The Engineering Society For Advancing Mobility Land & Sea Air and Space®

400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 3625B

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Superseding AMS 3625A

ELASTOMERIC TUBING, ELECTRICAL INSULATION
Crosslinked Silicone, Pigmented, Flexible, Heat-Shrinkable
1.750 to 1 Shrink Ratio

1. SCOPE:

1.1 Form: This specification covers an irradiated, thermally-stabilized, flame-resistant, modified silicone rubber in the form of heat shrinkable tubing.

1.2 Application: Primarily for use as a flexible, electrical insulation tubing whose diameter can be reduced to a predetermined size by heating to 175°C (347°F) or higher. This tubing is stable under the following conditions:

-70° to +180°C (-94° to +356°F) Continuous
-70° to +300°C (-94° to +572°F) 4 hours

1.3 Safety-Hazardous materials: While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications 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

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D624 - Rubber Property - Tear Resistance
ASTM D2240 - Rubber Property - Durometer Hardness
ASTM D2671 - Testing Heat-Shrinkable Tubing for Electrical Use
ASTM G21 - Determining Resistance of Synthetic Polymeric Materials to Fungi

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

2.3.1 Federal Standards:

FED-STD-228 - Cable and Wire, Insulated, Methods of Testing

2.3.2 Military Specifications:

MIL-G-5572 - Gasoline, Aviation, Grades 80/87, 100/130, 115/145
MIL-H-5606 - Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance
MIL-T-5624 - Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-L-7808 - Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-A-8243 - Anti-Icing and Deicing-Defrosting Fluid

2.3.3 Military Standards:

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

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be an irradiated, thermally-stabilized, flame-resistant, modified silicone rubber.

3.2 Color: Shall be black.

3.3 Properties: Tubing shall conform to the following requirements; reported values shall be the average of all specimens tested for each requirement. Except as otherwise specified herein, tests shall be performed in accordance with ASTM D2671, insofar as practicable.

3.3.1 Recovered Tubing: The following requirements apply to tubing after being shrunk by heating to 200°C ± 5 (392°F ± 9) in a convection-current air oven with an air velocity of 100 - 200 feet per minute (0.5 - 1.0 m/second) past the tubing, holding at heat for not less than 10 minutes, removing from the oven, and conditioning for not less than 4 hours at 23°C ± 2 (73°F ± 4) and 45 - 55% relative humidity.

3.3.1.1 Tensile Strength, minimum Jaw separation rate 20 inches per minute (8.5 mm/second), using Die D for sizes 1/2 and larger	600 psi (4.12 MPa)	
3.3.1.2 Ultimate Elongation, minimum	200%	
3.3.1.3 Tensile Stress at 100% Elongation, maximum	500 psi (3.45 MPa)	
3.3.1.4 Hardness, Durometer A or equivalent	60 ± 5	ASTM D2240
3.3.1.5 Tear Resistance, minimum	50 pounds force/inch (8756 N/m) thickness	ASTM D624, Die B
3.3.1.6 Dietelectric Strength, minimum		4.5.1
ø Sizes 1/4 - 7/8	350 V/mil (13,780 V/mm	
Sizes 1 - 2	200 V/mil (7,874 V/mm)	
3.3.1.7 Volume Resistivity, minimum	10^{11} ohm-cm	
3.3.1.8 Flammability 0 Time to Extinguish, maximum	60 seconds; no dripping or flowing; not more than 25% of indicator flag burned or charred	
3.3.1.9 Fungus Resistance	Rating of 1 or less	ASTM G21
3.3.1.10 Low-Temperature Flexibility At -75°C ±2 (-103°F ± 4)	No cracks	4.5.2
3.3.1.11 Heat Aging, 168 hours ± 2 at 200°C ± 3 (392°F ± 5)		
3.3.1.11.1 Tensile Strength, minimum	480 psi (3.31 MPa)	
3.3.1.11.2 Ultimate Elongation, minimum	100%	
3.3.1.12 Corrosion, After 16 hours ± 0.25 at 175°C ± 3 (347°F ± 5)	Non-Corrosive	Procedure A
3.3.1.13 Fluid Resistance		4.5.3

3.3.1.13.1 Tensile Strength, minimum	300 psi (2.07 MPa)	
3.3.1.13.2 Ultimate Elongation, minimum	100%	
3.3.1.13.3 Dielectric Strength, minimum	200 V per mil (7874 V/mm)	
3.3.1.14 Dimensional Change on Heating		
3.3.1.14.1 Diametral	In accordance with Table I	
3.3.1.14.2 Longitudinal, maximum	-10%, +1%	

3.3.2 Expanded Tubing: The following requirements apply to tubing in the expanded (as-received> condition. Heating for the tests of 3.3.2.1 and 3.3.2.2 shall be performed in an oven as specified in 3.3.1.

3.3.2.1 Heat Shock at 300°C ± 5 (572°F ± 9)	No dripping, flowing, or cracking	
3.3.2.1.1 Bending after Heat Shock	No cracks	4.5.4
3.3.2.2 Restricted Shrinkage, After 30 minutes ± 1 at 150°C ± 5 (302°F ± 9)	No cracks; withstand 2000 V for 1 minute	Procedure C
3.3.2.3 Specific Gravity, maximum	1.35	
3.3.2.4 Water Absorption, maximum 24 hours ± 0.25 at 25°C ± 2 (77°F ± 4)	1.00%	

3.3.3 Shelf Life: Tubing shall meet the expanded (as-supplied) dimensions specified in Table I after conditioning for 2 weeks at 40°C ± 1 (104°F ± 2) and shall meet the recovered dimensions specified in Table I after heat shrinking as in 3.3.1. Specimens for test shall be nominally 6 inches (152 mm) long.

3.4 Quality: Tubing, as received by purchaser, shall be uniform in quality and condition, smooth, and free from foreign materials and from imperfections detrimental to usage of the tubing.

3.5 Standard-Sizes and Tolerance: Tubing shall be supplied in the standard sizes and to the tolerances shown in Table I. Tolerances apply at 23° - 30°C (73° - 86°F). Measurements shall be made in accordance with ASTM D2671.

TABLE I

Size	Expanded (As Supplied) ID, Inches minimum	Recovered Dimensions (After Heating) ID, Inches maximum	Nominal Wall Thickness Inch	Wall Thickness Tolerance Inch plus and minus
1/4	0.250	0.143	0.035	0.010
3/8	0.375	0.214	0.040	0.010
1/2	0.500	0.286	0.048	0.015
5/8	0.625	0.357	0.052	0.015
3/4	0.750	0.429	0.057	0.015
7/8	0.875	0.500	0.065	0.015
1	1.000	0.571	0.070	0.020
1-1/4	1.250	0.714	0.087	0.020
1-1/2	1.500	0.857	0.095	0.020
1-3/4	1.750	1.000	0.107	0.020
2	2.000	1.143	0.110	0.020

TABLE I (SI)

Size	Expanded (As Supplied) ID, Millimetres minimum	Recovered Dimensions (After Heating) ID, Millimetres maximum	Nominal Wall Thickness Millimetres	Wall Thickness Tolerance Millimetre plus and minus
1/4	6.35	3.63	0.89	0.25
3/8	9.52	5.44	1.02	0.25
1/2	12.70	7.26	1.22	0.38
5/8	15.88	9.07	1.32	0.38
3/4	19.05	10.90	1.45	0.38
7/8	22.22	12.70	1.65	0.38
1	25.40	14.50	1.78	0.51
1-1/4	31.75	18.14	2.21	0.51
1-1/2	38.10	21.77	2.41	0.51
1-3/4	44.45	25.40	2.72	0.51
2	50.80	29.03	2.79	0.51

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of tubing 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 4.6. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the tubing conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for tensile strength (3.3.1.1, ultimate elongation (3.3.1.2), tensile stress (3.3.1.3), flammability (3.3.1.8), dimensional change on heating (3.3.1.14), heat shock (3.3.2.1), and sizes and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for hardness (3.3.1.4), tear resistance (3.3.1.5), dielectric strength (3.3.1.6), volume resistivity (3.3.1.7), fungus resistance (3.3.1.9), low-temperature flexibility (3.3.1.10), heat aging (3.3.1.11), corrosion (3.3.1.13), fluid resistance (3.3.1.17), restricted shrinkage (3.3.2.2), specific gravity (3.3.2.3), and water absorption (3.3.2.4) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 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 tubing to a purchaser, when a change in material and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.3.1 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, contracting officer, or request for procurement.

4.3 Sampling: Shall be in accordance with ASTM D2671 and the following; a lot shall be all tubing of the same size from the same production run and presented for vendor's inspection at one time. 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. An inspection lot shall be not more than 250,000 feet (76,200 m) but may be packaged in smaller quantities and delivered under the basic lot approval provided lot identification is maintained.

4.3.1 For Acceptance Tests: Not less than 16 feet (4.88 m) of tubing from each lot.

4.3.1.1 When a statistical sampling plan and acceptance qualtiy level (AQL) have been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6.1 shall state that such plan was used.

4.3.2 For Periodic Tests: not less than 50 feet (15.2 m) of tubing of each size or size range. Certain representative sizes may be used to demonstrate conformance of a range of sizes as follows:

Representative Size	Range of Sizes
1/2	1/4 - 1/2, incl
1	5/8 - 1, incl
2	1-1/4 - 2, incl

4.3.3 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Sample tubing shall be approved by purchaser before tubing for production use is supplied, unless such approval be waived by purchaser. Results of tests on production tubing shall be essentially equivalent to those on the approved sample tubing.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production tubing which are essentially the same as those used on the approved sample tubing. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures! vendor shall submit for reapproval a statement of the proposed changes in material and/or processing and, when requested, sample tubing. Tubing made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Dielectric Strength: Shall be determined in accordance with ASTM D2671, 0 on specimens recovered on metal mandrels for 10 minutes at 200°C ± 5 (392°F ± 9) or until the tubing is completely shrunk on the mandrels.

4.5.2 Low-Temperature Flexibility: Shall be determined in accordance with ASTM D2671, Procedure C, bending the specimen around the applicable mandrel of Table II. Any side-cracking, caused by flattening of the specimen on the mandrel, shall be disregarded.

TABLE II

Size	Mandrel Diameter	
	Inch	Millimetres
1/4 to 1/2, incl	3/8	9.5
5/8 to 1, incl	5/8	15.9
1-1/4 to 2, incl	7/8	22.2