

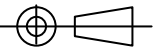
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THIRD ANGLE PROJECTION		CUSTODIAN NATIONAL AEROSPACE STANDARDS COMMITTEE	REVISION 6
PROCUREMENT SPECIFICATION NONE		TITLE PACKING, PREFORMED, ETHYLENE PROPYLENE RUBBER	CLASSIFICATION SPECIFICATION NAS1613
			SHEET 1 OF 18



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AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
1000 WILSON BLVD.
ARLINGTON, VA 22209

THIS DRAWING SUPERSEDES ALL ANTECEDENT STANDARD DRAWINGS FOR THE SAME
PRODUCT AND SHALL BECOME EFFECTIVE NO LATER THAN SIX MONTHS FROM THE LAST
REVISION DATE.

FORM 12-01

REVISION DATE: NOVEMBER 30, 2012

ISSUE DATE: MAY 1961

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1. SCOPE

1.1 Scope

This specification establishes requirements for elastomer seal elements for use in hydraulic systems using phosphate ester fluids.

1.2 Classifications

The elastomeric compound, ethylene propylene copolymer or terpolymer rubber described in this specification covers two (2) types of O-ring packings: standard size O-rings per NAS1611/NAS1612, and all other elastomer seal elements used in specialty seals.

The elastomeric compound shall pass all specification requirements including soak testing in all commercially available phosphate ester hydraulic fluids that meet AS1241, Type IV, Class 1 and Class 2, and Type V, Grade A and Grade B requirements as described in 3.2.

The manufacturers of these products are required to be ISO 9000 registered and AS9100 compliant as determined by a third party registered auditor.

2. APPLICABLE DOCUMENTS

2.1 Government Documents

2.1.1 Specifications and standards

The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issue of these documents shall be those listed in the issue of the department of defense index of specifications and standards (DoDISS) and supplement thereto, cited in the solicitation.

Federal

FED-STD-791 Lubricants, Liquid Fuels, and Related Products; Methods of Testing

Copies can be obtained from the Department of Defense Single Stock Point (DODSSP). <http://dodssp.daps.dla.mil>

2.2 Other Publications

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

American Society for Quality

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

Copies can be obtained from the American Society for Quality, 600 North Plankinton Ave., Milwaukee, WI 53203.
www.asq.org

Aerospace Industries Association

NAS1611 Packing, Preformed O-Ring Phosphate Ester Resistant

NAS1612 Packing, Preformed Straight Thread Tube Fitting Boss, Phosphate Ester Resistant

Copies can be obtained from the Aerospace Industries Association, 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209. www.aia-aerospace.org

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ASTM International

ASTM B36/B36M	Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar
ASTM B139/B139M	Standard Specification for Phosphor Bronze Rod, Bar, and Shapes
ASTM B150/B150M	Standard Specification for Aluminum Bronze Rod, Bar and Shapes
ASTM D91	Precipitation Number of Lubricating Oils, Test Method For
ASTM D1414	Standard Methods of Testing Rubber O-Rings
ASTM D3677	Standard Test Methods for Rubber – Identification by Infrared Spectrophotometry
ASTM E1547	Standard Terminology Relating to Industrial and Specialty Chemicals
ASTM E473	Standard Definition of Terms Relating to Thermal Analysis
ASTM E1131	Standard Test Method for Compositional Analysis by Thermogravimetry
ASTM E29	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

Copies can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. www.astm.org

SAE International

AMS3678	Molded or Extruded Polytetrafluoroethylene (PTFE) Unfilled, Pigmented and Filled Compounds
AIR851	O-Ring Tension Testing Calculations
AS1241	Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft
AS603	Impulse Testing of Hydraulic Hose, Tubing and Fitting Assemblies
AMS2817	Packaging and Identification, Preformed Packing
AS4716	Aerospace Standard, Gland Design, O-Ring and Other Elastomeric Seals
AMS-QQ-A-250/4	Aluminum Alloy 2024, Plate and Sheet
AMS6345	Steel, Sheet, Strip, and Plate .95 Cr .20 Mo (SAE4130) Normalized or Otherwise Heat Treated
AS871	Manufacturing and Inspection Standard for Preformed Packings (O-Rings)

Copies can be obtained from SAE International, 400 Commonwealth Dr., Warrendale, PA 15096-0001. www.sae.org

ASME

ASME B46.1	Surface Texture (Surface Roughness, Waviness and Lay)
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Copies can be obtained from ASME, Three Park Ave., New York, NY 10016-5990. www.asme.org

For test procedure for determining the cure state of elastomers by differential scanning calorimetry (DSC), see appendix.

2.3 Order of Precedence

In the event of a conflict between the text of this specification and the references cited herein (except for associated specification sheets), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

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3. REQUIREMENTS

3.1 Material

Material shall be an elastomer compound based on either an ethylene propylene copolymer or terpolymer free from sulfur and labile halogens and capable of meeting all the requirements of this specification.

3.2 Fluid

The test fluids used for soak testing shall be all the commercially available, low density, phosphate ester hydraulic fluids that meet AS1241, Type IV, Class 1 requirements, all the commercially available phosphate ester hydraulic fluids that meet AS1241, Type V, Grade A and Grade B requirements, and all the commercially available, high density, phosphate ester hydraulic fluids that meet AS1241, Type IV, Class 2 requirements. Fluid soak tests shall be performed in each fluid independently. Test requirements will remain the same for all test fluids.

3.3 Design and Construction

3.3.1 Shape and Dimensions

The shape and dimensions of packing rings and elastomer seal elements shall conform to the applicable standard.

3.3.2 Physical Properties

3.3.2.1 Specific Gravity

Specific gravity shall be determined by test and shall not vary more than ± 0.02 from this value in normal production when tested (see 4.3.3.1). For definitions of terms relating to density and specific gravity, refer to ASTM E1547.

3.3.2.2 Hardness

Durometer rating shall be a nominal 80 Type M hardness and shall not vary by more than ± 5 points when tested (see 4.3.3.2) from the cited rating during qualification.

3.3.2.3 Volumetric Swell

Volumetric swell shall be reproduced within $\pm 2\%$ of the original value as determined when tested (see 4.3.3.3).

3.3.2.4 Tensile and Elongation

Tensile and elongation shall not be less than the values stated when tested (see 4.3.3.4). On production batches the tensile strength shall not vary more than 15% from the values determined in the referenced section as long as minimum requirements are met.

3.3.2.5 Cold Temperature Retraction

Cold temperature retraction TR-10 shall be no warmer than the following values when tested (see 4.3.3.5).

<u>Test Specimens</u>	<u>TR-10</u>	<u>TR-70</u>
As Received Specimen	-50 °F	-18 °F
Specimens Soaked in Phosphate Ester Test Fluids for 70 $\pm$ 2 Hours at 160° $\pm$ 4 °F	-52 °F	-3 °F

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3.3.2.6 Compression Set

The compression set values shall be obtained from testing (see 4.3.3.6) three (3) NAS1611-330A O-rings at the temperature cited.

3.3.2.7 High Temperature Air Aging

The durometer, tensile, and elongation shall be within the following values when tested (see 4.3.3.7).

Properties	Maximum Allowable Change from the Original Values
Durometer Shore M	+10 points
Tensile, PSI	-25%
Elongation	-10%

3.3.2.8 Modulus at 100% Elongation

The tensile stress at 100% elongation shall be no less than the following values when tested (see 4.3.3.8).

NAS1611-214A O-Rings as received.....	800 PSI (Minimum)
NAS1611-214A O-Rings soaked in phosphate ester test fluids for the various fluids soak test times at the various test temperatures	500 PSI (Minimum)

3.3.2.9 Corrosion and Adhesion

When tested (see 4.3.3.9) there shall be no adhesion of the seal material to the metals. There shall be only slight evidence of pitting, erosion, corrosion or discoloration on the steel and aluminum plates as shown by the following procedure, unless metallic plates are entirely unaffected by the test.

The surfaces of the plates that were in contact with the seals shall be inspected for discoloration, deposits, pitting, etc. If any exist, the surface of the plates shall be washed in naphtha. Deposits determined as rubber compounds or elements therefrom, which do not occur on the separate control plates, shall be construed as adhesion.

If any other marks remain on the surface of the plates after the above step, the surfaces shall be lightly polished with a nonabrasive cloth buff. Any pits or eroded marks remaining after this process shall be construed to be corrosion. Discoloration or staining (marks which do not physically affect the surface of the plates and which easily wash or buff off) shall not be considered detrimental. If any doubt should arise about the presence of pitting, erosion or corrosion on the metal plates, a microscope of 10 to 15 power magnification shall be used to determine the actual condition.

3.3.2.10 Material Traceability and Compound Confirmation

An FTIR spectra, a TGA curve, and a DSC curve confirming degree of cure will be made from a randomly chosen qualification sample in accordance with 4.3.3.10. These curves and spectra will be properly dated, recorded and maintained as a permanent record to identify the material being qualified. After qualification, production material shall be the same as qualified as evidenced by similar curves being produced on randomly chosen production items. This data can be requested during procurement to verify that no compound or process changes have been made or the curves can be requested during quality audits. It is the responsibility of the manufacturer to maintain these records, traceable to batch production, for a period of five years from the recorded production date. The qualification data will remain on permanent file for audit purposes. If the formulation of the qualified compound changes then full requalification to all the specification requirements is required.

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