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400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE

AMS 3228G

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Superseding AMS 3228F

Submitted for recognition as an American National Standard

ACRYLONITRILE BUTADIENE (NBR) RUBBER
Hot Oil and Coolant Resistant, Low Swell
65 - 75

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of April 30, 1991. It is recommended, therefore, that this specification not be specified for new designs.

This cover sheet should be attached to the "F" revision of the subject specification.

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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 3228F

Superseding AMS 3228E

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ACRYLONITRILE BUTADIENE (NBR) RUBBER Hot Oil and Coolant Resistant, Low Swell 65 - 75

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 hose, packings, bushings, grommets, and seals in contact with hot, petroleum-base lubricating oils and glycol-type coolants 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

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3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be a compound based on an acrylonitrile-butadiene (NBR) 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.	70 \pm 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	250%	ASTM D412, Die B or C
3.2.1.4	Specific Gravity ϕ	Preproduction Value \pm 0.02	ASTM D297
3.2.2	<u>Lubricating Oil Resistance:</u> (Immediate Deteriorated Properties)	Medium: Temperature: Time:	ASTM D471 ASTM Oil No. 1 150°C \pm 3 (302°F \pm 5) 70 hr \pm 0.5
3.2.2.1	Hardness Change, Durometer "A" or equiv.	-10 to +10	
3.2.2.2	Tensile Strength Change, max	-50%	
3.2.2.3	Elongation Change, max	-50%	
3.2.2.4	Volume Change	0 to +10%	
3.2.2.5	Decomposition	None	
3.2.2.6	Surface Tackiness	None	
3.2.3	<u>Processing Oil Resistance:</u> (Immediate Deteriorated Properties)	Medium: Temperature: Time:	ASTM D471 ASTM Oil No. 3 150°C \pm 3 (302°F \pm 5) 70 hr \pm 0.5
3.2.3.1	Hardness Change, Durometer "A" or equiv.	-20 to +5	

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3.2.3.2 Elongation Change, max -70%

3.2.3.3 Volume Change 0 to +45%

3.2.3.4 Decomposition None

3.2.3.5 Surface Tackiness None

3.2.4 Coolant Resistance:
(Immediate Deteriorated
Properties)

Medium: ASTM D471
Ethylene
Glycol 97%
Water 3%
Temperature: 150°C \pm 3
(302°C \pm 5)
Time: 70 hr \pm 0.5

3.2.4.1 Hardness Change, Durometer
"A" or equiv. -15 to +15

3.2.4.2 Tensile Strength Change,
max -25%

3.2.4.3 Elongation Change, max -50%

3.2.4.4 Volume Change 0 to +20%

3.2.4.5 Decomposition None

3.2.4.6 Surface Tackiness None

3.2.5 Dry Heat Resistance:

ASTM D573
Temperature: 100°C \pm 1
(212°F \pm 2)
Time: 70 hr \pm 0.5

3.2.5.1 Hardness Change, Durometer
"A" or equiv. 0 to +10

3.2.5.2 Tensile Strength Change,
max -25%

3.2.5.3 Elongation Change, max -40%

3.2.5.4 Bend (flat) No cracking
or checking

3.2.6 Compression Set:

ASTM D395,
Method B
Temperature: 125°C \pm 2
(257°F \pm 4)
Time: 70 hr \pm 0.5

3.2.6.1 Percent of Original
Deflection, max 50

3.2.7 Low-Temperature Resistance:

ASTM D2137,
Method A
Temperature: -40°C \pm 1
(-40°F \pm 2)
Time: 5 hr \pm 0.2

3.2.7.1 Brittleness Pass

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- 3.2.8 Weathering: The product, unless otherwise specified, shall have weather resistance acceptable to the purchaser, determined by a procedure agreed upon by purchaser and vendor.
- 3.2.9 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	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	--