



AEROSPACE MATERIAL

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

SPECIFICATION

AMS 3589

Issued 11-1-70
Revised

PLASTIC TUBING, ELECTRICAL INSULATION, RESIN BONDED
Polyethylene Terephthalate, Heat Shrinkable
1.3 to 1 Shrink Ratio

1. **ACKNOWLEDGMENT:** A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. **FORM:** Extra thin wall semi-rigid tubing.
3. **APPLICATION:** Primarily for use as a semi-rigid, electrical insulating tubing, the diameter of which can be reduced to a predetermined size by heating to a temperature higher than 135 C (275 F). This material is stable from -60 to +135 C (-76F to +275F).
4. **COMPOSITION:** The material shall be a spirally-wound, resin-bonded, thermally-stabilized, polyethylene terephthalate film.
5. **TECHNICAL REQUIREMENTS:**
 - 5.1 **Color:** The tubing shall be furnished clear or in striped colors as ordered. When ordered in colors, the colors shall be in accordance with the latest issue of MIL-STD-104, unless otherwise specified.
 - 5.2 **Properties:** The product shall conform to the requirements of 5.2.1 through 5.2.4 and shall be capable of meeting the requirements of 5.2.5 through 5.2.13. Tests shall be performed in accordance with the issue of specified ASTM methods listed in the latest issue of AMS 2350, insofar as practicable. Unless otherwise specified, the tubing shall be tested after being shrunk, on a smooth metallic mandrel which has a diameter equal to or less than the acceptable maximum tubing ID (+0.000, -0.002 in. or 2%, whichever is greater) after unrestricted shrinkage, by heating for 5 min. in a mechanical convection oven which is at 160 C $\pm$ 2 (320F $\pm$ 3.6) with an air velocity of 100 - 200 ft per min. past the tubing, removed from the oven, and cooled to room temperature.

5.2.1 Tensile Strength, psi, min	20.000	ASTM D638, Speed D See Note 1
5.2.2 Elongation, %, min	60	ASTM D638, Speed D See Note 1
5.2.3 Color Stability	Pass	Note 2
5.2.4 Heat Shock	Pass	Note 3
5.2.5 Flammability	Self Extinguishing	ASTM D876
5.2.6 Low Temperature Flexibility	Pass	Note 4
5.2.7 Heat Aging	Pass	Note 5
5.2.8 Solvent Resistance	Pass	Note 6
5.2.9 Fungus Resistance	Pass	Note 7
5.2.10 Specific Gravity, max	1.39	ASTM D792, Method A

5.2.11	Water Absorption in 24 hr, %, max	0.8	ASTM D357
5.2.12	Volume Resistivity, ohm-cm, min	10^{15}	ASTM D257
5.2.13	Dielectric Strength, short time test, v per mil, min	2500	ASTM D876

Note 1. Five specimens, each 4 in. long, shall be tested using 1 in. bench marks and 1 in. initial jaw separation. The specimens shall be full sections of tubing for sizes 0.250 and smaller and strip specimens, not less than 0.250 in. wide, cut longitudinally from sizes 0.375 and larger. No metal plugs are necessary when testing full sections of tubing. A specimen break at a bench mark or outside the gage length shall be cause for retest.

Note 2. Three specimens in the expanded form (as supplied), each 4 in. long, of each color shall be conditioned for 48 hr in a mechanical convection oven which is at $175\text{ C} + 3$ ($347\text{ F} + 5.4$) with an air velocity of 100 - 200 ft per min. past the specimens. After conditioning, the specimens shall be removed from the oven, cooled to room temperature, and evaluated to the limits of MIL-STD-104.

Note 3. Three specimens in the expanded form (as supplied), each 6 in. long, shall be conditioned for 4 hr in a mechanical convection oven which is at $175\text{ C} + 3$ ($347\text{ F} + 5.4$) with an air velocity of 100 - 200 ft per min. past the specimens. After conditioning, the specimens shall be removed from the oven, cooled to room temperature, and visually examined. Tubing shall not drip, flow, or crack. Also, tubing shall be bent through 180 deg over a steel mandrel of the diameter shown in Table I. The tubing shall remain free from cracks except that any side cracking caused by flattening of the specimen on the mandrel shall be disregarded.

TABLE I

Tubing ID, Inch	Diameter of Mandrel, Inch
0.046 to 0.187, incl	0.312
0.250 to 1, incl	0.750
1.125 to 2, incl	1.125

Note 4. Three specimens, each 6 in. long (6 in. by 0.250 in. strips cut from sizes 0.375 and larger), shall be conditioned at $-50\text{ C} + 2$ ($-58\text{ F} + 3.6$) for 4 hours. A fixed steel mandrel, selected in accordance with Table I above, shall be conditioned at this temperature. Upon completion of this conditioning, and at this same temperature, the specimens shall not crack when wrapped not less than 360 deg about the mandrel in approximately 2 sec after removal from conditioning temperature.

Note 5. Specimens shall be prepared as in Note 1 and shall be conditioned for 168 hr in a mechanical convection oven which is at $155\text{ C} + 5$ ($311\text{ F} + 9$) with an air velocity of 100 - 200 ft per min. past the specimens. After conditioning, the specimens shall be removed from the oven, cooled to room temperature, and tested for elongation. Specimens shall have elongation not less than 40%.

Note 6. Tubing shall have tensile strength not lower than 20,000 psi and dielectric strength not lower than 3000 v per mil for 0.0015 - 0.0060 in., excl, wall thickness and not less than 2500 v per mil for 0.006 - 0.010 in., incl, wall thickness, after being immersed for 24 hr ± 2 at $23\text{ C} + 3$ ($73.4\text{ F} + 5.4$) in JP-4 fuel, SAE phosphate ester fluid No. 1, hydraulic oil, aviation gasoline 100/130, and water. Six specimens (a total of 30) each 6 in. long, shall be immersed in each of the fluids. The volume of the fluid shall be not less than 20 times that of the specimens. After immersion, the specimens shall be lightly wiped, air dried for 30 - 60 min. at room temperature, and subjected to the tensile strength and dielectric strength tests; three of each group of six specimens shall be tested for tensile strength and the other three for dielectric strength.