



AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AMS 3228E

Superseding AMS 3228D

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NITRILE RUBBER

Hot Oil and Coolant Resistant, Low Swell

65 - 75

1. SCOPE:

1.1 Form: This specification covers a nitrile 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 at temperatures from -40° to +100°C (-40° F 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 Society of Automotive Engineers, Inc., 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 - Compression Set of Vulcanized Rubber

ASTM D412 - Tension Testing of Vulcanized Rubber

ASTM D471 - Change in Properties of Elastomeric Vulcanizates Resulting from Immersion in Liquids

ASTM D573 - Accelerated Aging of Vulcanized Rubber by the Oven Method

ASTM D2137 - Low-Temperature Impact Test for Brittleness Determination of Flexible Polymeric Materials or Fabrics Coated Therewith, or Both

ASTM D2240 - Indentation Hardness of Rubber and Plastics by Means of a Durometer

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

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

Ø 3.1.1 Color: Shall be black.

SAE Technical Board rules provide that: "All technical reports, including standards, approved practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

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 (6.9 MPa)	ASTM D412, Die B or C
3.2.1.3	Elongation, min	250%	ASTM D412, Die B or C

3.2.2 Lubricating Oil Resistance:
(Immediate Deteriorated Properties)

ASTM D471

Medium: ASTM Oil No. 1

Temperature: 150°C $\pm$ 3
(302°F $\pm$ 5.4)

Time: 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 Processing Oil Resistance:
(Immediate Deteriorated Properties)

ASTM D471

Medium: ASTM Oil No. 3

Temperature: 150°C $\pm$ 3
(302°F $\pm$ 5.4)

Time: 70 hr $\pm$ 0.5

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

ASTM D471

Medium: Ethylene Glycol 97%
Water 3%

Temperature: 150°C $\pm$ 3
(302°F $\pm$ 5.4)

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

3.2.5.1 Hardness Change, Durometer
"A" or equiv.

0 to +10

Temperature: 100°C $\pm$ 1
(212°F $\pm$ 1.8)
Time: 70 hr $\pm$ 0.5

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

3.2.6.1 Percent of Original Deflection, max

50

Temperature: 125°C $\pm$ 2
(257°F $\pm$ 3.6)
Time: 70 hr $\pm$ 0.5

Ø 3.2.7 Low Temperature Resistance:

ASTM D2137, Method A

3.2.7.1 Brittleness

Pass

Temperature: -40°C $\pm$ 1
(-40°F $\pm$ 1.8)
Time: 5 hr $\pm$ 0.2

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

3.2.9 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 shall be uniform in quality and condition, clean, smooth, as free from foreign material as commercially practicable, and free from imperfections detrimental to fabrication, appearance, or performance of parts.

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

3.4.1 Sheet and Strip:

TABLE I

Nominal Thickness Inches	Tolerance, Inch plus and minus
Up to 0.125, incl	0.016
Over 0.125 to 0.500, incl	0.031
Over 0.500	0.047

TABLE I (SI)

Nominal Thickness Millimetres	Tolerance, Millimetres plus and minus
Up to 3.18, incl	0.41
Over 3.18 to 12.70, incl	0.79
Over 12.70	1.19

3.4.2 Tubing:3.4.2.1 Diameter:TABLE II

Nominal OD or ID (not both), Inches	Tolerance plus and minus	Ovality, % (See 3.4.2.1.1)
Up to 0.500, incl	0.020 in.	10
Over 0.500 to 1.000, incl	0.030 in.	15
Over 1.000	4%	15

TABLE II (SI)

Nominal OD or ID (not both), Millimetres	Tolerance plus and minus	Ovality, % (See 3.4.2.1.1)
Up to 12.70, incl	0.51 mm	10
Over 12.70 to 25.40, incl	0.76 mm	15
Over 25.40	4%	15

3.4.2.1.1 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 on the tube, expressed as a percentage of the nominal diameter.

3.4.2.2 Wall Thickness:TABLE III

Nominal Wall Thickness Inches	Tolerance plus and minus
Up to 0.063, excl	0.005 in.
0.063 and over	10%

TABLE III (SI)

Nominal Wall Thickness Millimetres	Tolerance plus and minus
Up to 1.60, excl	0.13 mm
1.60 and over	10%

4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Responsibility for Inspection: The vendor of the product shall supply all samples 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 perform such confirmatory testing as he deems necessary to ensure that the product conforms to the requirements of this specification.