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

AEROSPACE MATERIAL SPECIFICATION

AMS 3623

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Revised

ELASTOMERIC TUBING, ELECTRICAL INSULATION
Irradiated Polychloroprene, 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 135 C (275 F). This material is stable under the following conditions:

-55 C (-67 F) to 90 C (194 F) Continuous
-55 C (-67 F) to 150 C (302 F) 4 hr

4. COMPOSITION: The material shall be an irradiated, thermally stabilized, flame-resistant, modified polychloroprene 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 5.2.16. 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 135 C ± 5 (275 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	1500	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	2500	ASTM D412 (See Note 1)
5.2.4	Hardness, Durometer "A" or equivalent	80 ± 5	ASTM D2240
5.2.5	Heat Shock	Pass	Note 2
5.2.6	Flammability, 15 sec, max	Self-Extinguishing	ASTM D876
5.2.7	Low Temperature Flexibility	Pass	Note 3
5.2.8	Heat Aging	Pass	Note 4
5.2.9	Solvent Resistance	Pass	Note 5
5.2.10	Fungus Resistance	Pass	Note 6

5.2.11	Restricted Shrinkage	Pass	Note 7
5.2.12	Specific Gravity, max	1.50	ASTM D792, Method A
5.2.13	Water Absorption in 24 hr, %, max	1.00	ASTM D570
5.2.14	Dielectric Strength, short time test, v per mil, min	200	ASTM D876
5.2.15	Volume Resistivity, ohm-cm, min	10^9	ASTM D257
5.2.16	Shelf Life	Pass	ASTM D2671 (See Note 8)

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 150 C ± 5 (303 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. Two specimens in the expanded form (as supplied), each cut into a 6 in. long x 1/4 in. wide strip, shall be mounted in a loop position between movable, parallel jaws 2-1/2 in. apart. Each end of the specimens shall be firmly fastened by at least 3/4 in. extending into a set of jaws. The specimens and the test fixture shall be conditioned for 4 hr at -55 C ± 2 (-67 F ± 3.6). While at this temperature, the jaws shall be moved rapidly from a 2-1/2 in. to a 1 in. separation. The specimens shall be free from cracks. See ASTM D736 for appropriate flexing test fixture.

Note 4. Specimens shall be prepared as in Note 1 and shall be conditioned for 96 hr in a mechanical convection oven which is at 100 C ± 2 (212 F ± 3.6), 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 of not lower than 1200 psi and elongation not lower than 150%.

Note 5. Tubing shall have tensile strength not lower than 900 psi, elongation not lower than 125%, and dielectric strength not lower than 200 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 30 - 60 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 6. 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 7. 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 135 C ± 5 (275 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 8. 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 135 C ± 5 (275 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:

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

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	1.125	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.

9. PACKAGING:

9.1 Packaging shall be accomplished in such a manner as to ensure that the product, during shipment and storage, will not be permanently distorted and will be protected against damage from exposure to weather or any normal hazard. Unless otherwise specified, standard packages shall contain the following quantities:

Size	Quantity, ft
1/4 to 1-3/4, incl	100
2	50

9.2 Each package shall be permanently and legibly marked with the AMS number, size, quantity, purchase order number, manufacturer's identification, and date of manufacture.

10. APPROVAL:

10.1 To assure adequate performance characteristics, 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.

10.2 Vendor shall use the same compound and manufacturing processes for production tubing as for approved sample tubing. If necessary to make any change in compound or processing which could unfavorably affect any characteristics of the tubing, vendor shall obtain written permission from purchaser prior to incorporating such change.