AEROSPACE MATERIAL SPECIFICATION

AMS3328™	REV. D

Issued 1984-07
Reaffirmed 2001-04
Revised 2022-05

Superseding AMS3328C

(R) Elastomer: Fluorosilicone Rubber (FVMQ)
Fuel and Oil Resistant
35 - 45 Type "A" Durometer Hardness
for Products Used in Engine Oil Systems/Fuel Systems

RATIONALE

Five-Year Review and to update to the current AMS3XXX template format so as to standardize these documents for ease in interpretation and revision when necessary.

1. SCOPE

1.1 Form

This specification covers a fluorosilicone (FVMQ) rubber in the form of sheet, strip, tubing, extrusions, and molded shapes.

This specification is not to be used for the manufacture of O-rings, molded O-ring cord, or molded in place seals or gaskets for aerospace applications.

1.2 Application

This material type is resistant to jet fuel and lubricating oils, but usage is not limited to such applications. This material type has a typical service temperature range of -70 to +392 °F (-56.7 to +200 °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 exposure, 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. Statutory and Regulatory Requirements,
2. Procurement Document or Contractual Agreement,
3. Applicable purchaser's design data, including the specifications and requirements specified therein,
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/AMS3328D/

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

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 Other Publications

Available from NCSL International, 2995 Wilderness Place, Suite 107, Boulder CO 80301, Tel: 303-440-3339 www.ncsli.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 a 100% fluorosilicone (FVMQ) elastomer, suitably cured to produce a product meeting the requirements of 3.2. Incorporating reprocessed vulcanized material (regrind) within the compound is not acceptable.

3.1.1 Color

Unless otherwise specified, material procured to this specification shall be blue.

3.2 Properties

The product shall conform to requirements shown in Table 1.

Table 1 - Physical property requirements

The following testing shall be performed every 5 years, and test reports shall be made available upon request.

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	800 psi (5.52 MPa)	ASTM D412, Die C
3.2.1.3	Elongation, minimum	ASTM Platen	225%	ASTM D412, Die C
3.2.1.4	Tear Resistance, minimum	ASTM Platen	40 p.p.i. (7.0 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 #1 Percent of original deflection, maximum	ASTM Platen, Plied Discs	25	ASTM D395, Method B Temperature: 347 °F ± 5 °F (175 °C ± 3 °C) Time: 22 ±0.5 hours
3.2.1.7	Compression set #2 Percent of original deflection, maximum	ASTM Platen, Plied Discs	15	ASTM D395, Method B Temperature: 75 °F ± 5 °F (23.9 °C ± 3 °C) Time: 70 ±0.5 hours
3.2.1.8	Temperature Retraction Test, (TR10) maximum Use an elongation of 50% of the original ultimate elongation value.	ASTM Platen	-70 °F (-56.6 °C)	ASTM D1329
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 ± 5 °F (200 °C ± 3 °C) Time: 70 hours ± 0.5 hour
3.2.2.2	Tensile Strength Change, maximum	ASTM Platen	-30%	
3.2.2.3	Elongation Change, maximum	ASTM Platen	-25%	
3.2.2.4	Weight Loss, % maximum	ASTM Platen	-2%	

3.2.3	**Fluid Resistance #1 - AMS3021 - ASTM D471**			
3.2.3.1	Hardness Change, Durometer, Type "A"	BUTTON or plied platens	-15 to +15	ASTM D471 Temperature: 302 °F ± 5 °F (150 °C ± 3 °C) Time: 70 hours ± 0.5 hour Fluid: AMS3021 ASTM D395, Method B
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 #3 Percent of Original Deflection, maximum	ASTM Platen Plied Discs	35	
3.2.4	**Fuel Resistance - ASTM Reference Fuel B - ASTM D471**			
3.2.4.1	Hardness Change, Durometer, Type "A"	BUTTON or plied platens	-15 to 0	ASTM D471 Temperature: 75 °F ± 5 °F (23.9 °C ± 3 °C) Time: 22 hours ± 0.5 hour Fluid: ASTM Ref. Fuel B
3.2.4.2	Tensile Strength Change, maximum	ASTM Platen	-65%	
3.2.4.3	Elongation Change, maximum	ASTM Platen	-60%	
3.2.4.4	Volume Change	ASTM Platen	+1% to +30%	

3.3 Quality

Product, as received by 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.) detrimental to usage of the product.

3.4 Tolerances

Shall conform to all applicable requirements of AMS2279 unless otherwise specified in the drawing, P.O., design data, 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. Purchaser reserves the right 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 4.5), 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

Paragraph	Property	Test Sample	Requirement	Test Method
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	800 psi (5.52 MPa)	ASTM D412
3.2.1.3	Elongation, minimum	ASTM Platen	225%	ASTM D412
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, max	ASTM Platen, Plied Discs	25	ASTM D395, Method B Temperature: 347 °F ± 5 °F (175 °C ± 3 °C) Time: 22 hours ±0.5 hours
3.2.4	**Fluid Resistance - ASTM Reference Fuel B - ASTM D471**			
3.2.4.4	Volume change	ASTM Platen	+1 to +30	ASTM D471 Temperature: 75 °F ± 5 °F (23.9 °C ± 3 °C) Time: 22 hours ± 0.5 hours Fluid: ASTM Ref. Fuel B
3.3	Quality	Part	Requirements	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 and shall be defined in the purchase agreement and/or specified in the design data.

4.2.3 Retesting

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 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 or flawed specimen, then the test is considered invalid and new specimens can be issued for testing.

NOTE 1: Example - As 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.

4.2.3.1 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, which shall include these minimum requirements.

4.3.1 The original batches used shall have been mixed utilizing the same formulation and mixed at the same mix location.

4.3.2 The original batch numbers and weights utilized in the blended batch shall be documented.

4.3.3 All batch records for the original batches shall be retained, easily accessible, and traceable to the new blended batch.

4.3.4 The original batches used in creating a blended batch shall have met all of the acceptance testing criteria of any applicable specifications prior to blending and shall be within shelf-life requirements. The maximum shelf life of any batch that can be utilized in the blending process cannot exceed one year.

4.3.4.1 If a batch that is selected for blending has exceeded its shelf-life, the manufacturer/compounder shall have a documented process which allows for shelf-life extension in place, and that process must be completed and the shelf-life extension approved, prior to that batch being utilized in the blend.

4.3.5 The new, blended batch shall be tested for batch acceptance testing per the intended specification prior to its release for production.

4.3.6 The new, blended batch's shelf-life shall be determined based upon the mix date and expiration date of the oldest batch utilized in the blend. (Example: If the oldest batch utilized in the blend has only 3 months remaining in its pre-blended shelf-life, then the blended batch must also expire in that same time frame.)

4.3.7 Blended material cannot be blended a second time.

4.4 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.

4.4.1 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.

4.4.2 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, which shall include the minimum requirements listed in 4.3.)

4.5 Approval

4.5.1 Manufacturer shall use ingredients, manufacturing procedures, processes, and methods of inspection on production product which are essentially the same as those used on the qualification sample. If any change in process control factors or procedures is necessary, 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.

4.5.2 Manufacturer shall establish, for each size of product, parameters for the process control factors which 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, 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.