SAE The Engineering Resource For Advancing Mobility

400 COMMONWEALTH DRIVE WARRENDALE PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 3229F
Superseding AMS 3229E

Issued 12-1-42
Revised 4-1-83

ACRYLONITRILE BUTADIENE (NBR) RUBBER
Hot Oil Resistant, Low Swell
75 - 85

1. SCOPE:

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

1.2 Application: Primarily for packings, bushings, and grommets in contact with hot, petroleum-base oils from -40° to +100°C (-40° to +212°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

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 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 an acrylonitrile-butadiene 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.	80 ± 5	ASTM D2240
3.2.1.2	Tensile Strength, min	1000 psi (6.90 MPa)	ASTM D412, Die B or C
3.2.1.3	Elongation, min	150%	ASTM D412, Die B or C
3.2.1.4 Ø	Specific Gravity	Preproduction Value ± 0.02	ASTM D297

3.2.2 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

3.2.2.1	Hardness Change, Durometer "A" or equiv.	-5 to +10
3.2.2.2	Volume Change	0 to +10%
3.2.2.3	Decomposition	None
3.2.2.4	Surface Tackiness	None
3.2.2.5	Bend 90 deg over radius 5 times specimen thickness	No cracking or checking

3.2.3 Processing Oil Resistance: (Immediate Deteriorated Properties)

ASTM D471
Medium: ASTM Oil No. 3
Temperature: 150°C ± 3 (302°F ± 5)
Time: 70 hr ± 0.5

3.2.3.1	Hardness Change, Durometer "A" or equiv.	-20 to +5

3.2.3.2	Volume Change	0 to +45%		
3.2.3.3	Decomposition	None		
3.2.3.4	Surface Tackiness	None		
3.2.4	Compression Set:			ASTM D395, Method B
3.2.4.1	Percent of Original Deflection, max	50	Temperature:	125°C ± 1 (257°F ± 2)
			Time:	70 hr ± 0.5
3.2.5	Low-Temperature Resistance:			ASTM D2137, Method A
3.2.5.1	Brittleness	Pass	Temperature:	-40°C ± 1 (-40°F ± 2)
			Time:	5 hr ± 0.2

3.2.6 Weathering: The product, unless otherwise specified, shall have weather resistance acceptable to the purchaser, determined by a procedure agreed upon by purchaser and vendor.

3.2.7 Corrosion: The product, unless otherwise specified, shall not have a corrosive effect on other materials when exposed to conditions normally encountered in service, 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	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	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.
Ø

3.4.2 Tubing Diameter and Wall Thickness:
Ø

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)	0.013	10
Over 0.100 to 0.160, incl	0.016	15
Over 0.160 to 0.250, incl	0.020	15
Over 0.250 to 0.400, incl	0.025	15
Over 0.400 to 0.630, incl	0.032	15
Over 0.630 to 1.000, incl	0.040	15
Over 1.000	0.0350xD	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)	0.32	10
Over 2.50 to 4.00, incl	0.40	15
Over 4.00 to 6.30, incl	0.50	15
Over 6.30 to 10.00, incl	0.63	15
Over 10.00 to 16.00, incl	0.80	15
Over 16.00 to 25.00, incl	1.00	15
Over 25.00	0.0350xD	15

3.4.2.1 In general, cross-sectional dimensions less than 0.040 in. (1.00 mm) are impractical to extrude.
Ø

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 on 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 Ø 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:

Property	Paragraph
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 Processing Oil	3.2.3.2
Compression Set	3.2.6

4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests Ø and shall be performed prior to or on the initial shipment of the 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:

4.3.1 For Acceptance Tests: Sufficient product shall be taken at random from Ø 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. If test specimens cannot be prepared from the product, ASTM test specimens prepared from the same batch and state of cure shall be used. When the product is an extrusion of such shape that suitable test specimens cannot be cut from the product,