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

AEROSPACE MATERIAL SPECIFICATION

AMS 3584A
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PLASTIC TUBING, ELECTRICAL INSULATION
Polytetrafluoroethylene, Heat Shrinkable
Overexpanded

1. SCOPE:

1.1 Form: This specification covers a modified polytetrafluoroethylene in the form of flexible 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 325°C (620°F) or higher. This tubing is stable for continuous exposure from -65°C (-90°F) to +250°C (+480°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

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

ASTM D2671 - Testing Heat-Shrinkable Tubing for Electrical Use

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 modified polytetrafluoroethylene composition.

3.2 Color: Shall be a standard unpigmented state, varying from transparent milk-white to translucent-tan.

3.3 Properties: Tubing shall conform to the following requirements; reported values shall be the ø average of all specimens tested for each requirement. 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 350°C ± 3 (662°F ± 5) in a convection-current air oven with an air velocity of 100 - 200 ft per min. (0.5 - 1.0 m/sec) past the tubing, holding at heat for not less than 10 min., removing from the oven, and cooling to room temperature.

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3.3.1.1 Tensile Strength, min Jaw separation rate 2 in. per min. (50 mm/min.)	2500 psi (17.2 MPa)	
3.3.1.2 Elongation, min	200%	
3.3.1.3 Dielectric Strength, min	800 V per mil (31,500 V/mm)	4.5.1
3.3.1.4 Volume Resistivity, min	10^{18} ohm-cm	
3.3.1.5 Low-Temperature Flexibility At -67°C ± 2 (-89°F ± 4)	No cracks	4.5.2
3.3.1.6 Heat Aging, 96 hr ± 2 at 350°C ± 4 (662°F ± 7)		
3.3.1.6.1 Tensile Strength, min	2500 psi (17.2 MPa)	
3.3.1.6.2 Elongation, min	200%	
3.3.1.6.3 Dielectric Strength, min	800 V/mil (31,500 V/mm)	
3.3.1.7 Dimensional Change on Heating		
3.3.1.7.1 Diametral	In accordance with Table I	
3.3.1.7.2 Longitudinal, max	±15%	

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 400°C ± 5 (752°F ± 9)	No dripping, flowing, or cracking	
3.3.2.1.1 Bending After Heat Shock	No cracks	4.5.3
3.3.2.2 Restricted Shrinkage, Procedure C After 5 min. ± 1 at 350°C ± 4 (662°F ± 7)	No cracks; withstand 2000 V for 1 min.	
3.3.2.3 Specific Gravity	2.13 - 2.20	
3.3.2.4 Water Absorption, max 24 hr ± 0.25 at 25°C ± 2 (77°F ± 4)	0.01%	

3.4 Quality: Tubing shall be uniform in quality and condition, clean, smooth and free from foreign materials and from internal and external imperfections detrimental to fabrication, appearance, or performance of parts.

3.5 Standard Sizes and Tolerances: Tubing shall be supplied in lengths of 48 in., +1, -0 (1219 mm, +25, -0) and in the standard sizes and to the tolerances shown in Table I, unless otherwise specified. Tolerances apply at 23° - 30°C (73° - 86°F). Measurements shall be made in accordance with ASTM D2671.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of tubing 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 4.6. Purchaser reserves the right to perform such confirmatory testing as he deems 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), elongation (3.3.1.2), dimensional change on heating (3.3.1.7), heat shock (3.3.2.1), and size 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 dielectric strength (3.3.1.3), volume resistivity (3.3.1.4), low-temperature flexibility (3.3.1.5), heat aging (3.3.1.6), 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 Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification tests and shall be performed on the initial shipment of tubing to a purchaser, when a change in material 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, qualification test material shall be submitted to the cognizant qualification agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be in accordance with ASTM D2671 and the following; a lot shall be not more than 100,000 ft (30,480 m) of tubing of the same size from the same production run presented for vendor's inspection at one time. The number of specimens for each test shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

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

4.3.1.1 When a statistical sampling plan and acceptance quality 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 Periodic Tests: Not less than 50 ft (15.3 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
1/4	5/64 - 1/4, incl
1	3/8 - 1-1/4, incl

4.3.3 Qualification 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. Results of tests on production tubing shall be essentially equivalent to those on the approved sample.

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 any change is necessary 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 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 by dividing the dielectric breakdown voltage, determined in accordance with ASTM D2671, by the wall thickness, measured at the point of electrical rupture.

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)
5/64 to 3/8 incl	5/16	(7.9)
1/2 to 3/4 incl	3/8	(9.5)
1 to 1-1/4 incl	7/16	(11.1)

4.5.3 Bending After Heat Shock: Specimens from the heat shock test of 3.3.2.1 shall be bent 360 deg around the applicable mandrel of Table II. Any sidecracking, caused by flattening of the specimen on the mandrel, shall be disregarded.

4.6 Reports:

4.6.1 The vendor of tubing shall furnish with each shipment three copies of a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the tubing conforms to the other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, vendor's compound number, lot number, size, and quantity.

4.6.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of tubing, supplier's compound number, part number, and quantity. When tubing for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of tubing to determine conformance to the requirements of this specification, and shall include in the report a statement that the tubing conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.