

**AEROSPACE
MATERIAL
SPECIFICATION**

AMS 3238D

Superseding AMS 3238C

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**BUTYL (IIR) RUBBER
Phosphate Ester Resistant
65 - 75**

1. SCOPE:

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

1.2 Application: Primarily for parts such as O-rings, gaskets, grommets, and seals requiring resistance to phosphate esters or low permeability to gases. Not suitable for use in contact with petroleum-base fluids due to excessive swell.

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

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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 D518 - Rubber Deterioration - Surface Cracking
 ASTM D573 - Rubber - Deterioration in an Air Oven
 ASTM D624 - Rubber Property - Tear Resistance
 ASTM D797 - Rubber Property - Young's Modulus at Normal and Subnormal Temperatures
 ASTM D1149 - Rubber Deterioration - Surface Ozone Cracking in a Chamber (Flat Specimens)
 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 a butyl (IIR) elastomer, suitably cured to produce a product meeting the requirements of 3.2.

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	1500 psi (10.5 MPa)	ASTM D412, Die B or C
3.2.1.3	Elongation, min	300%	ASTM D412, Die B or C
3.2.1.4	Tear Resistance lb per in. (kg/m), min	80% of Preproduction Value	ASTM D624, Die B or C
3.2.1.5	Specific Gravity \emptyset	Preproduction Value \pm 0.03	ASTM D297

3.2.2 Phosphate Ester Resistance: (Immediate Deteriorated Properties)

ASTM D471
 Medium: Tri-n-butyl phosphate
 Temperature: 100°C \pm 1
 (212°F \pm 2)
 Time: 70 hr \pm 0.5

3.2.2.1 Hardness Change, 0 to -30
 Durometer "A" or equiv.

3.2.2.2 Tensile Strength Change, -30%
max

3.2.2.3 Elongation Change, max -20%

3.2.2.4 Volume Change 0 to +30%

3.2.3 Dry Heat Resistance:

ASTM D573

Temperature: $100^{\circ}\text{C} \pm 1$
($212^{\circ}\text{F} \pm 2$)

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

Time: 70 hr ± 0.5

3.2.3.2 Tensile Strength Change, -20%
max

3.2.3.3 Elongation Change, max -40%

3.2.4 Compression Set:

ASTM D395, Method B

Temperature: $100^{\circ}\text{C} \pm 1$
($212^{\circ}\text{F} \pm 2$)

3.2.4.1 Percent of Original 85
Deflection, max

Time: 70 hr ± 0.5

3.2.5 Low Temperature Resistance:

3.2.5.1 Brittleness Pass

ASTM D2137, Method A

Temperature: $-35^{\circ}\text{C} \pm 1$
($-31^{\circ}\text{F} \pm 2$)

Time: 10 min. ± 0.5

3.2.5.2 Young's Modulus, max 30,000 psi
(See 8.2) (207 MPa)

ASTM D797

Temperature: $-40^{\circ}\text{C} \pm 1$
($-40^{\circ}\text{F} \pm 2$)

3.2.6 Weathering: The product, unless otherwise specified, shall show no
Ø evidence of cracking when tested in accordance with ASTM D1149 for seven
days at $40^{\circ}\text{C} \pm 1$ ($105^{\circ}\text{F} \pm 2$). Test specimens shall be prepared and
mounted in accordance with ASTM D518, Method B.

3.2.7 Corrosion: The product, unless otherwise specified, shall not have a
Ø 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 materials 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	Tolerances, 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	Tolerances, 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.

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	Tolerances, Inch Plus and Minus	Ovality, % (See 3.4.2.1)
Up to 0.100, incl	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	Tolerances, Millimetres Plus and Minus	Ovality, % (See 3.4.2.1)
Up to 2.50, incl	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 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.

3.4.3 Extrusions:

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TABLE III

Nominal Cross-Sectional Dimension Inches	Tolerances, Inch Plus and Minus
Up to 0.100, incl (See 3.4.3.2)	0.013
Over 0.100 to 0.160, incl	0.016
Over 0.160 to 0.250, incl	0.020
Over 0.250 to 0.400, incl	0.025
Over 0.400 to 0.630, incl	0.032
Over 0.630 to 1.000, incl	0.040
Over 1.000 to 1.600, incl	0.050
Over 1.600 to 2.500, incl	0.063
Over 2.500	See 3.4.3.1

TABLE III (SI)

Nominal Cross-Sectional Dimension Millimetres	Tolerances, Millimetres Plus and Minus
Up to 2.50, incl (See 3.4.3.2)	0.32
Over 2.50 to 4.00, incl	0.40
Over 4.00 to 6.30, incl	0.50
Over 6.30 to 10.00, incl	0.63
Over 10.00 to 16.00, incl	0.80
Over 16.00 to 25.00, incl	1.00
Over 25.00 to 40.00, incl	1.25
Over 40.00 to 63.00, incl	1.60
Over 63.00	See 3.4.3.1

3.4.3.1 For dimensions over 2.500 in. (63.00 mm), tolerances shall be as agreed upon by purchaser and vendor.

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

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
Compression Set	3.2.4

- 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 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: Shall be as follows:

- 4.3.1 For Acceptance Tests: Sufficient product shall be taken at random from 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. When the product supplied is an extrusion of such shape that suitable test specimens cannot be cut from the product, a separate flat strip test sample shall be supplied upon request. This strip shall be prepared from tubing 1.00 in. \pm 0.063 (25 mm \pm 1.60) in OD by 0.075 in. \pm 0.008 (1.90 mm \pm 0.20) in wall thickness, mechanically slit and flattened into a strip while being extruded, and cured in the same manner as production material. When the product is a molded shape from which test specimens cannot be cut, a slab 6 x 6 x 0.075 in. (150 x 150 x 2 mm) molded from the same batch of compound shall be supplied upon request.

- 4.3.1.1 A lot shall be all product from the same batch of compound processed in one continuous run and presented for vendor's inspection at one time. An inspection lot shall not exceed 500 lb (225 kg).
- 4.3.1.2 A batch shall be the quantity of compound run through a mill or mixer at one time.