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AEROSPACE MATERIAL SPECIFICATION

AMS 3329

Issued 7-1-84
Revised

FLUOROSILICONE (FVMQ) RUBBER
Fuel and Oil Resistant, High Strength
45 - 55

1. SCOPE:

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

1.2 Application: Primarily for parts requiring continuous operation in aromatic fuels and di-ester lubricants from -60° to +150°C (-75° to +300°F).

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) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2810 - Identification and Packaging, Elastomeric Products
AMS 3021 - Reference Fluid for Testing Di-Ester (Polyol) Resistant Materials

REAFFIRMED 10-91

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

ASTM D297 - Rubber Products - Chemical Analysis
ASTM D395 - Rubber Property - Compression Set
ASTM D412 - Rubber Properties in Tension
ASTM D471 - Rubber Property - Effect of Liquids
ASTM D573 - Rubber - Deterioration in an Air Oven
ASTM D624 - Rubber Property - Tear Resistance
ASTM D1329 - Rubber Property - Retraction at Low Temperatures (TR Test)
ASTM D2240 - Rubber Property - Durometer Hardness

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be a compound based on a fluorosilicone (FVMQ) elastomer, suitably cured to produce a product meeting the requirements of 3.2.

3.1.1 Color: Shall be blue.

3.2 Properties: The product shall conform to the following requirements; tests shall be performed on the product supplied and in accordance with specified ASTM methods, insofar as practicable:

3.2.1 As Received:

3.2.1.1	Hardness, Durometer "A" or equiv.	50 ± 5	ASTM D2240
3.2.1.2	Tensile Strength, min	1150 psi (7.95 MPa)	ASTM D412, Die B or C
3.2.1.3	Elongation, min	350%	ASTM D412, Die B or C
3.2.1.4	Tear Resistance, min	150 lb per in. (26.5 kN/m)	ASTM D624, Die C
3.2.1.5	Specific Gravity	Preproduction Value ± 0.03	ASTM D297
3.2.2	Di-Ester Oil Resistance: (Immediate Deteriorated Properties)		ASTM D471 Medium: AMS 3021 Temperature: 150°C ± 3 (300°F ± 5) Time: 70 hr ± 0.5
3.2.2.1	Hardness Change, Durometer "A" or equiv.	-15 to + 15	

3.2.2.2	Tensile Strength Change, max	-40%	
3.2.2.3	Elongation Change, max	-30%	
3.2.2.4	Volume Change	+1 to +15%	
3.2.3	Aromatic Fuel Resistance: (Immediate Deteriorated Properties)		ASTM D471 Medium: ASTM Ref. Fuel E Temperature: 20° - 30°C (68° - 86°F) Time: 22 hr ± 0.5
3.2.3.1	Hardness Change, Durometer "A" or equiv.	-25	
3.2.3.2	Tensile Strength Change, max	-40%	
3.2.3.3	Elongation Change, max	-30%	
3.2.3.4	Volume Change, max	+5 to +25%	
3.2.4	Dry Heat Resistance:		ASTM D573 Temperature: 200°C ± 3 (390°F ± 5) Time: 70 hr ± 0.5
3.2.4.1	Hardness Change, Durometer "A" or equiv.	-5 to +10	
3.2.4.2	Tensile Strength Change, max	-30%	
3.2.4.3	Elongation Change, max	-30%	
3.2.4.4	Bend (Flat)	No cracking or checking	
3.2.5	Compression Set:		ASTM D395, Method B Temperature: 175°C ± 3 (350°F ± 5) Time: 22 hr ± 0.5
	Percent of Original Deflection, max	40	
3.2.6	Low-Temperature Resistance:		ASTM D1329, Method A
3.2.6.1	Temperature Retraction, TR_{10} point, max	-57°C (-70°F)	

3.2.7 Corrosion: The product, unless otherwise specified, shall not have a corrosive effect on other materials, determined by a procedure agreed upon by purchaser and vendor. Discoloration of metal shall not be considered objectionable.

3.3 Quality: The product, as received by purchaser, shall be uniform in quality and condition, clean, smooth, as free from foreign material as commercially practicable, and free from imperfections detrimental to usage of the product.

3.4 Tolerances: Unless otherwise specified, the following tolerances shall apply:

3.4.1 Sheet and Strip:

TABLE I

Nominal Thickness (T) Inches	Tolerance, Inch Plus and Minus	
	Fixed	Closure (See 3.4.1.1)
Up to 0.400, incl	0.008	0.013
Over 0.400 to 0.630, incl	0.010	0.016
Over 0.630 to 1.000, incl	0.013	0.020
Over 1.000 to 1.600, incl	0.016	0.025
Over 1.600 to 2.500, incl	0.020	0.032
Over 2.500 to 4.000, incl	0.025	0.040
Over 4.000 to 6.300, excl	0.032	0.050
6.300 and over	0.005T	--

TABLE I (SI)

Nominal Thickness (T) Millimetres	Tolerance, Millimetres Plus and Minus	
	Fixed	Closure (See 3.4.1.1)
Up to 10.00, incl	0.20	0.32
Over 10.00 to 16.00, incl	0.25	0.40
Over 16.00 to 25.00, incl	0.32	0.50
Over 25.00 to 40.00, incl	0.40	0.63
Over 40.00 to 63.00, incl	0.50	0.80
Over 63.00 to 100.00, incl	0.63	1.00
Over 100.00 to 160.00, excl	0.80	1.25
160.00 and over	0.005T	--

3.4.1.1 Closure dimensions are across mold parting line.

3.4.2 Tubing Diameter and Wall Thickness:

TABLE II

Nominal OD or ID (D) (not both) and Wall Thickness Inches	Tolerance, Inch Plus and Minus	Ovality, % (See 3.4.2.1)
Up to 0.100, incl (See 3.4.3.2)	0.016	10
Over 0.100 to 0.160, incl	0.020	15
Over 0.160 to 0.250, incl	0.025	15
Over 0.250 to 0.400, incl	0.030	15
Over 0.400 to 0.630, incl	0.040	15
Over 0.630 to 1.000, incl	0.050	15
Over 1.000	0.0450xD	15

TABLE II (SI)

Nominal OD or ID (D) (not both) and Wall Thickness Millimetres	Tolerance, Millimetres Plus and Minus	Ovality, % (See 3.4.2.1)
Up to 2.50, incl (See 3.4.3.2)	0.40	10
Over 2.50 to 4.00, incl	0.50	15
Over 4.00 to 6.30, incl	0.63	15
Over 6.30 to 10.00, incl	0.80	15
Over 10.00 to 16.00, incl	1.00	15
Over 16.00 to 25.00, incl	1.25	15
Over 25.00	0.0450xD	15

3.4.2.1 Ovality applies to tubing ordered in straight lengths with wall thickness of 0.063 in. (1.60 mm) and over, and shall be computed from the difference between the minor and major axis diameter measurements, taken at the same transverse plane of the tube, expressed as a percentage of the nominal diameter.

3.4.3 Extrusions:

TABLE III

Nominal Cross-Sectional Dimension Inches	Tolerance, Inch Plus and Minus
Up to 0.100, incl (See 3.4.3.2)	0.013
Over 0.100 to 0.160, incl	0.016
Over 0.160 to 0.250, incl	0.020
Over 0.250 to 0.400, incl	0.025
Over 0.400 to 0.630, incl	0.032
Over 0.630 to 1.000, incl	0.040
Over 1.000 to 1.600, incl	0.050
Over 1.600 to 2.500, incl	0.063
Over 2.500	See 3.4.3.1

TABLE III (SI)

Nominal Cross-Sectional Dimension Millimetres	Tolerance, Millimetres Plus and Minus
Up to 2.50, incl (See 3.4.3.2)	0.32
Over 2.50 to 4.00, incl	0.40
Over 4.00 to 6.30, incl	0.50
Over 6.30 to 10.00, incl	0.63
Over 10.00 to 16.00, incl	0.80
Over 16.00 to 25.00, incl	1.00
Over 25.00 to 40.00, incl	1.25
Over 40.00 to 63.00, incl	1.60
Over 63.00	See 3.4.3.1

3.4.3.1 For dimensions over 2.500 in. (63.00 mm), tolerances shall be as agreed upon by purchaser and vendor.

3.4.3.2 In general, cross-section dimensions less than 0.040 in. (1.00 mm) are impractical to extrude.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms 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
Volume Change in Di-ester Oil	3.2.2.4
Volume Change in Fuel	3.2.3.4
Compression Set	3.2.5

4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of a product to a purchaser, when a change in material or processing, or both, requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient product shall be taken at random from each lot to perform all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three. When the product supplied is an extrusion of such shape that suitable test specimens cannot be cut from the product, a separate flat strip test sample shall be supplied upon request. This strip shall be prepared from tubing 1 in. ± 0.063 (25 mm ± 1.6) in OD by 0.075 in. ± 0.008 (1.90 mm ± 0.20) in wall thickness, mechanically split and flattened into a strip while being extruded, and cured in the same manner as production material. When the product is a molded part from which test specimens cannot be cut, a slab 6 x 6 x 0.075 in. (150 x 150 x 2 mm) molded from the same lot of material shall be supplied upon request.

4.3.1.1 A lot shall be all product from the same batch of compound processed in one continuous run and presented for vendor's inspection at one time. An inspection lot shall not exceed 500 lb (225 kg).

4.3.1.2 A batch shall be the quantity of compound run through a mill or mixer at one time.

4.3.1.3 When a statistical sampling plan and acceptance quality level (AQL) have been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3 and the report of 4.5.1 shall state that such plan was used.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample material shall be approved by purchaser before material for production use is supplied, unless such approval be waived by purchaser. Results of tests on production material shall be essentially equivalent to those on the approved sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production material which are essentially the same as those used on the approved sample material. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material or processing, or both, and, when requested, sample material. Production material made by the revised procedure shall not be shipped prior to receipt of reapproval.