



AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AMS 3615C

Superseding AMS 3615B

Issued 11-1-49

Revised 6-1-74

PLASTIC TUBING

Cotton Fabric Reinforced Phenol-Formaldehyde

1. SCOPE:

- 1.1 Form: This specification covers one type of cotton fabric impregnated with a phenolic resin and supplied in the form of tubing.
- 1.2 Application: Primarily for electrical insulation at low voltages and for protection from galvanic corrosion. This material has good machining qualities and good moisture resistance.

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., Two Pennsylvania Plaza, New York, New York 10001.

- 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, Pennsylvania 19103.

ASTM D348 - Testing Laminated Tubes Used for Electrical Insulation

3. TECHNICAL REQUIREMENTS:

- 3.1 Material and Fabrication: Tubing shall consist of laminations of fabric which have been impregnated with a thermosetting, phenolic-type synthetic resin, rolled on a mandrel between heated pressure rolls, and cured in an oven.

- 3.1.1 Fabric: Shall be fine weave cotton weighing not more than 4 oz per sq yd (135.6 g/m²). Thread counts, determined by inspection of finished tubing, shall be not less than 50 per in. (25.4 mm) in each direction (warp and fill) and not less than 140 total in both warp and fill directions.

- 3.1.2 Finish: Shall be buffed.

- 3.1.3 Color: Shall be natural, unless otherwise ordered. When colored tubing is ordered, color shall be substantially uniform throughout the tubing. Surfaces shall be substantially free from streaks and stains.

- 3.2 Properties: Tubing shall conform to the following requirements; tests shall be conducted on the tubing supplied and in accordance with ASTM D348 insofar as practicable except that machinability, weather resistance, and corrosive effect shall be determined by procedures agreed upon by purchaser and vendor:

- 3.2.1 Tensile Strength, min

6,500 psi (44.8 MPa)

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3.2.2 Compressive Strength, Axial, min

Nominal Wall Thickness		
Inch	(Millimetres)	
Up to 0.063, excl	(Up to 1.60, excl)	13,000 psi (89.6 MPa)
0.063 to 0.125, excl	(1.60 to 3.18, excl)	15,000 psi (103 MPa)
0.125 and over	(3.18 and Over)	18,000 psi (124 MPa)

3.2.3 Density, min

1.10 g/cm³

3.2.4 Water Absorption (24 hr Immersion), %, max

Nominal Wall Thickness		Nominal ID	
Inch	(Millimetres)	Up to 0.500 in. (12.70 mm), excl	0.500 in. (12.70 mm) and over
Up to 0.063, incl	Up to 1.60, incl)	8.0	6.5
Over 0.063 to 0.094, incl	(Over 1.60 to 2.39, incl)	5.5	3.5
Over 0.094 to 0.125, incl	(Over 2.39 to 3.18, incl)	3.5	2.2
Over 0.125 to 0.188, incl	(Over 3.18 to 4.78, incl)	2.1	1.8
Over 0.188 to 0.250, incl	(Over 4.78 to 6.35, incl)	1.9	1.7
Over 0.250 to 0.500, incl	(Over 6.35 to 12.70, incl)	1.6	1.6
Over 0.500	(Over 12.70)	1.5	1.5

3.2.5 Machinability: Tubing shall not split, crack, chip, or delaminate when drilled, sawed, tapped, or machined in any direction.

3.2.6 Weather Resistance: Shall be acceptable to the purchaser.

3.2.7 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: Tubing shall be uniform in quality and condition, clean, sound, and free from blisters, wrinkles, cracks, crazing, and surface roughness and reasonably free from other small imperfections such as scratches and dents.

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

3.4.1 Diameter: Shall be as specified in Table I. Diameter tolerance applies to ID or OD, as ordered, but not to both.

TABLE I

Nominal Diameter Inches	Diameter Tolerance, Inch plus and minus	
	ID	OD
Up to 0.750, excl	0.003	0.005
0.750 to 2.000, excl	0.004	0.005
2.000 to 4.000, incl	0.008	0.008
4.000 to 12.000, incl	0.010	0.025
Over 12.000 to 18.000, incl	0.030	0.030
Over 18.000 to 24.000, incl	0.040	0.035
Over 24.000 to 48.000, incl	0.060	0.040

TABLE I (SI)

Nominal Diameter Millimetres	Diameter Tolerance, Millimetres plus and minus	
	ID	OD
Up to 19.05, excl	0.08	0.13
19.05 to 50.80, excl	0.10	0.13
50.80 to 101.60, incl	0.20	0.20
Over 101.60 to 304.80, incl	0.25	0.64
Over 304.80 to 457.20, incl	0.76	0.76
Over 457.20 to 609.60, incl	1.02	0.89
Over 609.60 to 1219.20, incl	1.52	1.02

3.4.2 Wall Thickness: Shall be as specified in Table II.

TABLE II

Nominal Wall Thickness Inch	Wall Thickness Tolerance, Inch plus and minus	
	ID Ranges, Inches	
	Up to 0.500, incl	Over 0.500
Up to 0.063, excl	0.010	0.008
0.063 to 0.125, excl	0.011	0.009
0.125 to 0.250, excl	0.013	0.011
0.250 to 0.500, incl	0.015	0.013

TABLE II (SI)

Nominal Wall Thickness Millimetres	Wall Thickness Tolerance, Millimetres plus and minus	
	ID Ranges, Millimetres	
	Up to 12.70, incl	Over 12.70
Up to 1.60, excl	0.25	0.20
1.60 to 3.18, excl	0.28	0.23
3.18 to 6.35, excl	0.33	0.28
6.35 to 12.70, incl	0.38	0.33

3.4.3 Length: Shall be as specified in Table III.

TABLE III

Nominal Length Inches	Length Tolerance, Inch plus and minus		
	OD Ranges, Inches		
	Up to 2.000 incl	Over 2.000 to 4.000, incl	Over 4.000
Up to 3.000, incl	0.010	0.010	0.030
Over 3.000 to 6.000, incl	0.010	0.015	0.030
Over 6.000 to 12.000, incl	0.015	0.020	0.030
Over 12.000 to 48.000, incl	0.030	0.030	0.050

TABLE III (SI)

Nominal Length Millimetres	Length Tolerance, Millimetres plus and minus		
	OD Ranges, Millimetres		
	Up to 50.80 incl	Over 50.80 to 101.60, incl	Over 101.60
Up to 76.20, incl	0.25	0.25	0.76
Over 76.20 to 152.40, incl	0.25	0.38	0.76
Over 152.40 to 304.80, incl	0.38	0.51	0.76
Over 304.80 to 1219.20, incl	0.76	0.76	1.27

3.4.4 Straightness: Shall be as specified in Table IV.

TABLE IV

Nominal OD Inches	Maximum Curvature (Depth of Arc) Inch	
	36 Inch Lengths	Other Lengths, Inches
Up to 0.250, incl	0.72	$0.000555 \times (\text{length})^2$
Over 0.250 to 0.750, incl	0.36	$0.000277 \times (\text{length})^2$
Over 0.750	0.18	$0.000138 \times (\text{length})^2$

TABLE IV (SI)

Nominal OD Millimetres	Maximum Curvature (Depth of Arc), Millimetres	
	1.0 Metre Lengths	Other Lengths, mm
Up to 6.35, incl	1.96	$0.00000196 \times (\text{length})^2$
Over 6.35 to 19.05, incl	0.98	$0.00000098 \times (\text{length})^2$
Over 19.05	0.49	$0.00000049 \times (\text{length})^2$

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of tubing shall supply all samples and 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 assure 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 material and fabrication (3.1), tensile strength (3.2.1), compressive strength (3.2.2), density (3.2.3), water absorption (3.2.4), and tolerance (3.4) requirements are classified as acceptance or routine control tests.

4.2.2 Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as qualification or periodic control tests.

4.3 Sampling:

4.3.1 Acceptance Tests: Each lot shall be sampled as required by ASTM D348; a lot shall be all tubing of one size manufactured from the same lots of materials in one production run and presented for inspection at one time.

4.3.2 Qualification Tests: Sampling for weather resistance, corrosion, and machinability tests shall be as agreed upon by purchaser and vendor.