AEROSPACE MATERIAL SPECIFICATION

AMS3334™	REV. G

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Superseding AMS3334F

(R) Elastomer: Silicone Rubber (MQ/VMQ/PVMQ)
Extreme Low-Temperature Resistant
35 – 45 Durometer Type 'A'

RATIONALE

For Five-Year Review and to update to latest 3XXX series template.

1. SCOPE

1.1 Form

This specification covers a silicone (MQ/VMQ/PVMQ) elastomer that can be used to manufacture product in the form of sheet, strip, tubing, extrusions, and molded shapes. This specification should not be designated for use in molded O-rings and molded O-ring cord, molded rings, compression seals, molded-in-place gaskets, and plate seals for aeronautical and aerospace applications.

1.2 Application

This material type has resistance to deterioration by weathering and high-aniline-point petroleum-based oils but is not limited to such applications. This material has a typical service temperature range of -112 to +248 °F (-80 to +120 °C) and is compounded especially for operation at extreme low temperatures. The service temperature range of the material is a general temperature range, but the presence of particular fluids and specific design requirements may modify this range. Each application should be considered separately. It is the responsibility of the user to determine that this specification is appropriate for the environments (temperature range, fluids exposure, etc.) in which it is sought to be used.

These products are not normally suitable for use in contact with low-aniline-point petroleum-based fluids, including fuels, due to excessive swelling.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
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SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS3334G/

1.3 Order of Precedence

This specification is in addition to and in no way limiting, superseding, or abrogating any contractual obligation as required by the applicable procurement document. In the event of conflict in requirements, the order of precedence shall be:

1. Statutory and regulatory requirements
2. Procurement document or contractual agreement
3. Applicable purchaser's drawing and/or design data
4. Specifications referenced on the drawings/design data
5. This document
6. All specifications that are referenced in this document

1.4 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 that 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.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2279 Tolerances, Rubber Products

AMS2810 Identification and Packaging, Elastomeric Products

AS5316 Storage of Elastomer Seals and Seal Assemblies Which Include an Elastomer Element Prior to Hardware Assembly

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.

ASTM D297 Standard Test Methods for Rubber Products - Chemical Analysis

ASTM D395 Standard Test Methods for Rubber Property Compression Set

ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension

ASTM D471 Standard Test Methods for Rubber Property - Effect of Liquids

ASTM D573 Standard Test Methods for Rubber Property - Deterioration in an Air Oven Rubber

ASTM D624 Standard Test Methods for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

ASTM D2137 Standard Test Methods for Rubber Property - Brittleness Point of Flexible Polymers and Coated Fabrics

ASTM D2240 Standard Test Methods for Rubber Property Durometer Hardness

2.3 ANSI Accredited Publications

Copies of these documents are available online at https://webstore.ansi.org/.

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

3. TECHNICAL REQUIREMENTS

3.1 Material

The material shall be prepared from ingredients as shall be necessary to achieve the requirements detailed in this standard and shall be a compound that is based on the material specified in 1.1, suitably cured to produce a product meeting the requirements of 3.2. Material shall be based on 100% virgin silicone (MQ/VMQ/PVMQ) elastomer. Reprocessed vulcanized material is not acceptable.

3.2 Properties

The product shall conform to the requirements shown in Table 1.

Table 1 - Properties

Paragraph	Property	Test Sample	Requirement	Test Method
3.2.1	**As Received**			
3.2.1.1	Hardness, Durometer Type “A”	Button or Plied Platens	40 ± 5	ASTM D2240
3.2.1.2	Tensile Strength, Minimum	ASTM Platen	500 psi (3.45 MPa)	ASTM D412, Die C
3.2.1.3	Elongation, Minimum	ASTM Platen	250%	ASTM D412, Die C
3.2.1.4	Tear Resistance, Minimum	ASTM Platen	50 lbf/in (8.75 kN/m)	ASTM D624, Die B
3.2.1.5	Specific Gravity	ASTM Platen	Preproduction Value ±0.03	ASTM D297, Hydrostatic Method
3.2.1.6	Compression Set, Percent of Original Deflection, maximum	Molded Button or ASTM Platen, Plied Discs	30	ASTM D395, Method B Temperature: 212 °F ± 4 °F (100 °C ± 2.2 °C) Time: 22 hours ± 0.25 hours
3.2.1.7	Low Temperature Brittleness, non-brittle @°F	ASTM Platen	All Samples Must Pass No Cracks, No Breaks	ASTM D2137, Method C Temperature: -112 °F ± 5 °F (-80 °C ± 3 °C) Time: 3 minutes
3.2.2	**Dry Heat Resistance - ASTM D573**			
3.2.2.1	Hardness Change, Durometer “A”	Button or Plied Platens	0 to +5	ASTM D573 Temperature: 212 °F ± 2 °F (100 °C ± 1 °C) Time: 22 hours ± 0.5 hour
3.2.2.2	Tensile Strength Change, Maximum	ASTM Platen	-10%	
3.2.2.3	Elongation Change, Maximum	ASTM Platen	-15%	
3.2.2.4	Bend (Flat)	ASTM Platen	No Cracking or Checking	
3.2.3	**Fluid Resistance - ASTM D471 in IRM901**			
3.2.3.1	Hardness Change, Durometer “A”	Button or Plied Platens	-10 to +5	ASTM D471 Temperature: 212 °F ± 2 °F (100 °C ± 1 °C) Time: 70 hours ± 0.5 hour Fluid: IRM901 Reference Fluid
3.2.3.2	Tensile Strength Change, Maximum	ASTM Platen	-30%	
3.2.3.3	Elongation Change, Maximum	ASTM Platen	-15%	
3.2.3.4	Volume Change	ASTM Platen	0 to 15%	
3.2.3.5	Decomposition	ASTM Platen	None	
3.2.3.6	Surface Tackiness	ASTM Platen	None	

3.3 Quality

Product, as received by the purchaser, shall conform to dimensional requirements as specified in the drawing or design data, be uniform in quality and condition, as free from foreign material as commercially practical, and free from internal imperfections (such as voids, etc.) that are detrimental to usage of the product

3.4 Tolerances

Shall be as specified in product design data and/or purchase documents. If not specified in the design data and/or purchase documents, then the tolerances listed in AMS2279 shall apply.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The manufacturer of the product shall be responsible to assure that all required inspection and testing as listed within this specification has been performed and that records of such inspection and testing is available. Unless specified otherwise by contractual requirements, testing may be performed at either the manufacturer's own internal test facility, at the mixer, or at a suitable independent testing facility.

The purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Preproduction Tests

Preproduction testing is defined as the performance of all of the testing listed in 3.2. This testing must be performed upon the initial selection/development of the compound in order for any product to be certified to this specification. If the compound being tested is intended to produce end items by multiple methods of production (e.g. molding, calendering, extruding, etc.), then preproduction testing shall be performed, and kept on file, for specimens that have been processed and vulcanized from each production method. Once performed, a copy of this testing must be kept on file as proof of compliance to this specification and must be made available upon request. Preproduction testing is valid for a period of 5 years and must be re-performed if any of the following occurs:

- At the end of the 5-year validity period
- When a change in ingredients and or process requires reapproval (see 4.5)
- If contractually required to do so by the purchaser

4.2.2 Acceptance Tests

Tests for the following requirements (see Table 2) are acceptance tests and shall be performed on each lot. If test specimens cannot be prepared from the end item, the applicable ASTM method shall be applied using material from the same batch and same state of cure and tested within 90 days of the manufacture subject lot.

Table 2

Ref. Tests from Table 1	Property	Test Sample	Requirements	Test Method
3.2.1	**As Received**			
3.2.1.1	Hardness, Durometer Type "A"	Part	40 ± 5	ASTM D2240
3.2.1.2	Tensile Strength, minimum	Part	500 psi (3.45 MPa)	ASTM D412, Die C
3.2.1.3	Elongation, minimum	Part	250%	ASTM D412, Die C
3.2.1.5	Specific Gravity/Relative Density	Part	Preproduction Value ± 0.03	ASTM D297 Hydrostatic Method
3.2.1.6	Compression Set, Percent of Original Deflection, maximum	Part	30	ASTM D395, Method B Temperature: 212 °F ± 4 °F (100 °C ± 2.2 °C) Time: 22 hours ± 0.25 hour
3.2.1.7	Low-Temperature Brittleness, non-brittle @°F	Part	All Samples Must Pass No Cracks, No Breaks	ASTM D2137, Method C Temperature: -112 °F ± 5 °F (-80 °C ± 3 °C) Time: 3 minutes
3.3	Quality	Part	Dimensional and Imperfections	Paragraph(s) 3.3 and 3.4 and Visual Inspection

4.2.2.1 Lot Acceptance Testing

Should the purchaser require additional or reduced product lot acceptance testing other than what is stated in Table 2, then the details of such testing shall be agreed upon between the purchaser and the manufacturer, shall be defined in the purchase agreement, and/or specified in the design data.

4.2.3 Retesting

4.2.3.1 If any original test fails to meet the specified requirements, the resampling and retesting requirement of the relevant ASTM test method shall be observed (see Note). If the relevant ASTM test method makes no mention of a resampling or retesting requirement, then repeat the test using valid test specimens from the same lot under consideration for product acceptance. If the repeat test using valid test specimens from the same lot under consideration also fails, then it is an indication of a lot-specific process issue; the lot must be reviewed to determine probable cause and the cause resolved (rework or re-sort of the product). After such a review, one additional test set is permitted. If a failure occurs using this one additional test set, then the lot shall be rejected. The same lot and batch of product as was used for the original test shall be used for retesting. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the products represented. If failure is due to a testing error, then the test is considered invalid and new specimens can be issued for testing.

NOTE: Example - as stated in ASTM D412 for tensile tests: Run three samples. If any fail, then two additional samples shall be tested, with test results reporting the median of the five.

4.2.3.2 No batch may be retested more than two times.

4.3 Blending of Compound

If the practice is observed for blending batches, the compounder/manufacturer shall have a material approval process that shall include these minimum requirements:

4.3.1 The original batch numbers and weights utilized in the blended batch shall be documented and easily accessible.

4.3.2 The original batches used shall be the same formulation and the same mix location.

4.3.3 The original batches used in creating a blended batch shall meet all of the acceptance testing criteria of any applicable specifications prior to blending and shall be within shelf-life requirements. If a batch that is selected for blending has exceeded its shelf life, the manufacturer shall run batch acceptance tests per the applicable specification prior to its utilization. If all the values are within the acceptance testing requirements per the applicable specification, then the material is still approved for use. This process shall not exceed a maximum of 1 year for all specifications, and, if beyond 1 year, the manufacturer shall have a process to run a batch/acceptance test prior to extending the shelf life for an additional shelf-life cycle per the applicable specification.

4.3.4 The new, blended batch shall be tested for batch and lot acceptance testing prior to shipment.

4.3.4.1 The new, blended batch shelf life shall be determined based upon the shelf life of the oldest original batch date of manufacture and shall follow the requirements of 4.3.3 used in the blend.

4.3.4.2 Blended material cannot be blended a second time.

4.3.5 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 specimens for each requirement shall be specified in the applicable test procedure.

4.3.5.1 A lot shall be all product of the same size and dimensions, cured from the same batch of compound, processed in one continuous production run, and presented for inspection at one time.

4.3.5.2 A batch shall be the quantity of compound run through a mill or mixer at one time. (If different batches of the same compound are blended, then the compounder/manufacturer shall have a material approval process that shall include the minimum requirements listed in 4.3.)

4.4 Approval

4.4.1 The manufacturer shall use ingredients, manufacturing procedures, processes, and methods of inspection on production products that are essentially the same as those used on the qualification sample. If any change in process control factors procedures is necessary, the manufacturer shall submit, for reapproval to the customer, 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.

4.4.2 The manufacturer shall establish, for each size of product, parameters for the process control factors that will produce products meeting the technical requirements of this specification. These shall constitute the approved procedures and shall be used for manufacturing production of products. If necessary to make any change in parameters for the process control factors, the manufacturer shall submit for reapproval a statement of the proposed changes in ingredients and/or processing. When requested, sample products shall be submitted in accordance with the provisions of 4.1. Products manufactured using a revised procedure shall not be shipped prior to reapproval of qualification in writing.