SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS7274 | REV. J

Issued 1949-03
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Superseding AMS7274H

Rubber: Butadiene-Acrylonitrile (NBR) 65 to 75 Hardness, For Elastomeric Seals in Aircraft Engine Oil Systems

RATIONALE

AMS7274J results from a Five Year Review and update of this specification. Qualification requirements have been added.

1. SCOPE

1.1 Form

This specification covers a butadiene-acrylonitrile (NBR) 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 hot-petroleum-based lubricating oil, but usage is not limited to such applications. Each application should be considered separately. This Butadiene-acrylonitrile (NBR) has a typical service temperature range of -67 to +302 °F (-55 to +150 °C) in engine oil.

1.2.1 The cross-section of such seals is usually not over 0.275 inch (6.98 mm) in diameter or thickness.

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)
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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/AMS7274J

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

AIR851 O-Ring Tension Testing Calculations

ARP3050 Suitable Test Sizes for O-ring Specifications

AS568 Aerospace Size Standard for O-rings

AS3570 Packing, Preformed - O-ring Seal, AMS 7274

AS5752 Aerospace - Visual Inspection Standard for Elastomeric Sealing Elements Other than 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 D 297 Rubber Products- Chemical Analysis

ASTM D 471 Rubber Property - Effects of Liquids

ASTM D 1414 Rubber - Testing O-Rings

ASTM D 2240 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, 161 Thorn Hill Road, Warrendale, PA 15086-7527, Tel: 724-772-1616, www.pri-network.org.

PD 2000 Procedures for an Industry Qualified Product Management Process

PD2102 Aerospace Quality Assurance, Product Standards, Qualification Procedure, Elastomeric Seal

2.5 ASQ Publications

Available from American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203, Tel: 800-248-1946 (United States or Canada)) or +1-414-272-8575 (International), www.asq.org.

ANSI/ASQ Z1.4 Sampling Procedures and Tables for Inspection by Attributes

3. TECHNICAL REQUIREMENTS

3.1 Material

Shall be prepared from ingredients as shall be necessary to achieve the requirements detailed in this standard and shall be a compound, based on a butadiene-acrylonitrile (NBR) elastomer, suitably cured to produce product meeting the requirements of 3.2. Material used shall be based on 100% virgin butadiene-acrylonitrile elastomer. No reprocessed or non-butadiene-acrylonitrile 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 – TEST REQUIREMENTS

Paragraph	Test	Requirement	Test Method / Conditions	
3.2.1	Original Properties			
3.2.1.1	Hardness Change, Durometer “A” or equivalent	70 ± 5	ASTM D 2240	
3.2.1.2	Tensile Strength, minimum	1500 psi (10.3 MPa)	ASTM D 1414	
3.2.1.3	Elongation, minimum	150%	ASTM D 1414	
3.2.1.4	Corrosion	Nil	ASTM D 1414	
3.2.1.5	Specific Gravity	Preproduction Value ±0.02	ASTM D 297, hydrostatic method	
3.2.2	Lubricating Oil Resistance (Immediate Deteriorated Properties)		Medium: Temperature:	IRM 901 Oil (ASTM D 471) 302 °F ± 5 (150 °C ± 3)
3.2.2.1	Hardness Change, Durometer "A" or equivalent	-5 to +10	Time:	96 hours ± 0.5
3.2.2.2	Tensile Strength Change, maximum	-60%		
3.2.2.3	Elongation Change, maximum	-50%		
3.2.2.4	Volume Change	0 to +10		
3.2.2.5	Decomposition	None		
3.2.2.6	Surface Tackiness	None		
3.2.3	Processing Oil Resistance (Immediate Deteriorated Properties)		Medium: Temperature:	IRM 903 Oil (ASTM D 471) 302 °F ± 5 (150 °C + 3)
3.2.3.1	Hardness Change, Durometer "A" or equivalent	-20 to 0	Time:	70 hours ± 0.5
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:	212 °F ± 2 (100 °C ± 1)
3.2.4.1	Hardness Change, Durometer "A" or equivalent	0 to +10	Time:	70 hours ± 0.5
3.2.4.2	Tensile Strength Change, maximum	-25%		
3.2.4.3	Elongation Change, maximum	-40%		
3.2.4.4	Bend (Flat)	No cracking or checking		
3.2.5	Compression Set		Temperature:	257 °F ± 4 (125 °C ± 2)
3.2.5.1	Percent of Original Deflection, maximum		Time:	70 hours ± 0.5
	Ring Cross Section Diameter			
	0.066 to 0.110 inch (1.68 to 2.79 mm), incl	85		
	Over 0.110 inch (2.79 mm)	75		
3.2.6	Low-Temperature Brittleness (After Aging in Lubricating Oil	No Cracking	4.4.1	

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. 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.

3.4 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 are as shown in AS568. The procedures outlined in Annex B of ISO 3601-1 shall be followed for dimensional inspection.

3.5 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.

3.6 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 PD 2000 (See 8.2). If no products are listed on the PRI qualified products list, then product qualification shall be as agreed between the purchaser and manufacturer.

3.6.1 Qualification shall be reapproved every 3 years in accordance with PD 2000, 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

4.2.1.1 Acceptance Tests for O-rings

Requirements shown in Table 2 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 shall be in accordance with 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 parts were molded within 90 days of the molding 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.

4.2.1.2 Acceptance Tests for All Other Seal Geometries

Specific gravity and volume change (3.2.1.5 and 3.2.2.4) 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 parts were molded within 90 days of the molding 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 Reference
Hardness	3.2.1.1
Tensile Strength	3.2.1.2
Elongation	3.2.1.3
Specific Gravity	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
Quality	3.3
Sizes and Tolerances	3.4

4.2.2 Lot

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

4.2.3 Batch

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.

4.2.4 Random Sampling

The method shall be as specified in the part 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.

4.2.5 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 approval, when purchaser deems confirmatory testing to be required, and for reapproval of qualification per 3.6.1.

4.2.5.1 Sample

Shall be from a product batch/lot. AS568 size -214 O-rings shall be used for all testing.

4.2.5.2 Testing

Shall be in accordance with PD 2000 and PD 2102. Verification tests shall consist of tests listed in Table 2. Testing for qualification reapproval shall be all technical requirements (no verification tests are required).

4.2.5.3 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.

4.4 Test Methods

4.4.1 The specimen for rings 2 inches (51 mm) and under in nominal ID shall be a complete ring; the specimen for rings over 2 inches (51 mm) in nominal ID shall be a piece 3 inches (76 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 hours ± 0.1. At the end of the refrigeration time, the specimen, while in the refrigerator or within 10 seconds 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-inch (76-mm) specimen shall be bent around to form a circle.

4.5 Approval

4.5.1 Manufacturer shall use ingredients, manufacturing procedures, processes, and methods of inspection in production which are essentially the same as those used on the approved 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 performs
Basic molding procedure (compression, transfer, injection)
Curing time and pressure; variations of ±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, specification number and revision, 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 rings represented. Results of all tests shall be reported.