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RAYCHEM TAT-125 ADHESIVE LINED TUBING Polyolefin, Flexible, Heat-Shrinkable, Dual Wall

1. SCOPE

This specification covers the requirements for one type of flexible, electrical insulating, extruded tubing whose diameter will reduce to a predetermined size upon the application of heat in excess of 121°C (250°F).

1.1 FORM

The tubing shall be flame retarded and shall be black with a thermoplastic hot melt adhesive lining, unless otherwise specified.

2. APPLICABLE DOCUMENTS

This specification takes precedence over documents referenced herein. Unless otherwise specified, the latest issue of referenced documents applies. The following documents form a part of this specification to the extent specified herein.

2.1 GOVERNMENT-FURNISHED DOCUMENTS

Military Documents

MIL-T-83133	JP-8 turbine fuel (NATO type F-34)
MIL-PRF-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance
Skydrol 500B	Aviation Hydraulic Fluid
Av Gas (100/130)	Aviation Gasoline
A-A -694	5% Na Cl solution
MIL-STD-104	Limits for Electrical Insulation Color

2.2 OTHER PUBLICATIONS

American Society for Testing and Materials (ASTM)D 2671 Standard Methods of Testing Heat-Shrinkable Tubing for Electrical Use
(Copies of ASTM publications may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)
ISO 846 Plastics-Evaluation of the action of microorganisms

3. REQUIREMENTS

3.1 MATERIALS

The tubing shall be fabricated from thermally stabilized, modified polyolefin and shall be crosslinked by irradiation. It shall be homogeneous and essentially free from flaws, defects, pinholes, bubbles, seams, cracks, and inclusions. It shall have an interior coating of thermoplastic adhesive.

3.2 PROPERTIES

The tubing shall meet the requirements of Table 3.

4. QUALITY ASSURANCE PROVISIONS

4.1 CLASSIFICATION OF TESTS

4.1.1 Qualification Tests

Qualification tests are those performed on tubing submitted for qualification as a satisfactory product and shall consist of all tests listed in this specification.

4.1.2 Acceptance Tests

Acceptance tests are those performed on tubing submitted for acceptance under contract. Acceptance tests shall be: dimensions, longitudinal change, tensile strength, ultimate elongation, secant modulus, flammability (jacket only), and heat shock. Statistical process control data may be used to demonstrate conformance for dimensions.

4.2 SAMPLING INSTRUCTIONS

4.2.1 Qualification Test Samples

Qualification test samples shall consist of 50 feet (15 m) of black tubing. Qualification of any size within each size range specified below shall qualify all sizes within that size range.

Range of Sizes

1/8 through 1/4

3/8 through 1

1-1/2 through 4

4.2.2 Acceptance Test Sample

Acceptance test samples shall consist of not less than 16 feet (5 m) of tubing selected at random from each compound batch or the first sleeving production lot of the batch compound. Physical property tests performed at this time qualify subsequent sleeving lots produced from the same compound batch.

4.3 TEST PROCEDURES

Unless otherwise specified, perform tests on specimens which have been fully recovered by conditioning for 5 minutes in a $150 \pm 5^{\circ}\text{C}$ ($302 \pm 9^{\circ}\text{F}$) oven. Condition the test specimens (and measurement gauges, when applicable) for 3 hours at $23 \pm 3^{\circ}\text{C}$ ($73 \pm 5^{\circ}\text{F}$) and 50 ± 5 percent relative humidity prior to all testing. Use mechanical convection type ovens in which air passes the specimens at a velocity of 100 to 200 feet (30 to 60 m) per minute.

4.3.1 Dimensions and Longitudinal Change

Measure three 6-inch (150 mm) specimens of tubing, as supplied, for length $\pm 1/32$ inch (± 1 mm), and inside diameter in accordance with ASTM D 2671. Condition the specimens for 5 minutes in a $150 \pm 5^\circ\text{C}$ ($302 \pm 9^\circ\text{F}$) oven, cool to $23 \pm 3^\circ\text{C}$ ($73 \pm 5^\circ\text{F}$) and then remeasure. Prior to and after conditioning, the dimensions of the tubing shall be in accordance with Table 1 and the longitudinal change shall be in accordance with Table 3. Dimensions of adhesive thickness shall be taken from specimens which have been hung vertically in the oven during recovery. The adhesive thickness shall be the average determined by measuring a cross section taken 1 inch from each end of the suspended specimen. Care should be taken not to overheat the adhesive so that it drips or flows from the tubing.

Calculate the longitudinal change as follows:

$$C = \frac{L_1 - L_0}{L_0} \times 100$$

Where: C = Longitudinal Change [Percent]
 L₀ = Length Before Conditioning [Inches (mm)]
 L₁ = Length After Conditioning [Inches (mm)]

4.3.2 Tensile Strength and Ultimate Elongation

Determine the tensile strength and ultimate elongation of the tubing in accordance with ASTM D 2671 using 1-inch (25-mm) bench marks, a 1-inch (25-mm) initial jaw separation, and jaw separation speed of 20 ± 2 inches (500 ± 50 mm) per minute.

4.4 REJECTION AND RETEST

Failure of any sample of tubing to conform to any one of the requirements of this specification shall be cause for rejection of the lot represented. Tubing which has been rejected may be replaced or reworked to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and action taken to correct the defects shall be furnished to the inspector.

5. PREPARATION FOR DELIVERY

5.1 FORM

The tubing shall be supplied in lengths of $48 +1, -0$ inches ($1220 +25, -0$ mm) unless otherwise specified.

5.2 PACKAGING

Packaging shall be in accordance with good commercial practice.

5.3 MARKING

Each container of tubing shall be permanently and legibly marked with the size, quantity, manufacturer's identification, specification number, and lot number.

TABLE 1
Tubing Dimensions

Dimensions - inches (mm)

Size	Minimum As Supplied I.D.	Maximum Recovered I.D.	Nominal Recovered Wall With Adhesive	Nominal Recovered Adhesive Thickness
1/8	.125 (3.17)	.062 (1.57)	.027 (0.68)	.009 (0.23)
3/16	.187 (4.74)	.093 (2.36)	.028 (0.71)	.010 (0.25)
1/4	.250 (6.35)	.125 (3.17)	.029 (0.74)	.005 (0.13)
3/8	.375 (9.50)	.187 (4.74)	.029 (0.74)	.005 (0.13)
1/2	.500 (12.7)	.250 (6.35)	.030 (0.76)	.006 (0.15)
3/4	.750 (19.05)	.375 (9.50)	.035 (0.89)	.006 (0.15)
1	1.00 (25.40)	.500 (12.7)	.042 (1.06)	.008 (0.20)
1-1/2	1.50 (38.10)	.750 (19.05)	.047 (1.20)	.011 (0.28)
2	2.00 (50.80)	1.000 (25.40)	.065 (1.65)	.022 (0.56)
3	3.00 (76.20)	1.500 (38.10)	.065 (1.65)	.022 (0.56)
4	4.00 (101.60)	2.000 (50.80)	.070 (1.78)	.020 (0.51)

TABLE 2
Mandrel Dimensions for Bend Testing

Tubing Size	Mandrel Diameter	
	in.	mm.
1/8" to 1/4" inclusive	5/16	7.9
3/8" to 3/4" inclusive	1/2	12.7
1" to 4"	9/16	14.3

TABLE 3
Requirements

PROPERTY	UNIT	REQUIREMENT	TEST METHOD
PHYSICAL Dimensions	Inches (<i>mm</i>)	In accordance with Table 1	Section 4.3.1 ASTM D 2671
Longitudinal Change	Percent	+1, -5	ASTM D 2671
Tensile Strength	psi (<i>MPa</i>)	1500 minimum (<i>10.3</i>)	Section 4.3.2 ASTM D 2671
Ultimate Elongation	Percent	200 minimum	
Secant Modulus (Expanded)	psi (<i>MPa</i>)	2.5×10^4 maximum (<i>172</i>)	ASTM D 882, 2% strain
Cold Impact at $-55 \pm 2^\circ\text{C}$ ($-67 \pm 4^\circ\text{F}$)	---	No more than 5 of 10 crack	ASTM D 746 Proc. A
Heat Shock 4 hours at $250 \pm 3^\circ\text{C}$ ($482 \pm 5^\circ\text{F}$)	---	No dripping, flowing or cracking of outer wall	Table 2 mandrels ASTM D 2671
Heat Resistance 168 hours at $175 \pm 2^\circ\text{C}$ ($347 \pm 4^\circ\text{F}$) Followed by test for mandrel bend	---	---	ASTM D 2671 Table 2 mandrels 360 ° bend in 10 ± 2 seconds
Color Stability 48 hours at $175 \pm 2^\circ\text{C}$ ($347 \pm 4^\circ\text{F}$)	---	MIL-STD-104	ASTM D 2671
ELECTRICAL Dielectric Strength	Volts/mil (<i>volts/mm</i>)	500 minimum (<i>19,680</i>) on dual wall specimen	NOTE 1 ASTM D 2671
Volume Resistivity	ohm-cm	10^{14} minimum on dual wall specimen	ASTM D 2671
CHEMICAL Copper Mirror Corrosion 16 hours at $121 \pm 2^\circ\text{C}$ ($250 \pm 4^\circ\text{F}$)	- --	No removal of copper	ASTM D 2671 Procedure A
Copper Contact Corrosion 16 hours at $121 \pm 2^\circ\text{C}$ ($250 \pm 4^\circ\text{F}$)	---	No pitting or blackening of copper	ASTM D 2671 Procedure B

TABLE 3
Requirements
(continued)

PROPERTY	UNIT	TYPE 1	TYPE 2	TEST METHOD
CHEMICAL (continued) Flammability (jacket only)	---	Self-extinguishing within 1 minute, 25% maximum flag burn	---	ASTM D 2671 Procedure B
Water Absorption 24 hours at 23°C (73°F)	Percent	0.5 maximum	0.2 maximum	ASTM D 2671
Fluid Resistance 24 hours at 23°C (73°F) in: JP-8 Turbine Fuel (MIL-T-83133) Skydrol 500B Hydraulic Fluid (MIL-PRF-5606) Aviation Gasoline (100/130) 5% NaCl Water Followed by tests for: Dielectric Strength Tensile Strength	---	---	---	ASTM D 2671
	Volts/mil (volts/mm)	400 minimum (15,760)	400 minimum (15,760)	
	psi (MPa)	1000 minimum (6.9)	1000 minimum (6.9)	
Fungus Resistance Followed by tests for: Tensile Strength Ultimate Elongation Dielectric Strength	psi (Mpa) percent Volts per mil (volts per mm)	1500 minimum (10.3) 200 minimum 500 minimum (19,680)	1500 minimum (10.3) 200 minimum 500 minimum (19,680)	ISO 846 Method B Section 4.3.2 ASTM D 2671 ASTM D 2671

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NOTE 1: Recover the specimens on the metal mandrels for 10 minutes, minimum, at 150 ± 3°C (302 ± 5°F) or until the tubing is completely shrunk on the mandrels.