



AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
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RINGS, SEALING, SILICONE RUBBER
Heat-Resistant, Low Compression Set
70 - 80

1. SCOPE:

- 1.1 Form: This specification covers a heat-resistant, low-compression-set silicone rubber in the form of molded rings.
- 1.2 Application: Sealing rings for use at temperatures from -65° to $+260^{\circ}$ C (-85° to $+500^{\circ}$ F) in contact with air. The cross-section of such rings is usually not over 0.275 in. (6.98 mm) in diameter or thickness. Standard sizes are as shown in AS 568.

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), Aerospace Standards (AS), and Aerospace Information Reports (AIR) 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., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2817 - Packaging and Identification, Preformed Packings

2.1.2 Aerospace Standards:

AS 568 - Aerospace Size Standard for O-Rings
AS 871 - Manufacturing and Inspection Standards for Preformed Packings (O-Rings)

2.1.3 Aerospace Information Report:

AIR 851 - O-Ring Tension Testing Calculations

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

ASTM D575 - Compression-Deflection Characteristics of Vulcanized Rubber
ASTM D1414 - Testing Rubber O-Rings

3. TECHNICAL REQUIREMENTS:

- 3.1 Material: Shall be a compound based on a silicone elastomer, suitably cured to produce a product meeting all requirements of this specification.

SAE Technical Board rules provide that: "All technical reports, including standards, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any 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: The product shall conform to the following requirements; tests shall be performed on the product supplied, except for the tests of 3.2.1.4 and 3.2.4, and in accordance with ASTM D1414, insofar as practicable. Testing for tensile strength 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. Calculations of tensile strength and elongation may be made in accordance with AIR 851.

3.2.1 As Received:

3.2.1.1 Hardness, Durometer "A" or equiv. 75 ± 5

3.2.1.2 Tensile Strength, min 650 psi
(4.48 MPa)

3.2.1.3 Elongation, min 125%

3.2.1.4 Compression-Deflection, at 20% deflection, min

4.5.1

At $20^{\circ} - 30^{\circ} \text{C}$ ($68^{\circ} - 86^{\circ} \text{F}$)

200 psi (1.38 MPa)

At $250^{\circ} \text{C} \pm 3$ ($482^{\circ} \text{F} \pm 5.4$)

150 psi (1.03 MPa)

3.2.1.5 Corrosion Nil

3.2.1.6 Specific Gravity, variation from approved sample, max

± 0.05

3.2.2 Lubricating Oil Resistance:
(Immediate Deteriorated Properties)

Medium: ASTM Oil No. 1

Temperature: $175^{\circ} \text{C} \pm 3$

($347^{\circ} \text{F} \pm 5.4$)

3.2.2.1 Hardness Change, Durometer "A" or equiv.

-10 to +5

Time: 70 hr

3.2.2.2 Tensile Strength Change, max (based on area before immersion)

-30%

3.2.2.3 Elongation Change, max

-30%

3.2.2.4 Volume Change

0 to +15%

3.2.3 Dry Heat Resistance:

Temperature: $250^{\circ} \text{C} \pm 3$

($482^{\circ} \text{F} \pm 5.4$)

3.2.3.1 Hardness Change, Durometer "A" or equiv.

-5 to +10

Time: 70 hr

3.2.3.2 Tensile Strength Change, max

-30%

3.2.3.3 Elongation Change, max

-45%

3.2.3.4 Bend (flat)

No cracking or checking

3.2.4 Polymer Reversion:

4.5.2

3.2.4.1 Hardness Change, max, Durometer "A" or equiv.

-10

3.2.5 Compression Set:

Temperature: $225^{\circ}\text{C} \pm 3$
 $(437^{\circ}\text{F} \pm 5.4)$
 Time: 22 hr

Percent of Original Deflection, max
 Ring Cross Section Diameter
 0.066 to 0.110 in. (1.68 to 2.79 mm), incl 70
 Over 0.110 in. (2.79 mm) 60

3.2.6 Low Temperature Resistance:

Temperature Retraction, TR_{10}
 point, max $-42^{\circ}\text{C} (-43.6^{\circ}\text{F})$

3.3 Quality: The product shall be uniform in quality and condition, clean, smooth, as free from foreign material as commercially practicable, and free from internal 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 assure 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 or routine control tests and shall be performed on each lot of rings. A lot of rings is defined as all rings of the same size from the same batch of compound processed in one continuous run and submitted for the vendor's inspection at one time. A batch shall be the quantity of compound run through a mill or mixer at one time.

Test	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, as received	3.2.1.6
Volume Change in oil	3.2.2.4
Compression Set	3.2.5

4.2.2 Periodic Control Tests: Tests to determine conformance to the acceptance tests of 4.2.1 plus the following tests are classified as periodic control tests and shall be performed on rings produced from a production batch of compound at intervals not greater than 6 months.

Test	Paragraph Reference
Corrosion, as received	3.2.1.5
Tensile Strength Change in oil	3.2.2.2
Elongation Change in oil	3.2.2.3
Hardness Change after dry heat exposure	3.2.3.1
Bend after dry heat exposure	3.2.3.4
Temperature Retraction, TR_{10} point	3.2.6

4.2.3 Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification tests and may be the basis for approval of the compound (See 4.4.1).

4.3 Sampling: A sufficient number of rings shall be taken from each lot or batch to perform each required test on three specimens, except that sampling for the compression-deflection and polymer reversion tests shall be as follows:

4.3.1 Specimens for the compression-deflection test shall be disks cut from molded slabs stacked to 0.500 in. ± 0.010 (12.70 mm ± 0.25) thickness.

4.3.2 Specimens for the polymer reversion test shall be disks 1.129 in. ± 0.005 (28.68 mm ± 0.13) in diameter stacked to a total thickness of 0.500 - 0.550 in. (12.70 - 13.97 mm).

4.4 Approval:

4.4.1 Sample rings shall be approved by purchaser before rings for production use are supplied. 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 the control factors of processing which will produce rings meeting all requirements of this specification. These shall constitute the approved procedures and shall be used for manufacturing production rings. If necessary to make any change in control factors of processing which could affect quality or properties of the rings, vendor shall submit for reapproval a statement of the revised procedures and, when requested, sample rings. No production rings incorporating the revised procedures shall 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 and pressure (variations of $\pm 10\%$ are permissible)
Basic and minimum curing temperatures
Finishing methods
Methods of routine inspection

4.4.2.1.1 Any of the above control factors of processing considered proprietary by the vendor may be assigned a code designation. Each variation in such factors shall be assigned a modified code designation.

4.5 Test Methods:

4.5.1 Compression-Deflection: Shall be determined in accordance with ASTM D575, Method A, except using a compression rate of 0.10 in. (2.5 mm) per min. and omitting buffing of the surfaces. For tests at 250°C (482°F), the compression apparatus shall be surrounded by a suitable heater and the specimen and test fixture stabilized at test temperature for 1 hr before applying the load.

4.5.2 Polymer Reversion: Hardness of the stacked disks shall be measured and the specimen placed in the cup of the test fixture (See Fig. 1). The fixture shall be assembled and the screw cap tightened to 25 lb-in. (2.8 N·m) torque. The fixture shall be placed in an oven which is at 250°C ± 3 (482°F ± 5.4) for 6 hr ± 10 min., removed, cooled to room temperature in not less than 2 hr, and disassembled. Test specimen shall be removed and hardness again determined.