
3.2.5.3	Elongation Change, max	-5%	
3.2.5.4	Weight Loss, max	5%	4.4.1
3.2.6	Compression Set, max	40%	ASTM D 395 Method B 446 °F ± 5 (230 °C ± 2) 70 hours ± 0.5
3.2.7	Long Term Compression Set, max	55%	ASTM D 395 Method B 446 °F ± 5 (230 °C ± 2) 336 hours ± 0.5

3.3 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. Surface imperfections shall be no greater than permitted by ISO3601-3 Grade CS or AS5752 type 1 or 2 as applicable.

3.4 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.

3.5 Part Numbers

Shall consist of the following

1. The specification number AMS7257
2. A dash followed by the appropriate dash number from AS568

Example 1

AMS7257 – 014

Example 2

AMS7257 – 121

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). This QPL requirement shall be in effect one year after the date of issuance of this document.

- 3.7.1 Qualification shall be reapproved every three years in accordance with PD2000, PD2102 and the instructions from the Performance Review Institute. Testing shall be in accordance with 4.2.2.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

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

4.1.1 Manufacturer

Shall be on the current PRI Qualified Manufacturer's List (QML).

4.2 Classification of Tests

4.2.1 Acceptance Tests

Acceptance Tests for o-rings: Requirements shown in Table 2 are acceptance tests and shall be performed on each lot. Acceptance Tests for o-rings: Requirements shown in Table 3 are acceptance tests and shall be performed on each batch. 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 ARP3050. 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

Acceptance tests for all other seal geometries: Specific gravity and volume swell (3.2.1.4, 3.2.2.4, 3.2.3.4, and 3.2.4.4) 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.

TABLE 2 – ACCEPTANCE TESTS

Requirement	Paragraph
Hardness	3.2.1.1
Specific Gravity	3.2.1.4
Quality	3.3
Sizes and Tolerances	3.4

TABLE 3 – BATCH ACCEPTANCE TESTS

Requirement	Paragraph
Hardness	3.2.1.1
Tensile Strength	3.2.1.2
Elongation	3.2.1.3
Specific Gravity	3.2.1.4
Compression Set	3.2.6

4.2.1.1 Lot

A quantity of one size of product processed and packaged as one production entity from a batch.

4.2.1.2 Batch

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

4.2.1.3 Random Sampling

The method shall be as specified in the parts standard, drawing or purchase document. If not specified, product shall be taken at random from each lot to perform all the required acceptance tests. The number of test iterations for each requirement shall be specified in the applicable test procedure.

4.2.1.4 Sample

Shall be end product whenever possible. Suitable test size for o-rings shall be determined by ARP3050. When impossible to test the end product, AS568 size -214 o-rings with the same state of cure as the production part shall be tested.

4.2.2 Qualification Tests

All technical requirements shall be performed prior to the initial shipment of the product to a purchaser. When a change in ingredients and/or processing requires reapproval, when purchaser deems confirmatory testing to be required, and for reapproval of qualification per 3.7.1

4.2.2.1 Sample:

Shall be from a production batch/lot; AS568 size -214 o-rings shall be used for all testing.

4.2.2.2 Testing

Shall be in accordance with PD2000 and PD2102. Verification tests shall consist of tests listed in Table 3 plus long term compression set (3.2.7). Testing for qualification reapproval shall be all technical requirements (no verification tests are required).

4.2.2.3 Report

The supplier of the product shall make a qualification test report available. This report shall include AMS number, manufacturer's identification and product designation, batch/lot number, date of manufacture and the results of all qualification tests.

4.3 Inspection

4.3.1 End of Process Inspection

Shall be as specified in the parts standard, drawing or purchase document. If not specified, shall be as follows:

Prior to inspection, mold flash shall be removed from the parts in such a manner that they conform to the requirements specified herein. Each individual part (100%) shall be visually inspected according to ISO 3601-3, Grade CS or AS5752 as applicable, using 1X magnification. The entire surface of the part shall be manually inspected.

4.3.2 Final Inspection

Shall be as specified in the parts standard, drawing or purchase document. If not specified, shall be as follows:

The parts shall be visually inspected according to ISO 3601-3, Grade CS or AS5752, as applicable, using 2X magnification. The entire surface of the part shall be manually inspected. The sample size for final inspection shall be in accordance with ANSI/ASQ Z1.4 single sampling plan inspection level II with an AQL 1.0 except that the acceptance number shall be zero. The sample unit shall be one part. The manufacturer of the parts shall be responsible for the required inspections. The purchaser reserves the right to sample and perform any confirmatory inspection deemed necessary to ensure that the parts conform to the specified requirements.

Prior to inspection, mold flash shall be removed from the parts in such a manner that they conform to the requirements specified herein. Each individual part (100%) shall be visually inspected according to ISO 3601-3, Grade CS (S for Silicones) or AS5752 as applicable, using 2X magnification. The entire surface of the part shall be manually inspected.

4.4 Test Methods

4.4.1 Weight Loss Tests

The weight loss test shall be conducted on samples air-aged at $554^{\circ}\text{F} \pm 5$ ($290^{\circ}\text{C} \pm 2$). Test specimens shall be conditioned for 24 hours ± 0.5 in a desiccator before and after air aging. The specimens shall be weighed immediately after the desiccation period before and after aging. The percentage weight loss shall be calculated as shown in Equation (1).

$$\text{Percentage Weight Loss} = \frac{W_1 - W_2}{W_1} * 100 \quad (1)$$

Where

W_1 = weight of sample before air-aging

W_2 = weight of sample after air-aging

4.5 Approval

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

4.5.2 Manufacturer shall establish, for each size of seal, parameters for the process control factors which will produce seals meeting the technical requirements of this specification. These shall constitute the approved procedures and shall be used for manufacturing production of seals. If necessary to make any change in parameters for the process control factors, manufacturer shall submit for reapproval a statement of the proposed changes in ingredients and/or processing. When requested, sample seals shall be submitted in accordance with the provisions of 4.1. Seals manufactured using a revised procedure shall not be shipped prior to reapproval of qualification in writing.

4.5.2.1 Control factors for producing seals include, but are not limited to, the following:

Compound ingredients and 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 permissible

Finishing methods

Methods of inspection.

4.6 Certificate of Analysis (CFA)

The supplier of the product shall furnish with each shipment a CFA from the manufacturer showing the results of tests to determine conformance to the acceptance test requirements and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS number and revision letter, manufacturer's material designation, part number, address of manufacturing and testing site(s).

4.7 Re-sampling and Retesting

If any original test fails to meet the specified requirements, three additional tests shall be necessary for product acceptance. The same batch/lot of product as was used for the original test shall be used for retesting. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the products represented. Results of all tests shall be reported.