

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE

AMS 3228H

Issued DEC 1942
Revised SEP 1996

Superseding AMS 3228G

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

This specification has been "CANCELLED" by the Aerospace Materials Division, SAE, as of September 1996. By this action, the document revision letter and title will be deleted from the active specification index of Aerospace Material Specifications. Cancelled specifications are available from SAE upon request.

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400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE

AMS 3228G

Issued 1 DEC 1942
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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.

"NONCURRENT" refers to those materials which have previously been widely used and which may be required on some existing designs in the future. The Aerospace Materials Division, however, does not recommend these as standard materials for future use in new designs. Each of these "NONCURRENT" specifications is available from SAE upon request.

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**AEROSPACE
MATERIAL
SPECIFICATION**

AMS 3228F
Superseding AMS 3228E

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

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
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3.2.1.2 Tensile Strength, min	1000 psi (6.90 MPa)	ASTM D412, Die B or C
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3.2.1.3 Elongation, min	250%	ASTM D412, Die B or C
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3.2.1.4 Specific Gravity ρ	Preproduction Value $\pm$ 0.02	ASTM D297
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3.2.2 Lubricating Oil Resistance:
(Immediate Deteriorated Properties)

Medium:	ASTM D471 ASTM Oil No. 1
Temperature:	150°C $\pm$ 3 (302°F $\pm$ 5)
Time:	70 hr $\pm$ 0.5

3.2.2.1 Hardness Change, Durometer "A" or equiv.	-10 to +10
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3.2.2.2 Tensile Strength Change, max	-50%
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3.2.2.3 Elongation Change, max	-50%
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3.2.2.4 Volume Change	0 to +10%
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3.2.2.5 Decomposition	None
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3.2.2.6 Surface Tackiness	None
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3.2.3 Processing Oil Resistance:
(Immediate Deteriorated Properties)

Medium:	ASTM D471 ASTM Oil No. 3
Temperature:	150°C $\pm$ 3 (302°F $\pm$ 5)
Time:	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	<u>Coolant Resistance:</u> (Immediate Deteriorated Properties)		Medium:	ASTM D471 Ethylene Glycol 97% Water 3%
3.2.4.1	Hardness Change, Durometer "A" or equiv.	-15 to +15	Temperature:	150°C $\pm$ 3 (302°C $\pm$ 5)
3.2.4.2	Tensile Strength Change, max	-25%	Time:	70 hr $\pm$ 0.5
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	<u>Dry Heat Resistance:</u>			ASTM D573
3.2.5.1	Hardness Change, Durometer "A" or equiv.	0 to +10	Temperature:	100°C $\pm$ 1 (212°F $\pm$ 2)
3.2.5.2	Tensile Strength Change, max	-25%	Time:	70 hr $\pm$ 0.5
3.2.5.3	Elongation Change, max	-40%		
3.2.5.4	Bend (flat)	No cracking or checking		
3.2.6	<u>Compression Set:</u>			ASTM D395, Method B
3.2.6.1	Percent of Original Deflection, max	50	Temperature:	125°C $\pm$ 2 (257°F $\pm$ 4)
			Time:	70 hr $\pm$ 0.5
3.2.7	<u>Low-Temperature Resistance:</u>			ASTM D2137, Method A
3.2.7.1	Brittleness	Pass	Temperature:	-40°C $\pm$ 1 (-40°F $\pm$ 2)
			Time:	5 hr $\pm$ 0.2

- 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	--