Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10000

AEROSPACE MATERIAL SPECIFICATION

AMS 3625

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Revised

ELASTOMERIC TUBING, ELECTRICAL INSULATION
Cross Linked Silicone, Pigmented, Flexible, Heat Shrinkable
1.750 to 1 Shrink Ratio

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. FORM: Flexible tubing.

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

-70 C (-94 F) to 180 C (356 F) Continuous
-70 C (-94 F) to 300 C (572 F) 4 hr

4. COMPOSITION: The material shall be a crosslinked, thermally stabilized, flame-resistant, modified silicone rubber.

5. TECHNICAL REQUIREMENTS:

5.1 Color: The tubing shall be furnished in black, unless otherwise ordered.

5.2 Properties: The product shall conform to the requirements of 5.2.1 through 5.2.6 and shall be capable of meeting the requirements of 5.2.7 through 5.2.18. 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, tubing shall be tested after being shrunk by heating for 10 min. in a mechanical convection oven which is at 175 C ± 5 (347 F ± 9), 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	600	ASTM D412 (See Note 1)
5.2.2	Elongation, %, min	200	ASTM D412 (See Note 1)
5.2.3	Tensile Stress at 200% Elongation, psi, max	1000	ASTM D412 (See Note 1)
5.2.4	Hardness, Durometer "A" or equivalent	60 ± 5	ASTM D2240
5.2.5	Heat Shock	Pass	Note 2
5.2.6	Flammability	Self-Extinguishing	Note 3
5.2.7	Low Temperature Flexibility	Pass	Note 4
5.2.8	Heat Aging	Pass	Note 5
5.2.9	Corrosion	Pass	Note 6

5.2.10	Solvent Resistance	Pass	Note 7
5.2.11	Fungus Resistance	Pass	Note 8
5.2.12	Restricted Shrinkage	Pass	Note 9
5.2.13	Specific Gravity, max	1.35	ASTM D792, Method A
5.2.14	Water Absorption in 24 hr, %, max	1.00	ASTM D570
5.2.15	Dielectric Strength, short time test, v per mil, min	300	ASTM D876
5.2.16	Volume Resistivity, ohm-cm, min	10^{11}	ASTM D257
5.2.17	Shelf Life	Pass	ASTM D2671 (See Note 10)
5.2.18	Tear Resistance, lb/in., min	100	ASTM D624, Die B

Note 1. Three specimens, each 4 in. long, shall be tested, using 1 in. bench marks. An initial jaw separation of 1 in. shall be used for full sections of tubing and 2 in. for dumbell specimens. The specimens shall be full sections of tubing for sizes 3/8 and smaller and shall be cut with die D from sizes 1/2 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 6 in. in length, shall be conditioned for 4 hr in a mechanical convection oven which is at 300 C ± 5 (572 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 visually examined. Tubing shall not drip, flow, or crack. Also, tubing shall be bent through 360 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

Size	Diameter of Mandrel, Inch
1/4 to 1/2, incl	3/8
5/8 to 1 , incl	5/8
1-1/4 to 2 , incl	7/8

Note 3. A specimen of tubing 18 in. in length shall be shrunk over a metal rod, 21 in. in length, with a diameter equivalent to the applicable maximum recovered diameter specified in Table II. The specimen then shall be subjected to the vertical test in accordance with Federal Test Method Standard No. 228, Method 5221. The tubing shall extinguish within 1 min. after final removal of the gas flame, shall not drip or flow, and not more than 25% of the indicator flag shall be burned or charred. Brown scorching or soot on the indicator flag shall not be cause for rejection.

Note 4. Three specimens, each 12 in. in length, shall be conditioned at -70 C ± 3 (-94 F ± 5.4) 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 be wrapped not less than 360 deg about the mandrel in approximately 2 seconds. The specimens shall be free from cracks.

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 200 C ± 3 (392 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 tested for tensile strength and elongation. Specimens shall have tensile strength not lower than 480 psi and elongation not lower than 120%.

Note 6. A specimen 1 in. in length (a 1/4 in. wide strip cut from sizes 7/8 and larger), shall be placed in the bottom of each of two clean 1/2 in. x 12 in. test tubes. A third tube shall be used for control. A copper-glass mirror about 1/4 in. wide x 1 in. long shall be suspended 6 - 7 in. above the bottom of each tube by fine copper wire attached to a silicone rubber stopper wrapped in aluminum foil. The mirrors shall be vacuum-deposited copper, on one side only, with a thickness equal to 10% ± 5 transmission of normal incident light of 5000 Angstroms. The coated mirrors shall be stored in vacuum and may be used for test only if no oxide film is present and the copper is not visibly damaged. The three test tubes shall be tightly sealed. The lower 2 in. of each tube shall be placed in an oven or oil bath at 175 C ± 3 (347 F ± 5.4) for 16 hours. After cooling, the mirrors shall be examined in a good light against a white background. The copper shall not have been removed from a mirror leaving an area of transparency greater than 5% of the total area. Discoloration of the copper film shall not be considered corrosion.

Note 7. Tubing shall have tensile strength not lower than 300 psi, elongation not lower than 120%, and dielectric strength not lower than 300 v per mil after being immersed for 24 hr ± 2 at 23 C ± 3 (73.4 F ± 5.4) in JP-4 Fuel, hydraulic oil, aviation gasoline 100/130, and water. Six specimens (a total of 24), each 6 in. in length, 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 60 - 70 min. at room temperature, and subjected to the tensile strength, elongation, and dielectric strength tests; three of each group of six specimens shall be tested for tensile strength and elongation, and the other three for dielectric strength.

Note 8. Fungus resistance shall be determined in accordance with ASTM D1924 except that the incubation period shall be 28 days and the test organisms shall be Aspergillus niger, Aspergillus flavus, Penicillium luteum, and Trichoderma T-1. At the end of the incubation period, not more than traces of growth on the specimens are permissible. Three specimens, each 3 in. long, shall be used for each organism.

Note 9. A specimen in the expanded form (as supplied) shall be shrunk onto a clean metallic mandrel of the configuration and size shown in Fig. 1. The tubing on the mandrel then shall be conditioned for 30 min. in an oven which is at 200 C ± 5 (392 F ± 9), in accordance with ASTM D573. When cooled to room temperature, the tubing shall be visually examined and then shall be subjected to the following voltage withstand test. The tubing shall snugly fit the mandrel and shall not be cracked. The test potential shall be applied between the mandrel and a metal foil electrode wrapped around the largest diameter of the tubing in accordance with ASTM D876. The test potential then shall be applied in accordance with the short-time test of ASTM D149 using a 500 v per sec rate of rise. The specimen shall withstand 2000 v for 1 minute.

Note 10. Tubing shall meet expanded (as supplied) dimensions shown in Table II after conditioning for 2 weeks at 40 C ± 1 (104 F ± 1.8) and shall meet recovered dimensions shown in Table II after heat shrinking as described in 5.3. Three specimens, each 6 in. long, shall be used.

5.3 Dimensions After Shrinkage:

5.3.1 Diametral: Three specimens in the expanded form (as supplied), each 6 in. in length, shall be measured for length and inside diameter. The specimens shall be conditioned for 10 min. in a mechanical convection oven which is at 175 C ± 5 (347 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 then remeasured. Longer heating at such temperature shall cause no additional shrinkage. Prior to and after conditioning, the dimensions of the tubing shall be in accordance with Table II. Measurements shall be made in accordance with ASTM D876.

5.3.2 Longitudinal: In reaching its recovered dimensions, the tubing shall not exhibit a longitudinal change greater than +1%, -10%, computed as follows:

$$\% \text{ Change} = \frac{\text{Length after heating - Length before heating}}{\text{Length before heating}} \times 100$$

5.4 Marking: Prior to and after shrinkage, tubing shall be capable of having numbers or characters printed on it with conventional tubing marking techniques.

6. QUALITY: The product shall be uniform in quality and condition, clean, smooth, and free from foreign materials and from imperfections detrimental to fabrication, appearance, or performance of parts.

7. STANDARD SIZES AND TOLERANCES: Unless otherwise specified, tubing shall be supplied in lengths shown in 9.1 and in the standard sizes and tolerances shown in Table II. Tolerances apply at 23 - 30 C (73.4 - 86 F).

TABLE II

Expanded (As Supplied)		Recovered Dimensions (After Heating)		
Size	ID, Inches min	ID, Inches max	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

8. REPORTS:

8.1 Unless otherwise specified, the vendor of the product shall furnish with each shipment three copies of a report stating that the product conforms to the requirements of this specification. This report shall include the purchase order number, material specification number, vendor's compound number, size, and quantity.

8.2 Unless otherwise specified, 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, contractor or other direct supplier of material, supplier's compound number, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.