AEROSPACE MATERIAL SPECIFICATION

AMS3330™	REV. D

Issued 1984-07
Reaffirmed 2001-02
Revised 2023-08

Superseding AMS3330C

Elastomer: Fluorosilicone (FVMQ) Rubber
Fuel and Oil Resistant
45 - 55 Shore A Hardness
For Products in Fuel Systems/Lubricating Oils

RATIONALE

For Five-Year Review and evaluate versus MIL-DTL-25988C and to update to latest 3XXX series template.

1. SCOPE

1.1 Form

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

1.2 Application

This material type has resistance to jet fuel and lubricating oils, but usage is not limited to such applications. This material type has a typical service temperature range of -76°F to +302°F (-60°C to +150°C). 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 exposures, etc.) in which it is sought to be used.

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. Procurement Document or Contractual Agreement and all statutory and regulatory requirements (excluding this document)
2. Applicable purchaser's drawing and/or design data
3. Specifications referenced on the drawing
4. This document
5. All specifications referenced in this document

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS3330D

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 which 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

AMS2629 Fluid, Jet Reference

AMS2810 Identification and Packaging Elastomeric Products

AMS3021 Fluid, Reference for Testing Di-Ester (Polyol) Resistant Material

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 Deterioration in an Air Oven

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

ASTM D1329 Standard Test Methods for Evaluating Rubber Property Retraction at Low Temperatures (TR Test)

ASTM D2240 Standard Test Methods for Rubber Property Durometer Hardness

2.3 U.S. Government Publications

Copies of these documents are available online at https://quicksearch.dla.mil.

MIL-STD-289 Visual Inspection Guide for Rubber Sheet Material

MIL-STD-298 Visual Inspection Guide for Rubber Extruded Goods

MIL-STD-407 Visual Inspection Guide for Rubber Molded Items

2.4 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

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

3.1.1 Color

Unless otherwise specified, the color shall be blue.

(A pigment which has been successfully used is Ferro Blue No. 3247, supplied by Ferro Corporation, 4150 East 56th Street, Cleveland, Ohio 44101 or 1395 Aspen Way, Vista, California 92083. A formula of 1.5 parts of this pigment per 100.0 parts of fluorosilicone is suggested.)

3.2 Properties

The product shall conform to 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	50 ± 5	ASTM D2240
3.2.1.2	Tensile Strength, Minimum	ASTM Platen	900 psi (6.21 MPa)	ASTM D412, Die C
3.2.1.3	Elongation, Minimum	ASTM Platen	200%	ASTM D412, Die C
3.2.1.4	Tear Resistance, Minimum	ASTM Platen	40 ppi (7.0 kN/m)	ASTM D624, Die B
3.2.1.5	Specific Gravity/Relative Density	ASTM Platen	Preproduction Value ±0.03	ASTM D297 Hydrostatic Method
3.2.1.6	Compression Set Percent of Original Deflection, Maximum	ASTM Platen, Plied Discs	15%	ASTM D395, Method B Temperature: 75 °F ± 4 °F (23.9 °C ± 2.2 °C) Time: 70 hours ± 0.25 hour
3.2.1.7	Compression Set Percent of Original Deflection, Maximum	ASTM Platen, Plied Discs	35%	ASTM D395, Method B Temperature: 347 °F ± 4 °F (175 °C ± 2.2 °C) Time: 22 hours ± 0.25 hour
3.2.1.8	Temperature Retraction, TR_{10} Point, °F, Maximum	ASTM Platen	-71 °F (-57 °C)	ASTM D1329 Using an Elongation of 50% of the Original Ultimate Elongation Value
3.2.2	**Dry Heat Resistance - ASTM D573**			
3.2.2.1	Hardness Change, Durometer Type "A"	BUTTON or Plied Platens	-5 to +10	ASTM D573 Temperature: 392 °F ± 4 °F (200 °C ± 2.2 °C) Time: 70 hours ± 0.25 hour
3.2.2.2	Tensile Strength Change, Maximum	ASTM Platen	-25%	
3.2.2.3	Tensile Elongation Change, Maximum	ASTM Platen	-25%	
3.2.2.4	Weight Loss, Maximum	ASTM Platen	-2%	
3.2.3	**Fluid Resistance - AMS3021 - ASTM D471**			
3.2.3.1	Hardness Change, Durometer Type "A"	BUTTON or Plied Platens	-15 to +15	ASTM D471 Temperature: 302 °F ± 4 °F (150 °C ± 2.2 °C) Time: 70 hours ± 0.5 hour Fluid: AMS3021
3.2.3.2	Tensile Strength Change, Maximum	ASTM Platen	-45%	
3.2.3.3	Elongation Change, Maximum	ASTM Platen	-30%	
3.2.3.4	Volume Change	ASTM Platen	+1 to +15%	
3.2.3.5	Compression Set Percent of Original Deflection, Maximum	ASTM Platen, Plied Discs	35%	
3.2.4	**Fluid Resistance - AMS2629, Type 1* - ASTM D471**			
3.2.4.1	Hardness Change, Durometer Type "A", Maximum	BUTTON or Plied Platens	-15	ASTM D471 Temperature: 72 °F ± 4 °F (22.2 °C ± 2.2 °C) Time: 22 hours ± 0.5 hour Fluid: AMS2629, Type 1*
3.2.4.2	Tensile Strength Change, Maximum	ASTM Platen	-55%	
3.2.4.3	Elongation Change, Maximum	ASTM Platen	-50%	
3.2.4.4	Volume Change, Maximum	ASTM Platen	+1 to +25%	
*ASTM D471, Reference Fuel B is an acceptable alternate Test Fluid				

3.3 Quality

Product, as received by the purchaser, shall conform to dimensional requirements, 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 conform to all applicable requirements of AMS2279 unless otherwise specified in drawing, design data, purchase order, or contract.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The manufacturer of the product shall be responsible to assure that all required testing and product inspection has been performed and that test data is available. Unless specified otherwise by contractual requirements, testing may be performed at either the product vendor's own internal test facility, at the mixer, or at a suitable independent test 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 necessary testing required to show that a compound complies with all of the technical requirements of this specification as listed in 3.2 and includes all such testing. This testing must be performed upon the initial development of the compound in order for any product to be certified to this specification. Once performed, a copy of this testing must be kept on file as objective evidence of compliance and must be made available upon request. Preproduction testing is valid for a period of 5 years and must be re-performed if any one of the following occurs:

- At the end of the current 5-year validity period, or
- When a change in ingredients and/or process requires reapproval (see 4.4), or
- If contractually required by the purchaser.

4.2.2 Acceptance Tests

Tests for the following requirements 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	50 ± 5	ASTM D2240
3.2.1.2	Tensile Strength, Minimum	Part	900 psi (7.93 MPa)	ASTM D412, Die C
3.2.1.3	Elongation, Minimum	Part	200%	ASTM D412, Die C
3.2.1.4	Tear Strength, Minimum	Part	40 ppi (7.0 kN/m)	ASTM D624, Die B
3.2.1.5	Specific Gravity/Relative Density	Part	Preproduction Value ±0.03	ASTM D297, Hydrostatic Method
3.2.1.7	Compression Set Percent of Original Deflection, Maximum	Part	35%	ASTM D395, Method B Temperature: 347 °F ± 4 °F (175 °C ± 2.2 °C) Time: 22 hours ± 0.25 hour
3.2.4	**Fluid Resistance AMS2629, Type 1* - ASTM D471**			
3.2.4.4	Volume Change, %	Part	+1 to +25	ASTM D471 Temperature: 72 °F ± 4 °F (22.2 °C ± 2.2 °C) Time: 22 hours ± 0.5 hour AMS2629, Type 1*
3.3	Quality	Part	Dimensional and Visual	Dimensional: per Design Data and 3.4 Visual: per MIL-STD-289, MIL-STD-298, or MIL-STD-407 (as applicable)
*ASTM D471, Reference Fuel B is an acceptable alternate Test Fluid				

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 and 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 re-sampling and retesting requirement of the relevant ASTM test method shall be observed (see Note 1). If the relevant ASTM test method makes no mention of a re-sampling 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 1: Example – 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

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

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

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

4.3.1.3 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.

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

4.3.1.5 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 4.3.1.3 used in the blend.

4.3.1.6 Blended material cannot be blended a second time.

4.3.2 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.

4.3.2.1 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.