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Superseding AMS7272F	

Rubber: Butadiene-Acrylonitrile (NBR)  
Synthetic Lubricant Resistant  
65 – 75 Hardness  
For Seals in Synthetic Lubricant Systems

#### RATIONALE

Service Liquid 101 is being replaced by Service Liquid 106 (ARM 200). This revision is intended to update AMS7272 in order to reflect the difference in volume change resulting from the change in test liquids. Acceptance tests have been defined for seal sizes other than those listed in ARP3050. A QPL requirement has 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 been used typically as sealing rings in contact with diester synthetic lubricants in service up to 275 °F (135 °C), but usage is not limited to such applications. These products may not be suitable for use in high temperature stabilized, "HTS", engine oils (those conforming to MIL-PRF-23699 Class HTS, MIL-PRF-7808 Grade 4 and AS5780 Class HPC). The cross-section of such rings 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.

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## 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](http://www.sae.org).

AMS2817	Packaging and Identification, Preformed Packings
AS568	Aerospace Size Standard for O-Rings
AS5752	Aerospace - Visual Inspection Standard for Elastomeric Sealing Elements Other than O-Rings
AS5780	Specification for Aero and Aero-Derived Gas Turbine Engine Lubricants
AIR851	O-Ring Tension Testing Calculations
ARP3050	Suitable Test Sizes for O-ring Specifications

## 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](http://www.astm.org).

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, 1, rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland, Tel: +41-22-749-01-11, [www.iso.org](http://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](http://www.pri-network.org).

PD2000	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](http://www.asq.org).

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

## 2.6 U.S. Government Publications

Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6396, <http://quicksearch.dla.mil/>.

MIL-PRF-7808 Lubricating Oil, Aircraft Turbine Engine, Synthetic Base

MIL-PRF-23699 Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, NATO Code Number O-156

## 3. TECHNICAL REQUIREMENTS

### 3.1 Material

Shall be a compound, based on a butadiene-acrylonitrile (NBR) elastomer, suitably cured to produce product meeting the requirements of 3.2.

### 3.2 Properties

Product shall conform to the requirements shown in Table 1. Tests shall be performed in accordance with ASTM D 1414 unless otherwise indicated. Calculations for tensile strength, elongation, and tensile stress may be made in accordance with AIR851.

TABLE 1 - PROPERTIES

Paragraph	Property	Requirement	Method of Testing
3.2.1	As Received		
3.2.1.1	Hardness, 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	250%	ASTM D1414
3.2.1.4	Tensile Stress at 100% Elongation, minimum	500 psi (3.45 MPa)	ASTM D1414
3.2.1.5	Corrosion	Nil	ASTM D 1414
3.2.1.6	Specific Gravity	Preproduction Value ± 0.02	ASTM D 297
3.2.2	Synthetic Lubricant Resistance (Immediate Deteriorated Properties)		Section 4.4.1 and ASTM D 471 ASTM Service Liquid 106  302 °F ± 5 (150 °C ± 3) 70 hours ± 0.5
3.2.2.1	Tensile Strength Change, maximum	-70%, but actual strength shall be not lower than 600 psi (4.14 MPa)	

TABLE 1 - PROPERTIES (CONTINUED)

3.2.2.2	Elongation Change, maximum	-70%	
3.2.2.3	Volume Change	0 to +30%	
3.2.2.4	Decomposition	None	
3.2.2.5	Surface Tackiness	None	
3.2.3	Aromatic Fuel Resistance (Immediate Deteriorated Properties)		ASTM D 471 ASTM Ref. Fuel B 68 to 86 °F (20 to 30 °C) 70 hours ± 0.5
3.2.3.1	Tensile Strength Change, maximum (based on area before immersion)	-60%	
3.2.3.2	Elongation Change, maximum	-55%	
3.2.3.3	Volume Change	0 to +35%	
3.2.3.4	Volume Change after 70 hours ± 0.5 immersion in 30% aromatic fuel followed by 48 hours ± 0.5 drying at 158 °F ± 2 (70 °C ± 1), maximum (based on unimmersed volume)	-10%	
3.2.4	Dry Heat Resistance		ASTM D 573 257 °F ± 4 (125 °C ± 2) 70 hours ± 0.5
3.2.4.1	Tensile Strength Change, maximum	-25%	
3.2.4.2	Elongation Change, maximum	-50%	
3.2.4.3	Bend (flat)	No cracking or checking	
3.2.5	Compression Set		ASTM D 395 Method B 257 °F ± 4 (125 °C ± 2) 70 hours ± 5
3.2.5.1	Percent of Original Deflection, maximum Ring Cross Section Diameter, 0.066 to 0.110 inch (1.68 to 2.79 mm), incl Over 0.110 inch (2.79 mm)	85 75	
3.2.6	Low-Temperature Resistance		
3.2.6.1	Temperature Retraction TR <sub>10</sub> point, maximum	-15 °F (-26 °C)	ASTM D 1329

### 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 rings. 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 Sizes and Tolerances

Shall be as specified on the drawing. Standard sizes are as shown in AS568. Inspection for conformance to dimensional requirements shall be made in accordance with ISO3601-1.

### 3.5 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). If no products are listed on the PRI qualified products list, then product qualification shall be as agreed between the purchaser and manufacturer until a PRI QPL is established.

3.5.1 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 4.2.5.

## 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 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

##### 4.2.1.2 Acceptance tests for all other seal geometries

Specific gravity and volume swell (Section 3.2.1.6 and 3.2.2.3) 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 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	3.2.1.6
Volume Change in Synthetic Lubricant	3.2.2.3
Decomposition in Synthetic Lubricant	3.2.2.4
Surface Tackiness in Synthetic Lubricant	3.2.2.5
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 and packaged 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 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.

#### 4.2.5 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 reapproval, when purchaser deems confirmatory testing to be required, and for reapproval of qualification per 3.5.1.

##### 4.2.5.1 Sample

Shall be from a production 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 plus long term compression set (Table 1). 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 Synthetic Lubricant Resistance

Place 140 mL of ASTM Service Liquid 106 (ASTM D 471) in 38 mm OD X 300 mm long test tubes at room temperature. Immerse test tubes in the heating medium so that 2 inches (51 mm) of each tube extends above the level of the heat transfer oil in oil bath heaters or so that 1 inch (25 mm) of each tube extends above the top insulation of aluminum block or air well heaters. Heat the test fluid to  $302\text{ }^{\circ}\text{F} \pm 5$  ( $150\text{ }^{\circ}\text{C} \pm 3$ ). For rings 1 inch (25 mm) and under in nominal ID, hang three rings in each tube from corrosion-resistant steel wire or wires so that the top points of the rings will be 1, 2-1/2, and 4 inches (25, 63.5, and 102 mm) below the surface of the test fluid. For rings over 1 inch (25 mm) but not over 3 inches (76 mm) in nominal ID, cut segments from each of three rings, form to 1-inch (25-mm) ID rings, securing the ends of the segments with corrosion-resistant steel wire, and hang as for complete rings. For sizes over 3 inches (76 mm) in nominal ID, cut 5-inch (127-mm) long segments from each of three rings. Hang each segment by a corrosion-resistant steel wire so that the segments do not touch each other or the walls of the test tube and so that the mid-length of each segment is at the approximate mid-depth of the test fluid. Stopper the test tubes with new, bare cork stoppers 1.5 inches (38 mm) thick having two 8-mm OD glass tubes through the cork, one 3 inches (76 mm) long extending 1 inch (25 mm) below the bottom of the cork and one 5.5 inches (140 mm) long extending 3.5 inches (89 mm) above the top of the cork. Force the wire or wires from which the rings are hung into the bottom of the cork before inserting in the test tube. After the immersion period, suspend the rings in fresh test fluid at room temperature and allow to cool in this fluid for approximately 30 minutes, remove the rings, rinse them briefly in acetone, and blot lightly with filter paper. Determine changes in properties as required in 3.2.2, using the water displacement method for measuring volume change. Record results as the average of the properties for the three specimens.

### 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.