



AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AMS 7273B
Superseding AMS 7273A

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RINGS, SEALING, FLUOROSILICONE RUBBER
High Temperature Fuel and Oil Resistant
70 - 80

1. SCOPE:

1.1 Form: This specification covers a fluorosilicone rubber in the form of molded rings.

1.2 Application: Sealing rings for use from -55°C (-70° to $+175^{\circ}\text{C}$) (-70° to $+345^{\circ}\text{F}$) in fuels and from -55° to $+150^{\circ}\text{C}$ (-70° to $+300^{\circ}\text{F}$) in lubricating oils. The cross-section of such rings is usually not over 0.275 in. (7 mm) in diameter or thickness.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) and Aerospace Standards (AS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

AMS 2817 - Packaging and Identification, Performed Packings

AMS 3021 - Reference Fluid for Testing Di-Ester (Polyol) Resistant Material

AMS 5645 - Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant, 18Cr - 10Ni - 0.40Ti (SAE 30321)

AMS 5646 - Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant, 18Cr - 11Ni - 0.60 (Cb+Ta) (SAE 30347)

2.1.2 Aerospace Standards:

AS 568 - Aerospace Size Standard for O-Rings

AS 871 - Manufacturing and Inspection Standards for Preformed Packings (O-Rings)

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be compound based on a fluorosilicone elastomer, suitably cured to produce sealing rings meeting the requirements of 3.2.

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade or those used by governmental agencies is entirely voluntary. There is no agreement to adhere to a SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

3.2 **Properties:** Rings shall conform to the following requirements; tests shall be performed on the rings supplied and, except as otherwise specified, in accordance with ASTM D1414, insofar as practicable. Tensile strength testing is not required on rings which are too small to permit assembly on rollers and are, after cutting, too short to permit testing as a single strand. Eliminating testing for tensile strength does not eliminate testing for elongation; elongation test can be made by stretching a ring over a mandrel of a size which will stretch the ring sufficiently to produce the required elongation when figured on the ID of the ring.

3.2.1 **As Received:**

3.2.1.1	Hardness, Durometer "A" or equiv.	75 ± 5
3.2.1.2	Tensile Strength, min	800 psi (5.52 MPa)
3.2.1.3	Elongation, min	100%
3.2.1.4	Tensile Stress at 100% Elongation	700 - 1000 psi (4.83 - 6.9 MPa)
3.2.1.5	Corrosion	Nil
3.2.1.6	Specific Gravity	Qualification Value ±0.03

3.2.2 **Aromatic Fuel Resistance:**
(Immediate Deteriorated Properties)

Medium: ASTM D471, Ref. Fuel B
Temperature: 20° - 30° C
(68° - 86° F)
Time: 70 hr ± 0.5

3.2.2.1	Hardness Change, Durometer "A" or equiv.	-10 to 0
3.2.2.2	Tensile Strength Change, max	-30%
3.2.2.3	Elongation Change, max	-15%
3.2.2.4	Volume Change	0 to +20%

∅ 3.2.3 **Lubricating Oil Resistance:**

Medium: AMS 3021
(See 8.2)
Temperature: 150° C ± 3
(302° F ± 5)
Time: 70 hr ± 0.5

3.2.3.1	Hardness Change, Durometer "A" or equiv.	-10 to 0
3.2.3.2	Tensile Strength Change, max	-25%
3.2.3.3	Elongation Change, max	-20%
3.2.3.4	Volume Change	0 to +12%

3.2.4 **Dry Heat Resistance:**

Temperature: 200° C ± 3
(392° F ± 5)
Time: 70 Hr ± 0.5

3.2.4.1	Hardness Change, Durometer "A" or equiv.	-5 to +5
3.2.4.2	Tensile Strength Change, max	-10%
3.2.4.3	Elongation Change, max	-15%
3.2.4.4	Bend (Flat)	No cracking or checking

3.2.5 Compression Set:

Temperature: 175°C ± 3
(347°F ± 5)
Time: 22 hr ± 0.25

Percent of Original Deflection	
Ring Cross Section Diameter	
0.066 to 0.110 in., incl	50
(1.68 to 2.75 mm, incl)	
Over 0.110 in. (2.75 mm)	30

3.2.6 Low-Temperature Resistance:

Temperature Retraction,	
TR ₁₀ point, max	-55°C (-67°F)

3.2.7 Simulated Component Test: Pass 4.5.1

3.3 Quality: Rings shall be uniform in quality and condition, clean, smooth, and free from foreign material and from internal and external imperfections detrimental to performance of parts. Surface imperfections shall, unless otherwise specified, be no greater than permitted by AS 871 for minor defects.

3.4 Sizes and Tolerances: Shall be as specified on the drawing. Inspection for conformance to dimensional requirements shall be made in accordance with AS 871, unless otherwise agreed upon by purchaser and vendor.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of rings shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.6. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the rings conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to the following requirements are classified as acceptance tests and shall be performed on each lot:

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
Tensile Stress, as received	3.2.1.4
Specific Gravity, as received	3.2.1.6
Volume Change in fuel	3.2.2.4
Compression Set	3.2.5

4.2.2 Periodic Tests: Tests to determine conformance to the following requirements are classified as periodic tests and shall be performed at a frequency not longer than six months:

Requirement	Paragraph Reference
Corrosion, as received	3.2.1.5
Tensile Strength Change in oil	3.2.3.2
Elongation Change in oil	3.2.3.3
Volume Change in oil	3.2.3.4
Hardness Change after dry heat exposure	3.2.4.1
Bend after dry heat exposure	3.2.4.4
Temperature Retraction, TR ₁₀ point	3.2.6
Simulated Component Test	3.2.7

- 4.2.3 Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification tests and shall be performed on the first-article shipment of rings to a purchaser, when a change in material or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.
- 4.2.3.1 For direct U.S. Military procurement, substantiating test data and, when requested, qualification test material shall be submitted to the cognizant qualification agency as directed by the procuring activity, the contracting officer, or the request for procurement.
- 4.3 Sampling: Sufficient rings shall be taken at random from each lot to perform all required tests; the number of tests for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three, except that the simulated component test shall be run on one specimen of each required size.
- 4.3.1 A lot shall be all rings of the same size from the same batch of compound processed in one continuous run and submitted for vendor's inspection at one time plus rings as required for the simulated component test when the sizes used for that test are not part of the lot.
- 4.3.2 A batch shall be the quantity of compound run through a mill or mixer at one time.
- 4.4 Approval:
- 4.4.1 Sample rings shall be approved by purchaser before rings for production use are supplied, unless such approval be waived. Results of tests on production rings shall be essentially equivalent to those on the approved samples.
- 4.4.2 Vendor shall establish for each size of ring parameters for the control factors of processing which will produce rings meeting the technical requirements of this specification. These shall constitute the approved procedure and shall be used for manufacturing production rings. If necessary to make any change in parameters for the control factors of processing, vendor shall submit for reapproval a statement of the proposed changes in material and processing and, when requested, sample rings. Production rings incorporating the revised procedures shall not be shipped prior to receipt of reapproval.
- 4.4.2.1 Control factors for producing rings include, but are not limited to, the following:
- Compound ingredients or 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, temperature, and pressure (variations of $\pm 10\%$ are permissible)
 - Finishing methods
 - Methods of routine inspection
- 4.4.2.1.1 Any of the above control factors of processing for which parameters are considered proprietary by the vendor may be assigned a code designation. Each variation in such parameters shall be assigned a modified code designation.
- 4.5 Test Methods:
- 4.5.1 Simulated Component Test: Sample rings shall pass the following test; any loss of test fluid in excess of "weeping" at any time or pressure on any fixture will be considered failure. Weeping is defined as the formation of small bubbles at a rate not greater than 10 per min. and which do not break the surface of the oil when tested under oil, and as slight wetting of the area around the fitting, with no visible flow of fuel, when tested in air.
- 4.5.1.1 Test Specimens: Shall be O-rings conforming in dimensions to AS 568-018, -120, and -214.

- 4.5.1.2 **Apparatus:** Shall consist of special blocks and plugs, as shown in Figs. 1 and 2, to be assembled as shown in Fig. 3, plus associated valves, piping, fittings, and means of applying nitrogen at pressures up to 1500 psig (10,300 kPa gage pressure) as shown in Fig. 4.
- 4.5.1.3 **Procedure:** The following tests shall be run in sequence, holding for 10 min., unless otherwise specified, at each pressure. In raising pressure, any momentary leaking while O-rings are seating themselves shall be disregarded. If escape of test fluid in excess of weeping occurs, the test shall be discontinued at that step; if no escape of test fluid in excess of weeping occurs, the test shall be continued to the next step.
- 4.5.1.3.1 Fill recesses in blocks with ASTM Reference Fuel B (ASTM D471). Wipe specimens with ASTM No. 1 oil (ASTM D471) to provide a lubricating oil film. Assemble specimens in their respective grooves in the plugs and assemble plugs to blocks. Tighten bolts to 90 - 100 lb-in. (10.2 - 12.4 N·m) torque. Fill test fixtures to top of each fitting, using a hypodermic syringe, with ASTM Reference Fuel B. Test for leakage at room temperature, using 100 psi (690 kPa) nitrogen pressure. If escape of test fluid in excess of weeping occurs, disassemble and reassemble test fixture, refill as necessary with ASTM Reference Fuel B, and again pressure test.
- 4.5.1.3.2 Place fixture in a suitable oil bath in an oven at $175^{\circ}\text{C} \pm 3$ ($347^{\circ}\text{F} \pm 5$), attach pressure lines (See Fig. 4), and close all valves. (A suitable oil is one which is clear, light in color, and stable at the test temperature (See 8.3)). Heat fixture at $175^{\circ}\text{C} \pm 3$ ($347^{\circ}\text{F} \pm 5$) for 6 hr ± 0.25 . Pressure test, using nitrogen as the pressurizing medium, at 250, 500, 1000, and 1500 psig (1725, 3450, 6900 and 10,300 kPa gage pressure, respectively), noting any leakage by bubble formation in the oil. The valve systems shall be used to isolate leakage of any particular ring.
- 4.5.1.3.3 Shut off heat input to the oven, allow apparatus to cool to room temperature, and release pressure. Remove fixture from the oil bath (See 8.3) and pressure test at room temperature in air at pressure of 250, 500, 1000, and 1500 psig (1725, 3450, 6900, and 10,300 kPa gage pressure, respectively) for 5 min. ± 1 at each pressure, using nitrogen as the pressurizing medium.
- 4.5.1.3.4 Place the fixture, still filled with ASTM Reference Fuel B at atmospheric pressure, in refrigerator at $-55^{\circ}\text{C} \pm 1$ ($-67^{\circ}\text{F} \pm 2$) for 5 hr ± 0.25 . While still in the refrigerator, pressure test at 250, 500, 1000, and 1500 psig (1725, 3450, 6900, and 10,300 kPa gage pressure, respectively) for 5 min. ± 1 at each pressure, using nitrogen as the pressurizing medium.
- 4.5.1.3.5 Remove the fixture from the refrigerator, warm to room temperature, and pressure test as in 4.5.1.3.3.
- 4.5.1.3.6 Repeat the tests of 4.5.1.3.2 through 4.5.1.3.5 twice, making a total of 3 complete cycles. At the conclusion of the final cycle, disassemble the fixture and examine the rings. There shall be no evidence of extrusion, cracking, splitting, and other defects.

4.6 Reports:

- 4.6.1 The vendor of rings shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the rings conform to other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, vendor's compound number, batch number, part number, and quantity.
- 4.6.2 In addition to the reports of 4.6.1, the vendor shall furnish at six-month intervals, the results of tests to determine conformance to the periodic test requirements. This report shall be included with, or shall form a part of, the report of results of acceptance tests on the first lot of rings shipped following determination of conformance to the periodic test requirements.

4.7 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the rings may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the rings represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Marking: Rings shall be packaged and identified as follows:

5.1.1 Individual rings shall be packaged and identified in accordance with AMS 2817 except cure date is not required.

5.1.2 Ring packages shall be packed in cartons in such a manner that the rings, during shipment and storage will not be permanently distorted and will be protected against damage from exposure to weather or any normal hazard. Each carton shall be marked to show not less than the following information:

AMS 7273B
PART NUMBER _____
PURCHASE ORDER _____
QUANTITY _____
COMPOUND NUMBER _____
BATCH NUMBER _____
MANUFACTURER'S IDENTIFICATION _____
DATE OF SHIPMENT _____

5.1.3 Cartons shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the rings to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.1.4 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-794, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.1.1, 5.1.2, and 5.1.3 will be acceptable if it meets the requirements of Level C.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Rings not conforming to this specification or to authorized modifications will be subject to rejection.

8. NOTES:

8.1 Marginal Indicia: The phi (ϕ) symbol is used to indicate technical changes from the previous issue of this specification.

8.2 Test Fluid: AMS 3021 Fluid may be ordered as Stauffer Blend No. 7700 from:

Stauffer Chemical Company
Special Chemical Division
289 Park Avenue
New York, NY 10017

8.3 Immersion Fluid: Silicone oils having nominal viscosities between 20 and 50 centistokes at 25°C (77°F) are recommended for use in the high temperature exposure portion (4.5.1.3.2) of the simulated component test; the fluid used should have flash point higher than the exposure temperature.

8.4 For direct U.S. Military procurement, purchase documents should specify not less than the following:

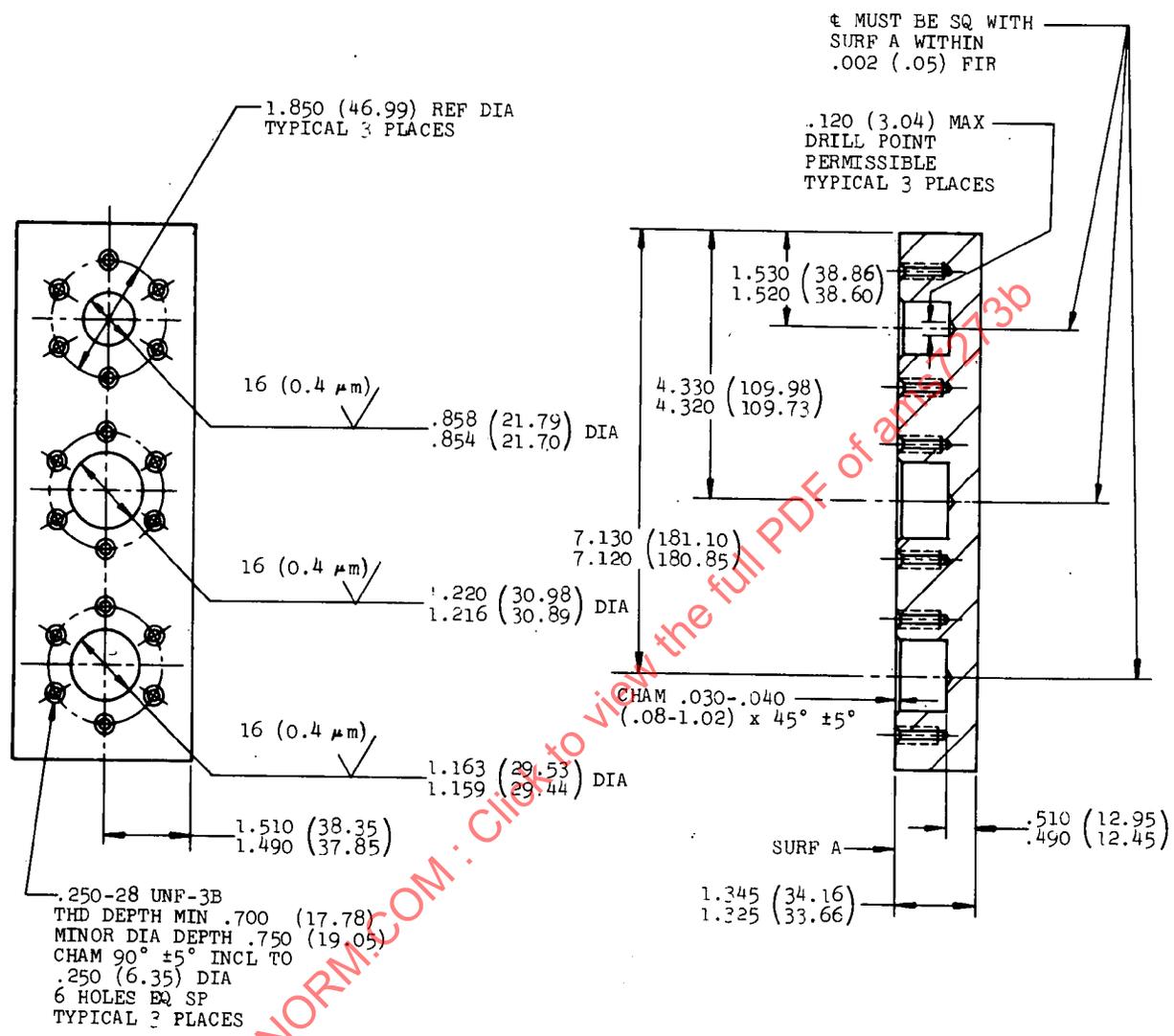
Title, number, and date of this specification

Size of rings desired

Quantity of rings desired

Applicable level of packaging (See 5.1.4)

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DIMENSIONS IN INCHES UNLESS OTHERWISE SHOWN
 () METRIC EQUIVALENT DIMENSIONS
 BREAK EDGES .003-.015 (.08-.38)
 CORNER FILLETS .005-.020 (.13-.51) R
 MATERIAL: AMS 5645 OR AMS 5646

FIGURE 1 - SEALING RING TEST FIXTURE BLOCK