AEROSPACE
MATERIAL SPECIFICATIONS

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AMS 3632

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Revised

PLASTIC TUBING, ELECTRICAL INSULATION
Irradiated Polyvinylidene Fluoride, Heat Shrinkable
2 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 insulation tubing whose diameter can be reduced to a predetermined size by heating. This material is stable under the following conditions:

-55 C (-67 F) to 175 C (347 F)	Continuous
-55 C (-67 F) to 200 C (392 F)	15,000 hr
-55 C (-67 F) to 240 C (464 F)	1,000 hr
-55 C (-67 F) to 280 C (536 F)	110 hr
-55 C (-67 F) to 315 C (599 F)	24 hr
-55 C (-67 F) to 350 C (662 F)	5 hr

4. COMPOSITION: The material shall be an irradiated, thermally stabilized, flame-resistant, modified polyvinylidene fluoride.

5. TECHNICAL REQUIREMENTS:

5.1 Color: The tubing shall be furnished in a standard unpigmented state, transparent to translucent light tan in color.

5.2 Properties: The product shall conform to the requirements of 5.2.1 through 5.2.3 and shall be capable of meeting the requirements of 5.2.4 through 5.2.12. 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 3 min. at 200 C ± 5 (392 F ± 9) and cooled by immersing in water for 30 seconds.

5.2.1	Tensile Strength psi, min	5000	ASTM D638, Speed C, See Note 1
5.2.2	Elongation, %, min	150	ASTM D638, Speed C, See Note 1
5.2.3	Heat Shock	Pass	Note 2
5.2.4	Flammability	Self-extinguishing	ASTM D876
5.2.5	Low Temperature Flexibility	Pass	Note 3
5.2.6	Heat Aging	Pass	Note 4
5.2.7	Solvent Resistance	Pass	Note 5
5.2.8	Fungus Resistance	Pass	Note 6
5.2.9	Specific Gravity, max	1.80	ASTM D792, Method A
5.2.10	Water Absorption, %, max	0.50	ASTM D570, 24 hr

5.2.11	Dielectric Strength, short time test, v per mil, min		ASTM D876
	Sizes 3/64 - 1/2	1000	
	Sizes 3/4 - 1	800	
5.2.12	Volume Resistivity, ohm-cm, min	10^{13}	ASTM D257

Note 1. The specimens shall be in accordance with ASTM D876,

Note 2. Three specimens in the expanded form (as supplied), each 4 in. in length, shall be conditioned for 4 hr in an oven which is at 300 C ± 5 (572 F ± 9). After this conditioning, the specimens shall be visually examined. Tubing shall not drip, flow, or crack.

Note 3. Three specimens in the expanded form (as supplied), each 18 in. in length, shall be conditioned at -55 C ± 2 (-67 F ± 3.6) for 4 hours. A fixed steel mandrel, selected in accordance with Table 1, 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 tubing shall be free from cracks.

TABLE 1

Size	Diameter of Mandrel, Inch
3/64 to 3/16, incl	5/16
1/4 to 1, incl	3/4

Note 4. Three specimens, each 6 in. in length, shall be conditioned for 168 hr in a gravity convection or mechanical convection oven which is at 250 C ± 5 (482 F ± 9), with a maximum air velocity of 50 ft per min. past the specimens. After conditioning, the specimens shall be removed from the oven, cooled to room temperature, and bent through 180 deg over a steel mandrel of the diameter shown in Table 1. The tubing shall remain free from cracks except that any side cracking caused by flattening of the specimen on the mandrel shall be disregarded.

Note 5. Tubing shall have tensile strength not lower than 5000 psi and dielectric strength not lower than 900 v per mil for sizes 3/64 - 1/2, and not less than 700 v per mil for sizes 3/4 - 1, after being immersed for 24 hr ± 2 at 23 C ± 3 (73.4 F ± 5.4) in JP-4 fuel, SAE phosphate ester fluid No. 1, hydraulic oil, aviation gasoline 100/130, salt water (5% salt), anti-icing fluid, and ASTM Service Fluid No. 101 (ASTM D471). Six specimens (a total of 42) 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 and dielectric strength tests; three of the six specimens shall be tested for tensile strength and the other three for dielectric strength.

Note 6. A mixed suspension prepared from viable cultures and containing a suitable wetting agent shall be sprayed over the test specimens supported on a non-nutrient agar medium. The test organisms shall be Aspergillis niger, Aspergillis flavus, Penicillium luteum, and Trichoderma T-1. A suitable control, such as untreated cotton twine, shall also be included. At the end of two weeks' incubation at 27.8 - 30 C (82 - 86 F) not more than traces of growth on the specimens are permissible. The controls shall show abundant growth. Three specimens, each 3 in. long, shall be used for each organism.

5.3 Dimensions After Shrinkage:

5.3.1 Diametral: The dimensions of the tubing in its expanded form (as supplied) and after recovery subsequent to the application of heat at any temperature in the range of 175 to 205 C (347 to 401 F) for 1 min. shall be in accordance with Table II. Longer heating at such temperature shall cause no additional shrinkage. Unless otherwise specified, measurements shall be made in accordance with the issue of ASTM D876 listed in the latest issue of AMS 2350.

5.3.2 Longitudinal: In reaching its recovered dimensions, the tubing shall not exhibit a longitudinal shrinkage greater than 10%.

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

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 of 48 in., +1, - 0. The sizes shown in Table II are standard and the tolerances apply between 23 - 30 C (73.4 - 86 F).

TABLE II

Expanded (As Supplied)		Recovered Dimensions (After Heating)		
Size	ID, Inch min	ID, Inch max	Nominal Wall Thickness, Inch	Wall Thickness Tolerance, Inch plus and minus
3/64	0.046	0.023	0.010	0.002
1/16	0.063	0.031	0.010	0.002
3/32	0.093	0.046	0.010	0.002
1/8	0.125	0.062	0.010	0.002
3/16	0.187	0.093	0.010	0.002
1/4	0.250	0.125	0.012	0.003
3/8	0.375	0.187	0.012	0.003
1/2	0.500	0.250	0.012	0.003
3/4	0.750	0.375	0.017	0.003
1	1.000	0.500	0.019	0.003

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.