



TAT-125 Heat Shrink Tubing Specification

TEC-108-120011

Raychem TAT-125 Adhesive Lined Tubing Polyolefin, Flexible, Heat-Shrinkable, Dual Wall

TAT-125 is an adhesive-lined, flexible, thin-wall, heat-shrinkable tubing. It provides one-step electrical insulation and moisture sealing for a wide variety of applications.

TAT-125 is especially suitable for applications where the moisture seal must withstand flexing or other physical abuse. Because both tubing and adhesive are flexible, the moisture seal is resistant to bending of the substrate.

The thin adhesive lining of TAT-125 melts and flows with the heat of application to form a positive environmental seal. The adhesive will adhere to a wide variety of plastics, rubbers, and metals, including PVC, polyethylene, neoprene, lead, and steel.

RoHS and REACH compliant.

Continuous operating temperature -55 to 110°C (-67 to 230°F).

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1. SCOPE

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

1.1. FORM

Type 1: The tubing shall be flame retarded and shall be black with a thermoplastic hot melt adhesive lining, unless otherwise specified.

Type 2: The tubing shall have a clear non-flame retarded jacket with a thermoplastic hot melt adhesive lining.

2. APPLICABLE DOCUMENTS

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

2.1. AMERICAN SOCIETY FOR TESTING AND MATERIAL (ASTM)

ASTM G21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
ASTM D746	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D882	Standard Test Method for Tensile Properties of Thin Plastic Sheeting
ASTM D910	Standard Specification for Leaded Aviation Gasolines
ASTM D2671	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 or via the ASTM website at <http://www.astm.org>).

2.2. INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 846 Plastics-Evaluation of the action of microorganisms

(Copies of ISO publications may be obtained from the International Organization for Standardization, 1, rue de Varembé, CH-1211 Geneva 20, Switzerland or via the ISO website at <http://www.iso.ch/iso/en/ISOOnline.frontpage>)

2.3. MILITARY DOCUMENTS

MIL-T-83133	JP-8 turbine fuel (NATO type F-34)
MIL-PRF-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance
MIL-STD-104	Limits for Electrical Insulation Color

(Copies of Military documents are available online at <http://quicksearch.dla.mil>.)



2.4. OTHER DOCUMENTS

TAT-125 SCD RAYCHEM TAT-125 Adhesive Lined Tubing SCD

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 (Type 1 jacket only)
Heat Shock

Statistical process control data may be used to demonstrate conformance for dimensions. Acceptance tests shall consist of:

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.

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**Range of Sizes**

1/8" through 1/4"

3/8" through 1"

1-1/2" through 4"

For the following property tests: Color stability, Specific gravity, Fungus resistance, and Volume resistivity, one size within the size range 3/16" through 3/4" shall qualify all sizes.

4.2.2. Acceptance Test Samples

Acceptance test samples shall consist of not less than 5 m (16 feet) 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.

4.2.3. Lot Formation

A lot shall consist of all tubing of the same size, from the same production run, and offered for inspection at the same time.

4.3. TEST PROCEDURES

Dimensions can be found in TEC-108-120011 TAT-125 SCD or the specific drawing for the numbered size.

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 30 to 60 m (100 to 200 feet) per minute.

4.3.1. Dimensions and Longitudinal Change

Measure three 6-inch (150 mm) specimens of tubing, as supplied, for length ± 1 mm ($\pm 1/32$ inch), 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.

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Calculate the longitudinal change as follows:

$$LC = ((L_1 - L_0) / L_0) \times 100$$

Where: LC = 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 25-mm (1-inch) initial jaw separation, and jaw separation speed of 500 ± 50 mm (20 ± 2 inches) 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 Quality.

5. PREPARATION FOR DELIVERY

5.1. FORM

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

5.2. PACKAGING

5.2.1. Packaging shall be in accordance with good commercial practice.

5.3. MARKING

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



APPENDIX

**TABLE 1
MANDREL DIMENSIONS FOR BEND TESTING**

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

**TABLE 2
REQUIREMENTS**

PROPERTY	UNIT	REQUIREMENT		TEST METHOD
		TYPE 1	TYPE 2	
PHYSICAL				
Dimensions	---	TAT-125 SCD	TAT-125 SCD	Section 4.3.1 ASTM D 2671
Longitudinal Change	Percent	+1, -5	+1, -5	ASTM D 2671
Tensile Strength based on Outer Jacket	MPa (<i>psi</i>)	10.3 min (1500)	10.3 min (1500)	Section 4.3.2 ASTM D 2671
Ultimate Elongation	Percent	200 minimum	200 minimum	
Secant Modulus (Expanded) based on Outer Jacket	MPa (<i>psi</i>)	172 max (2.5 x 10 ⁴)	172 max (2.5 x 10 ⁴)	ASTM D 882, 2% strain
Cold Impact at -55 ± 2°C (-67 ± 4°F)	---	No more than 5 of 10 crack	No more than 5 of 10 crack	ASTM D 746 Proc. A
Heat Shock 4 hours at 250 ± 3°C (482 ± 5°F)	---	No dripping, flowing or cracking of outer wall	No dripping, flowing or cracking of outer wall	Table 2 mandrels ASTM D 2671
Heat Resistance 168 hours at 175 ± 2°C (347 ± 4°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 ± 2°C (347 ± 4°F)	---	MIL-STD-104	---	ASTM D 2671
ELECTRICAL				
Dielectric Strength	Volts/mm (Volts/mil)	19,680 min (500) on dual wall specimen	19,680 min (500) on dual wall specimen	NOTE 1 ASTM D 2671
Volume Resistivity	ohm-cm	1 X 10 ¹⁴ minimum on dual wall specimen	1 X 10 ¹⁴ minimum on dual wall specimen	ASTM D 2671

Requirements are continued on next page.

TABLE 2



REQUIREMENTS (continued)

PROPERTY	UNIT	REQUIREMENT		TEST METHOD
CHEMICAL				
Copper Mirror Corrosion 16 hours at $121 \pm 2^{\circ}\text{C}$ ($250 \pm 4^{\circ}\text{F}$)	---	No removal of copper	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	No pitting or blackening of copper	ASTM D 2671 Procedure B
Flammability (jacket only)	---	Self-extinguishing within 1 minute, 25% maximum flag burn	---	ASTM D 2671 Procedure B
Water Absorption 24 hours at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($73^{\circ}\text{F} \pm 4^{\circ}\text{F}$)	Percent	0.5 maximum	0.2 maximum	ASTM D 2671
Fluid Resistance 24 hours at $24^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($75^{\circ}\text{F} \pm 5^{\circ}\text{F}$) in: JP-8 Turbine Fuel (MIL-T-83133) Skydrol 500B* Hydraulic Fluid (MIL-PRF-5606) Aviation Gasoline (ASTM D910Mi) 5% NaCl Water Followed by tests for: Dielectric Strength Tensile Strength	---	---	---	ASTM D 2671
	Volts/mm (Volts/mil)	15,760 min (400)	15,760 min (400)	
	MPa (psi)	6.9 min (1000)	6.9 min (1000)	
Fungus Resistance Followed by tests for: Tensile Strength Ultimate Elongation Dielectric Strength	MPa (psi) percent Volts per mm (Volts per mil)	10.3 min (1500) 200 minimum 19,680 min (500) No Growth	10.3 min (1500) 200 minimum 19,680 min (500) No Growth	ISO 846 Method B Section 4.3.2 ASTM D 2671 OR ASTM G 21

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NOTE 1: Recover the specimens on the metal mandrels for 10 minutes, minimum, at $150 \pm 3^{\circ}\text{C}$ ($302 \pm 5^{\circ}\text{F}$) or until the tubing is completely shrunk on the mandrels.