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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 3222F
Superseding AMS 3222E

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SYNTHETIC RUBBER
Hot Oil Resistant, High Swell
45 - 55

1. SCOPE:

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

1.2 Application: Primarily for gasket-type seals in contact with hot, petroleum-base lubricating oils where a space-filling seal operating from -40° to +100°C (-40° to +212°F) is required.

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

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

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 D2137 - Rubber Property - Brittleness Point of Flexible Polymers and Coated Fabrics
ASTM D2240 - Rubber Property - Durometer Hardness

3. TECHNICAL REQUIREMENTS:

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

3.1.1 Color: Shall be black.

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	1500 psi (10.5 MPa)	ASTM D412, Die B or C
3.2.1.3	Elongation, min	400%	ASTM D412, Die B or C
3.2.2	Petroleum Lubricating Oil Resistance: (Immediate Deteriorated Properties)		ASTM D471 Medium: ASTM Oil No. 1 Temperature: 150°C ± 3 (302°F ± 5) Time: 24 hr ± 0.2
3.2.2.1	Hardness Change, Durometer "A" or equiv.	-5 to +5	
3.2.2.2	Tensile Strength Change, max	-50%	
3.2.2.3	Elongation Change, max	-50%	
3.2.2.4	Volume Change	+15 to +30%	
3.2.2.5	Decomposition	None	
3.2.2.6	Surface Tackiness	None	
3.2.3	Petroleum Lubricating Oil Resistance: (Immediate Deteriorated Properties		ASTM D471 Medium: ASTM Oil No. 1 Temperature: 150°C ± 3 (302°F ± 5) Time: 70 hr ± 0.5

3.2.3.1	Hardness Change, Durometer "A" or equiv.	-10 to +10	
3.2.3.2	Volume Change	+15 to +40%	
3.2.3.3	Decomposition	None	
3.2.3.4	Surface Tackiness	None	
3.2.3.5	Bend (flat)	No cracking or checking	

3.2.4 Dry Heat Resistance: ASTM D573, Temperature: 100°C ± 1 (212°F ± 2), Time: 70 hr ± 0.5

3.2.4.1	Hardness Change, Durometer "A" or equiv.	0 to +10
3.2.4.2	Tensile Strength Change, max	-40%
3.2.4.3	Elongation Change, max	-50%
3.2.4.4	Bend (flat)	No cracking or checking

3.2.5 Compression Set: ASTM D395, Method B, Temperature: 100°C ± 1 (212°F ± 2), Time: 70 hr ± 0.5

3.2.5.1	Percent of Original Deflection, max	85

3.2.6 Low-Temperature Resistance: ASTM D2137, Method A, Temperature: -40°C ± 1 (-40°F ± 2), Time: 5 hr ± 0.2

3.2.6.1	Brittleness	Pass

3.2.7 Weathering: When specified, the product shall have weather resistance acceptable to the purchaser, determined by a procedure agreed upon by purchaser and vendor.

3.2.8 Corrosion: The product shall not have a corrosive effect on other materials when exposed to conditions normally encountered in service. 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, as free from foreign materials as commercially practicable, and free from internal and external imperfections detrimental to usage of the product.

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

3.4.1 Sheet and Strip:
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TABLE I

Nominal Thickness (T) Inches	Tolerance, Inch Plus and Minus Fixed	Tolerance, Inch Plus and Minus 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	Tolerance, Millimetres Plus and Minus 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.
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3.4.2 Tubing Diameter and Wall Thickness:
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TABLE II

Nominal OD or ID (D) (not both) and Wall Thickness Inches	Tolerance, Inch Plus and Minus	Ovality, % (See 3.4.2.2)
Up to 0.100, incl (See 3.4.2.1)	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 3.4.2.2)
Up to 2.50, incl (See 3.4.2.1)	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 In general, cross-section dimensions less than 0.040 in. (1.00 mm) are impractical to extrude.

3.4.2.2 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.

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 Oil	3.2.2.4 and 3.2.3.2

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 and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.