AEROSPACE
MATERIAL SPECIFICATIONS

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AMS 3637

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Revised

PLASTIC TUBING, ELECTRICAL INSULATION
Irradiated Polyolefin, Clear, 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: Thin wall flexible tubing.

3. APPLICATION: Primarily for use as a flexible, 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 135 C (275 F)	Continuous
-55 C (-67 F) to 150 C (302 F)	1000 hr
-55 C (-67 F) to 175 C (347 F)	168 hr
-55 C (-67 F) to 200 C (392 F)	24 hr
-55 C (-67 F) to 250 C (482 F)	4 hr
-55 C (-67 F) to 300 C (572 F)	1 hr

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

5. TECHNICAL REQUIREMENTS:

5.1 Appearance: Unless otherwise specified, a colorless transparent tubing shall be furnished. Tubing shall be sufficiently transparent to allow relatively undistorted visibility through two thicknesses produced by pressing the tubing flat upon itself. Typewritten letters shall be legible when viewed through these two thicknesses pressed onto the paper. Transparency shall apply to tubing in the expanded form (as supplied) and after tubing has been shrunk as specified in 5.2.

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	1500	ASTM D638, Speed D, See Note 1
5.2.2	Elongation, %, min	200	ASTM D638, Speed D, See Note 1
5.2.3	Heat Shock	Pass	Note 2
5.2.4	Low Temperature Flexibility	Pass	Note 3
5.2.5	Heat Aging	Pass	Note 4
5.2.6	Corrosion	Pass	Note 5
5.2.7	Solvent Resistance	Pass	Note 6
5.2.8	Fungus Resistance	Pass	Note 7

5.2.9	Specific Gravity, max	1.00	ASTM D792, Method A
5.2.10	Water Absorption, %, max	0.20	ASTM D570, 24 hr
5.2.11	Dielectric Strength, short time test, v per mil, min	500	ASTM D876
5.2.12	Volume Resistivity, ohm-cm, min	10^{16}	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 250 C ± 5 (482 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 I, 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 I

Size	Diameter of Mandrel, Inch
3/64 to 1/4, incl	5/16
3/8 to 1/2, incl	3/8
3/4 to 2, incl	7/16
3 to 4, incl	7/8

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 175 C ± 3 (347 F ± 5.4), 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 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.

Note 5. Two specimens, each 1 in. in length (1/4 in. wide x 1 in. long strip cut from sizes 1 - 4), shall be placed in the lower compartments of two glass tubes that are bent at two right angles as shown in Fig. 1. Copper-glass mirrors about 1/4 in. wide x 1 in. long shall be placed in the upper compartment of these tubes and in a third tube which shall serve as a control. The mirrors shall be vacuum-deposited copper, on one side only, with 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 with silicone rubber stoppers wrapped in aluminum foil and the lower compartments shall be placed in an oven or oil bath at 120 C ± 2 (248 F ± 3.6) for 16 hours. The copper mirrors shall be more than 4 in. from the source of heat. After cooling, the mirrors shall be examined in a good light against a white background. Evidence of corrosion shall be areas of transparency larger than pinholes in a mirror. Discoloration of copper film shall not be considered corrosion.

Note 6. Tubing shall have tensile strength not lower than 1000 psi and dielectric strength not lower than 400 v per mil after being immersed for 24 hr ± 2 at 23 C ± 3 (73.4 F ± 5.4) in JP-4 fuel, SAE phosphate ester test fluid No. 1, hydraulic oil, aviation gasoline 100/130, and water. Six specimens (a total of 30), 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 7. 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 121 to 205 C (249.8 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 5%.

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, Inches min	ID, Inches max	Nominal Wall Thickness, Inch	Wall Thickness Tolerance, Inch plus and minus
3/64	0.046	0.023	0.016	0.003
1/16	0.063	0.031	0.017	0.003
3/32	0.093	0.046	0.020	0.003
1/8	0.125	0.062	0.020	0.003
3/16	0.187	0.093	0.020	0.003
1/4	0.250	0.125	0.025	0.003
3/8	0.375	0.187	0.025	0.003
1/2	0.500	0.250	0.025	0.003
3/4	0.750	0.375	0.030	0.003
1	1.000	0.500	0.035	0.005
1-1/2	1.500	0.750	0.040	0.006
2	2.000	1.000	0.045	0.007
3	3.000	1.500	0.050	0.008
4	4.000	2.000	0.055	0.009

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
3/64, 1/16, 3/32, 1/8, 3/16	200
1/4, 3/8, 1/2, 3/4	100
1, 1-1/2	48
2, 3, 4	24

9.2 Each package shall be permanently and legibly marked to give the following information:

TUBING, IRRADIATED POLYOLEFIN, HEAT SHRINKABLE
AMS 3637
SIZE _____
QUANTITY _____
PURCHASE ORDER NUMBER _____
MANUFACTURER'S IDENTIFICATION _____
DATE OF MANUFACTURE _____

10. APPROVAL:

10.1 To assure adequate performance characteristics, compounds shall be approved by purchaser before material for production use is supplied, unless such approval be waived. Results of tests on production material shall be essentially equivalent to those on the approved sample.

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

11. REJECTIONS: Material not conforming to this specification or to authorized modifications will be subject to rejection.