



# AEROSPACE MATERIAL SPECIFICATION



AMS-P-25732A

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Superseding AMS-P-25732

Packaging, Preformed, Petroleum Hydraulic  
Fluid Resistant, Limited Service at 275°F (135°C)

## CANCELLATION NOTICE

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## NOTICE

This document has been taken directly from U.S. Military Specification MIL-P-25732C, Amendment 1, and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-P-25732C, Amendment 1. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Any material relating to qualified product lists has not been adopted by SAE. This material was part of the original military specification and is reprinted here for historic reference only.

## 1. SCOPE:

## 1.1 Scope:

This specification covers O-ring packings for use with petroleum based hydraulic fluids conforming to MIL-H-5606 and MIL-H-83282 over the temperature range of -65° to 275°F (-54° to 135°C).

## 1.2 Sizes:

The O-rings conform to sizes shown in MS28775.

## 2. APPLICABLE DOCUMENTS:

The following publications, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

### 2.1 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-P-4861 Packing, Preformed, Rubber, Packaging of  
MIL-G-5514 Gland Design, Packings, Hydraulic, General Requirements for  
MIL-H-5606 Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordinance  
MIL-H-6083 Hydraulic Fluid, Petroleum Base, for Preservation and Operation  
MIL-S-18729 Steel Plate, Sheet, and Strip, Alloy 4130 Aircraft Quality  
MIL-H-83282 Hydraulic Fluid, Fire, Resistant, Synthetic Hydrocarbon Base, Aircraft

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes  
MIL-STD-413 Visual Inspection Guide for Rubber O-rings

MS-28775 Packing O-rings, Hydraulic +275°F

QQ-A-250/4 Aluminum Alloy 2024, Plate and Sheet  
QQ-A-250/11 Aluminum Alloy 6061, Plate and Sheet  
QQ-A-250/12 Aluminum Alloy 7075, Plate and Sheet

### 2.2 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 5513 Steel, Corrosion Resistant, Sheet, Strip, and Plate, 19Cr - 9.2Ni (SAE 30304), Solution Heat Treated  
AMS 5630 Steel, Corrosion Resistant, Bars, Wire, 17Cr - 0.52Mo (0.95 - 1.20C) (SAE 51440C)

### 2.3 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 1414 Rubber O-rings

### 2.4 ANSI Publications:

Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI B46.1 Surface Texture (Surface Roughness, Waviness, and Lay)

### 3. REQUIREMENTS:

#### 3.1 Qualification:

The packings furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.3).

#### 3.2 Materials:

The packings shall be manufactured from a synthetic rubber which is compatible with hydraulic fluid conforming to MIL-H-5606. The polymeric ingredient of the synthetic rubber shall be a copolymer of butadiene/acrylonitrile. The finished product shall contain no substance which will adversely affect the properties of the fluid or the packings.

#### 3.3 Dimensions and tolerances:

The dimensions and tolerances of O-rings procured to this specification shall conform to MS28775.

#### 3.4 Physical properties:

The physical properties of the rubber shall conform to values given in Table I.

##### 3.4.1 Variations: The permissible variations in physical properties during actual production from those values obtained in the qualification tests shall be as follows:

- a. Specific gravity  $\pm 0.02$
- b. Tensile strength, percent  $\pm 20$
- c. Elongation, percent  $\pm 20$  (ultimate elongation shall not be less than 160%)

In addition, all physical properties tested shall meet the requirements specified in Table I.

#### 3.5 Dynamic cycling:

When tested in accordance with 4.7, the O-rings shall withstand a minimum of 75,000 cycles without failure. Failure is determined as that number of cycles at which a test ring leaks a total of 70 ml of hydraulic fluid. Each test consists of 2 test cells containing 2 test rings each. A minimum of 3 test runs shall be conducted making a total of 6 test cells to be tested. The number of cycles until failure shall be recorded. The highest number of cycles and the lowest number of cycles shall be discarded. The remaining 4 values shall be averaged and that value must be 75,000 minimum for the O-rings to pass the test.

Table I. Physical properties

Original properties	Requirements
Specific gravity	As determined
Hardness, Type A, points	68, minimum
Tensile strength, psi	1350, minimum
Elongation, percent	160, minimum (may not be lower than 160% in production)
Tensile stress (modulus) psi at 100 percent elongation	500, minimum
Temperature Retraction, TR-10 50 percent elongation and 10 percent return, °F	-49, maximum
Corrosion and adhesion	Slight corrosion allowed on 4130 steel, none on other metals
After aging 70 hours at 275° ± 5°F in MIL-H-5606	
Hardness change, Type A, points	+5, -15
Tensile strength decrease, percent	50, maximum
Elongation decrease, percent	35, maximum
Volume change, percent	1 to 20
Compression set, 25 percent deflection percent of original deflection	55, maximum
Temperature retraction TR-10 50 percent elongation and 10 percent return, °F	-49, maximum
After aging 70 hours at 275° ± 5°F in MIL-H-83282	
Hardness change, Type A, points	±10
Tensile strength decrease, percent	40, maximum
Elongation decrease, percent	45, maximum
Volume change, percent	0.5 to 15
Compression set, 25 percent deflection, percent of original deflection	55, maximum
Temperature retraction, TR-10 50 percent elongation and 10 percent return, °F	-47, maximum

### 3.6 Identification:

All O-rings shall be individually packaged. Each envelope shall have the following information printed on the outside:

National stock number  
Military part number  
Material specification  
Manufacturer's name  
Manufacturer's compound number  
Manufacturer's batch number  
Contract number  
Cure date.

## 4. QUALITY ASSURANCE PROVISIONS:

### 4.1 Responsibility for inspection:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facility suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

### 4.2 Classification of tests:

The inspection and testing of the rubber shall be classified as follows:

- a. Qualification tests (see 4.3).
- b. Quality conformance inspection (see 4.4).

### 4.3 Qualification tests:

4.3.1 Samples: Test samples shall be O-rings conforming to Size -214 of MS-28775. Size -218 O-rings are also required for dynamic cycling test (see 4.7). Hardness shall be determined on hardness discs of at least 1/4 inch thickness.

4.3.2 Tests: Qualification tests shall consist of all the tests specified in 4.6 and 4.7.

#### 4.4 Quality conformance inspection:

- 4.4.1 Sampling for inspection: Sampling for quality conformance inspection shall be in accordance with MIL-STD-105, except where otherwise indicated herein. Quality conformance tests are required for all production batches of material.
- 4.4.1.1 Batch: A batch shall be the quantity of material compounded on a mill or mixer at one time. A batch will always have to include MS28775-214 O-rings and hardness discs for quality conformance tests. A batch shall consist of a maximum of 200 pounds. Quality conformance tests shall be conducted on each 200 pounds if the batch size is more than 200 pounds.
- 4.4.2 Quality conformance test samples: The test samples shall be Size -214 O-rings conforming to MS-28775. Hardness discs shall be used for hardness determinations.
- 4.4.3 Inspection of materials and components: The supplier is responsible for insuring that materials and components used were manufactured, tested, and inspected in accordance with referenced subsidiary specifications and standards to the extent specified, or if none, in accordance with this specification (see 4.1). In the event of conflict, this specification shall govern. Inspection records shall be kept complete and available to the procuring activity at all times.
- 4.4.4 Inspection of the end item: Examination of the end item shall be in accordance with the classification of defects, inspection levels, and acceptable quality levels (AQL's) set forth herein. The lot size, for the purpose of determining the sample size in accordance with MIL-STD-105, shall be expressed in units of O-rings.
- 4.4.4.1 Examination for defects in appearance and workmanship: The examination shall be in accordance with MIL-STD-413. The sample size shall be in accordance with inspection level II of MIL-STD-105, and the AQL related to percent defective shall be 1.5.
- 4.4.4.2 Examination for dimensional defects: The examination shall be made to the tolerances specified in MS28775. Each size must be inspected for dimensional and tolerance conformance. Each size must be independent of other sizes for sampling quantities. The sample size shall be in accordance with inspection level II of MIL-STD-105 and the AQL related to percent defective shall be 1.5.
- 4.4.4.3 Examination for defects in preparation for delivery: An examination shall be made to determine that the packaging, packing, and markings comply with Section 5. The sample unit for this examination shall be one shipping container fully packed, selected just prior to the closing operation. Shipping containers fully prepared for delivery shall be examined for closure defects.

<u>Examine</u>	<u>Defect</u>
Packaging	Not the level specified. Not packaged as specified or required. Packaging material, closures not as specified.
Packing	Not level specified; not in accordance with contract requirements. Container not as specified, closures not accomplished by specified or required methods or materials. Any nonconforming component, component missing, damaged or otherwise defective, affecting serviceability. Inadequate application of components, such as incomplete closure of case liners, containing flaps loose or inadequate strapping, bulged or distorted containers.
Count	Less than specified or indicated quantity.
Weight	Gross weight exceeds specified requirements.
Markings	Interior or exterior markings, as applicable, omitted, illegible, incorrect, incomplete or not in accordance with contract requirements. Date of cure, storage instruction missing.

The sample size shall be in accordance with inspection level II of MIL-STD-105 and the AQL related percent defective shall be 2.5.

4.4.5 Quality conformance tests: The following tests shall be conducted on each batch of material (see 4.4.2):

Original

Specific gravity  
Hardness  
Tensile strength  
Elongation  
Tensile stress  
Temperature retraction

Fluid aged 70 hours at  $275^{\circ} \pm 5^{\circ}\text{F}$  in MIL-H-5606

Compression set  
Temperature retraction  
Hardness change  
Volume change

Size -214 per MS-28775 shall be used as test samples.

Hardness discs shall be used for the hardness test.

4.4.5.1 Rejection criteria: A lot shall be rejected upon the failure of any sample to meet the test requirements specified herein. A lot that has been rejected may be reworked to correct the deficiencies and resubmitted for acceptance.

4.5 Test conditions:

4.5.1 Fluid: The fluid aging in this specification shall be conducted using hydraulic fluids qualified to MIL-H-5606 and MIL-H-83282, as applicable. New fluid shall be used for each aging test.

4.5.2 Atmospheric conditions: All fluid cooling, conditioning, and physical property determinations shall be conducted in an atmosphere of  $50 \pm 15$  percent relative humidity and at a temperature of  $75^{\circ} \pm 5^{\circ}\text{F}$ .

4.6 Test methods:

4.6.1 Physical properties: Unless otherwise specified herein, physical properties shall be determined in accordance with ASTM D 1414.

4.6.2 Fluid aging: The containers used for fluid aging shall be of the conventional fruit - jar type. The cover for the container shall be either the two piece (lid and ring) fruit - jar type, except that the lid shall be inverted in order that the lid's flat surface comes in contact with the sealing surface of the container, or a glass cover held firmly in place by a wire - lever apparatus. Unclean, uneven sealing surfaces of the cover and container and oil contact with the sealing surfaces shall be avoided. During oil aging the O-rings shall be suspended in the oil by a glass or nichrome wire rack in such a manner that the O-rings will not come in contact with any part of the container. The hardness discs shall be placed loosely in the jars. Immediately after the aging period and before physical property determinations, the O-rings and hardness discs shall be cooled in new fluid for a period of not less than 30 minutes at  $77^{\circ} \pm 5^{\circ}\text{F}$ .

4.6.3 Corrosion and adhesion: Size -214 O-rings, two for each metallic plate below and using whole uncut rings, shall be prepared for corrosion testing by inserting sufficient quantities of the seals in a desiccator or similar humidity chamber maintained at 92 percent minimum relative humidity and  $75^{\circ} \pm 5^{\circ}\text{F}$  for at least 72 hours. Plates of the metals listed below shall be polished to a surface roughness of 4 to 16 RHR in accordance with ANSI B46.1. The edges shall also be polished to reduce the formation of edge corrosion. The plates shall be washed with toluene or aliphatic naphtha, or similar degreasing agent that will produce a clean dry surface free from film. The metals used shall be as follows:

QQ A-250/4	Aluminum Alloy 2024
QQ A-250/11	Aluminum Alloy 6061
QQ A-250/12	Aluminum Alloy 7075
AMS-5630	440C Stainless Steel
AMS-5513	304 Stainless Steel
MIL-S-18729	4130 Steel, Aircraft Quality

The humidified seals and the metallic plates shall be immersed in MIL-H-6083, Type I fluid and drained to the drop point. The seals and plates shall then be so laid together in a stack that at least two whole seals contact each specified metal. The stack shall be held together with a pressure of 20 to 30 pounds and placed in a desiccator which is maintained at not less than 92 percent relative humidity at  $75^{\circ} \pm 5^{\circ}\text{F}$ . This relative humidity may be produced by the use of a salt of sufficient concentration in solution with distilled water. No more than 15 minutes should be required for assembling the test samples. Time of humidity exposure for this portion of test shall be 14 days. At the termination of this test, the procedures outlined below shall be followed:

- a. The surface of the plates which were in contact with the seals shall be inspected for discoloration, deposits, pitting, or other evidence of corrosion or adhesion. If any exist, the surfaces of the plates shall be washed in aliphatic naphtha. Deposits determined as rubber compounds or elements therefrom, which can be removed by this process and which do not occur on other surfaces of the plates, shall be construed as adhesion.
- b. 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 surfaces 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 from the O-rings, a microscope of approximately 10- to 15-power magnification shall be used to determine the actual conditions.

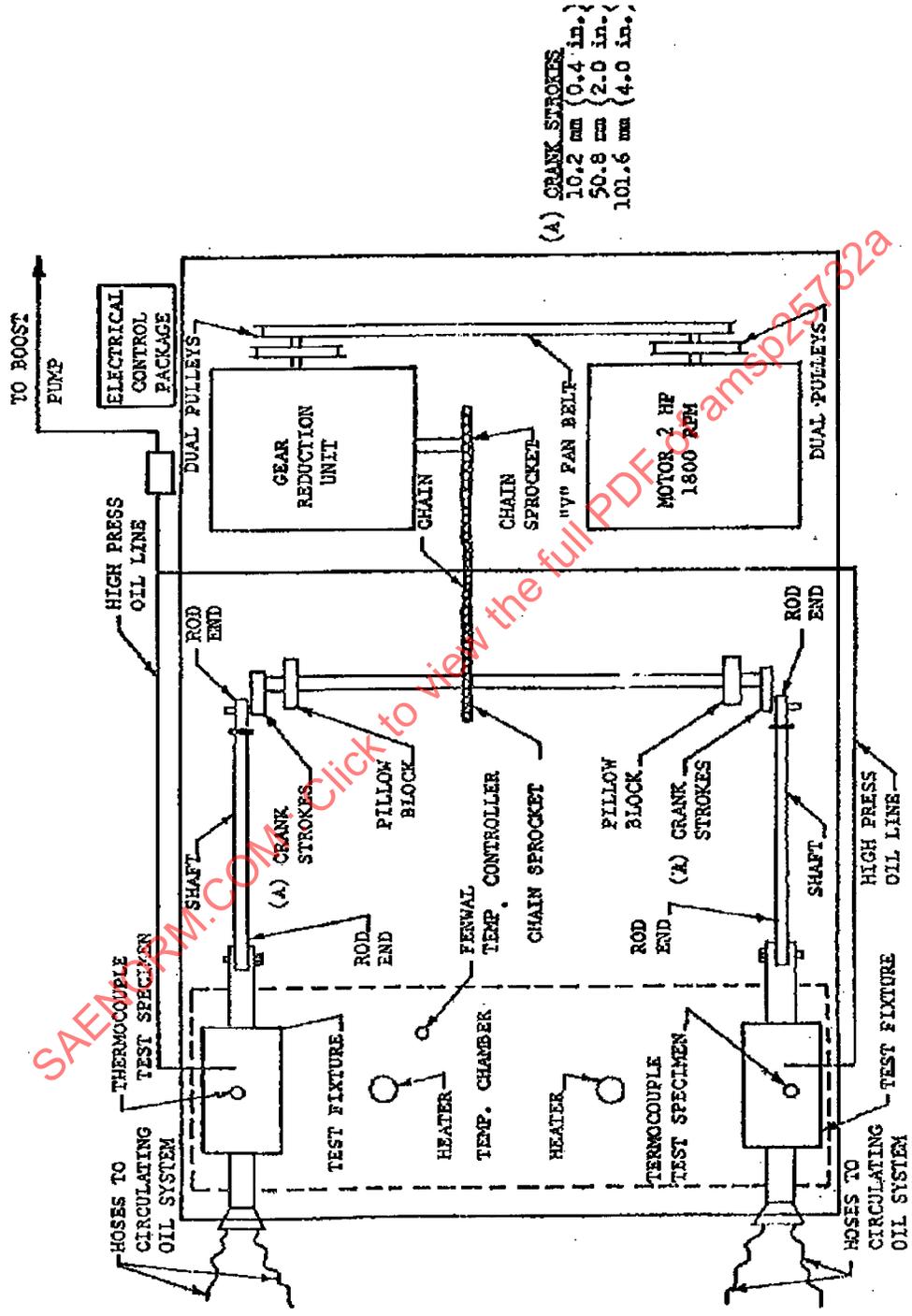


FIGURE 1. O-RING CYCLE TEST SET UP

#### 4.7 Dynamic cycling:

The dynamic cycling shall be performed on a rod seal test apparatus. The apparatus, as shown in Figure 1, is capable of evaluating O-rings under a high pressure, high temperature, cycling environment until failure. The apparatus is capable of testing four O-rings simultaneously. Two test cells are run concurrently with two O-rings in each cell. A test cell is shown in Figure 2. The testing environments are as follows:

- a. Test temperature - 275°F (135°C).
- b. Pressure - 1500 psig (10,300 kPas).
- c. Stroke length - 4 inches (10.2 cm).
- d. Cycling rate - 30 cycles/min where one cycle is defined as both the forward and return strokes.
- e. Pressure is to be applied for one complete cycle and pressure is to be reduced to zero during the next cycle.
- f. Hydraulic fluid - MIL-H-5606
- g. Tests are to be conducted without back-up rings. A steel spacer is to be used to maintain the proper gap dimension.
- h. Diametral clearance between rod and cell to be maintained at 0.004 inch (0.0102 cm).
- i. Surface finish on test rods to be between 10-20 micro-inches.

#### 4.7.1 Procedure: The procedure to be used in conducting dynamic O-ring evaluations is as follows:

- a. Select 4 size 214 unaged or unconditioned O-rings.
- b. Lubricate the rings with fresh MIL-H-5606 hydraulic fluid and assemble the rings and spacers into the test cylinders as shown in Figure 3.
- c. Rod and gland dimensions are to conform to MIL-G-5514.
- d. Fill with MIL-H-5606 hydraulic fluid taking care to exclude entrapped air.
- e. Bleed system at test cell locations to remove entrapped air in lines.
- f. Check of final test cells installation in test fixtures and insure that the test cells do not translate along the rod by more than 0.005 inch (0.0127 cm).