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Raychem

Specification
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RT-1255
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THERMOFIT® ADHESIVE S-1255-02
Fluid Resistant, High Temperature, One Part-Epoxy

1.0 SCOPE

This specification covers the requirements for one type of adhesive for use with heat-recoverable, plastic and elastomeric tubing and molded components. When used as specified with other compatible components, this adhesive is suitable for use in fluid resistant, high temperature harness systems as described herein. The adhesive is suitable for use in wire harness systems requiring resistance to the effects of nuclear, biological and chemical agent exposure and decontamination as defined herein and in RT-700.

2.0 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

MIL-L-2104	Lubricating Oil, Internal Combustion Engine, Heavy Duty
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance
MIL-T-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-A-8243	Anti-Icing and Deicing - Defrosting Fluids
MIL-C-43616	Cleaning Compounds, Aircraft Surface

Federal

O-S-1926	Sodium Chloride, Technical
VV-F-800	Fuel Oil, Diesel, Grade DF-2

2.2 OTHER PUBLICATIONS

American Society for Testing and Materials (ASTM)

ASTM D 149	Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Electrical Insulating Materials at Commercial Power Frequencies
ASTM D 257	Standard Test Methods for D-C Resistance or Conductance of Insulating Material
ASTM D 570	Standard Test Method for Water Absorption of Plastics
ASTM D 910	Standard Specification for Aviation Gasoline
ASTM D 1002	Standard Test Method for Strength Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal)
ASTM D 2093	Standard Practice for Preparation of Surfaces of Plastics Prior to Adhesive Bonding
ASTM D 2651	Standard Practice for Preparation of Metal Surfaces for Adhesive Bonding
ASTM G 21	Recommended Practice for Determining Resistance of Synthetic Polymer Materials to Fungi

(Copies of ASTM Publications may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

Raychem Corporation

RT-555	Thermofit® 555 Tubing
RT-1330	Thermofit® Fluoropolymer Molded Components
RT-700	Harness System Chemical Agent Exposure & Decontamination Specification 55A 55 Wire and Cable

(Copies of the Raychem Corporation specifications cited above may be obtained from the Literature Department, Raychem Corporation, 300 Constitution Drive, Mail Stop 527/6206, Menlo Park, California 94025-1164.)

3.0 REQUIREMENTS

3.1 MATERIAL

The adhesive shall consist of a one-part modified epoxy resin supplied in tape form, 0.75 inch (13 mm) wide and 0.010 inch (0.25 mm) thick, nominal.

3.2 COLOR

The color as supplied is black.

3.3 PROPERTIES

The adhesive shall meet the requirements of Table 1.

3.4 SYSTEMS PERFORMANCE

The performance of harness systems fabricated with this material shall satisfy the requirements of Systems Specification RT-700.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 CLASSIFICATION OF TESTS

4.1.1 Qualification Tests

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

4.1.2 Acceptance Tests

Acceptance tests are those performed on each production lot of adhesive. Acceptance tests shall consist of the following:

Visual inspection

Adhesive shear strength (Stainless Steel to Stainless Steel at 23°C)

Other tests shall be performed as often as necessary to ensure compliance with all requirements of this specification.

4.2 SAMPLING INSTRUCTIONS

4.2.1 Qualification Test Samples

Qualification test samples shall consist of not less than 100 ft (30 m) of adhesive.

4.2.2 Acceptance Test Samples

Acceptance test samples shall consist of not less than 10 ft (3 m) of adhesive from each lot. A lot shall consist of all adhesive from the same production run offered for inspection at the same time.

4.3 TEST PROCEDURES

4.3.1 Visual Inspection

Visually examine the test specimens for color, uniformity, and the presence of foreign particles or other contaminants.

4.3.2 Adhesive Peel Strength

Adhesive peel strength is determined by a test procedure described in greater detail in ASTM D 2671 with surface preparation methods based on ASTM D 2093 and ASTM D 2651. In this procedure, an inner and outer substrate of specified materials are bonded together and peel strength is determined in a tensile tester.

4.3.2.1 Tubing or Molded Component to Stainless Steel

4.3.2.1.1 Substrate Preparation

Abrade the outer surface of an 8-inch (*200-mm*) length of 1-inch (*25-mm*) diameter AISI Type 316 stainless steel pipe with a wire brush or dry sandblast and wipe with a lint-free cloth or paper towel moistened with isopropanol (IPA).

Select three sections of 1-1/2 inch (*38 mm*) Thermofit® RT-555 Tubing or three uniform tubular sections of Thermofit® RT-1330 Molded Components with an expanded internal diameter approximately 1-1/2 inches (*38 mm*) and a recovered internal diameter of 3/4 inches (*19 mm*) or less. Cut these sections to a width of 1-1/2 inches (*39 mm*) and prepare the inner surface by abrading with a Number 320 Emory cloth followed by wiping with a lint-free cloth or paper towel moistened with isopropanol (IPA).

4.3.2.1.2 Bonding Procedure

Spiral wrap the S-1255 adhesive tape with a 50 percent overlap to produce a double thickness of adhesive over the inner substrate. Place a 3/4-inch (*19-mm*) wide piece of masking tape lengthwise to 1) hold the adhesive in place and 2) provide unbonded ends from the outer substrate to insert into a tensile tester.

Place the tubing or molded component substrates over the adhesive-coated inner substrate and rapidly recover with a heat gun in accordance with the applicable installation instructions. Finally, heat in an air circulating oven at $240 \pm 5^{\circ}\text{C}$ ($464 \pm 9^{\circ}\text{F}$) for 15 minutes.

4.3.2.1.3 Tensile Testing

After cooling to ambient temperature, cut each of the three bonded outer substrates radially into 1-inch (25-mm) wide strips. Then cut each strip axially along the edge of the masking tape to free an unbonded end for rolling drum peel tensile testing.

Test at a jaw separation speed of 2 inches (50 mm) per minute. Take peel strength readings at every 1/2-inch (13-mm) of incremental jaw separation after 1-inch (25-mm) initial separation. Record the average peel strength for each specimen from the first four readings. Report the average peel strength from five specimens as the sample peel strength value.

Additional detail on specimen geometries, tensile test fixtures and calculations is contained in ASTM D 2671.

4.3.2.2 Molded Component to Tubing

4.3.2.2.1 Substrate Preparation

Heat recover a 6-inch (150-mm) length of 1-1/2-inch (38-mm) inside diameter Thermofit® RT-555 Tubing onto a metal tube 1 inch in diameter. This recovery requires the application of heat in excess of 250°C (482°F) and can be accomplished with the heat gun described in section 4.3.2.1.2 or an oven.

Allow the recovered tubing to cool to room temperature and prepare the outer surface as described in 4.3.2.1.1.

4.3.2.2.2 Bonding Procedure

Follow the bonding procedure described in Section 4.3.2.1.2 recovering the Thermofit® molded component (RT-1330) onto adhesive-wrapped tubing.

4.3.2.2.3 Tensile Testing

Cool the assembly to room temperature and cut lengthwise along one edge of the masking tape to remove the bonded assembly from the mandrel. Cut a 1-inch (25-mm) wide specimen suitable for T-peel testing from the center of each double thickness.

Insert the two unbonded ends in the tensile tester, and perform the remainder of the procedure as described in Section 4.3.2.1.3.

4.3.3 Adhesive Shear Strength

Adhesive Shear Strength is determined using a procedure based on ASTM D 1002 and a surface preparation method based on ASTM D 2651.

4.3.3.1 Specimen Form

The adhesive shear test is performed on assembly specimens formed by bonding two 1 x 5 x 0.050 ± .005 inch (25 x 100 x 1.27 ± 0.13 mm) AISI Type 316 stainless steel substrates with a 0.50 to 0.56 inch (12.7 to 14.2 mm) bonded overlap. A minimum of five assembly specimens are required.

4.3.3.2 Substrate Preparation

Abrade the stainless steel substrates with number 320 emery cloth and wipe with a lint-free cloth or paper towel moistened with isopropanol (IPA).

4.3.3.3 Bonding Procedure

Make the specimen bonded overlap length 0.50 to 0.56 inch (12.7 to 14.2 mm). Cut the adhesive tape and position to cover an area approximately 0.25 inch (6 mm) wider than the specified overlap length.

Cure these assemblies for 15 minutes in an air-circulating oven heated to 240 ± 5°C (464 ± 9°F) under a pressure of approximately 2 psi (0.14 MPa) using a suitable fixture (eg., wrap joint with teflon tape).

Specimens should be at 23 ± 3°C (73 ± 5°F) for at least 4 hours before testing.

4.3.3.4 Test Procedure

Test five specimens. Measure the bonded overlap area prior to testing; disregard any excess adhesive outside the overlap area.

Use an appropriate tensile testing machine with an initial jaw separation of 4 inches (100 mm) and a rate of jaw separation of 0.05 inch (1.3 mm) per minute.

Calculate and record the failing stress in psi (MPa). Report the central (median) value of the five breaking loads.

4.3.4 Volume Resistivity

Place two 5 x 5 - inch (127 x 127 mm) sections of 10 mil thick adhesive between two Teflon®*-based sheets 5 x 5 inch (127 x 127 mm) and seal edges with Teflon tape. Place the assembly between two 5 x 5 - inch (127 x 127 mm) metal plates and cure the assembly for 15 minutes at 240°C (464°F). Test for volume resistivity in accordance with ASTM D 257.

Teflon is a registered trademark of DuPont Corporation

4.3.5 Corrosive Effect

Individually test five 0.25 x 1.0 inch specimens cut from the adhesive tape in the thickness supplied for corrosive effect in accordance with ASTM D 2671, Procedure A (Copper Mirror). Condition the specimens for 15 minutes at 240°C (464°F) prior to testing.

4.3.6 Water Absorption

Test five 3 x 1 x 0.010 - 0.015 inch (75 x 25 x 0.25 - 0.38 mm) cured specimens for water absorption in accordance with ASTM D 2671 at the condition specified in Table 1. Report the average of the three specimens. Condition the specimens for 15 minutes at 240°C (464°F) prior to immersion.

4.3.7 Fluid Resistance

Completely immerse three specimens, prepared by bonding Stainless Steel to Stainless Steel in accordance with Section 4.3.3, in each of the fluids listed in the applicable section of Table 1 for 24 hours at the specified temperature. After immersion, lightly wipe the specimens and air dry for 30 to 60 minutes at room temperature. Test the specimens for adhesive shear strength in accordance with Section 4.3.3. Report the central (median) value of the three breaking loads.

4.3.8 Rejection and Retest

Failure of any specimen of adhesive to comply with any one of the requirements of this specification shall be cause for rejection of the lot represented. Adhesive which has been rejected may be replaced or reworked to correct the defect and then resubmitted for acceptance.

5.0 **PREPARATION FOR DELIVERY**

5.1 **PACKAGING**

Unless otherwise specified, the adhesive shall be packaged on rolls in sealed packages with a desiccant.

5.2 **MARKING**

Each carton of adhesive, shall be identified with the manufacturer's name or symbol, the product number, the lot number, and other appropriate information.

TABLE 1
Requirements

PROPERTY	UNIT	REQUIREMENT	TEST METHOD
PHYSICAL Visual Appearance		Homogeneous, no foreign particles or contaminants Black	Section 4.3.1
Color as supplied			
Adhesive Peel Strength at $23 \pm 3^{\circ}\text{C}$ ($73 \pm 5^{\circ}\text{F}$) RT-1330 to stainless steel (#316) RT-1330 to RT-555 RT-555 to stainless steel	pli (N/cm)	20 minimum (35) 20 minimum (35) 20 minimum (35)	Section 4.3.2 ASTM D 2671
Adhesive Shear Strength at $23 \pm 3^{\circ}\text{C}$ ($73 \pm 5^{\circ}\text{F}$) RT-1330 to stainless steel RT-555 to stainless steel Stainless steel to stainless steel (304)	psi (MPa)	100 minimum (0.69) 100 minimum (0.69) 1000 minimum (6.9)	Section 4.3.3 ASTM D 1002
HEAT RESISTANCE 336 hrs at $250 \pm 3^{\circ}\text{C}$ ($482 \pm 5^{\circ}\text{F}$) Followed by test for: Adhesive shear strength at $23 \pm 3^{\circ}\text{C}$ ($73 \pm 5^{\circ}\text{F}$) Stainless Steel to Stainless Steel	psi (MPa)	400 minimum (2.7)	Section 4.3.3 ASTM D 1002
ELECTRICAL Volume Resistivity	ohm-cm	1×10^{11} minimum	Section 4.3.4 ASTM D 2671
CHEMICAL Corrosive Effect (Copper Mirror) 16 hours at $200 \pm 5^{\circ}\text{C}$ ($392 \pm 9^{\circ}\text{F}$)	percent	Copper removal 5 maximum	Section 4.3.5 ASTM D 2671
Water Absorption 24 hours at $23 \pm 3^{\circ}\text{C}$ ($73 \pm 5^{\circ}\text{F}$)	percent	2 maximum	Section 4.3.6 ASTM D 2671
Fungus Resistance	---	Rating of 1 or less	ASTM G 21

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TABLE 1
Requirements (continued)

PROPERTY	UNIT	REQUIREMENT	TEST METHOD
Fluid Resistance 24 hours at $23 \pm 3^{\circ}\text{C}$ ($73 \pm 5^{\circ}\text{F}$) in: Gasoline, Aviation Grade 100 (ASTM D 910) Coolanol* 25 Followed by test for: Adhesive Shear Strength Stainless Steel to Stainless Steel	---	---	Section 4.3.7
	psi (MPa)	1000 minimum (6.9)	Section 4.3.3
24 hours at $50 \pm 3^{\circ}\text{C}$ ($122 \pm 5^{\circ}\text{F}$) in: JP-5 (MIL-T-5624) Deicing Fluid (MIL-A-8243) Cleaning Compound (MIL-C-43616) 5% Salt Solution (O-S-1926) Fuel Oil, Diesel (*VV-F-800, DF-2) Followed by test for: Adhesive Shear Strength Stainless Steel to Stainless Steel	---	---	Section 4.3.7
	psi (MPa)	1000 minimum (6.9)	Section 4.3.3
Fluid Resistance 24 hours at $75 \pm 3^{\circ}\text{C}$ ($167 \pm 5^{\circ}\text{F}$) in: Hydraulic Fluid (MIL-H-5606) Skydrol* 500 Lubricating Oil (MIL-L-2104) Lubricating Oil (MIL-L-7808) Followed by test for: Adhesive Shear Strength Stainless Steel to Stainless Steel	---	---	Section 4.3.7
	psi (MPa)	1000 minimum (6.9)	Section 4.3.3

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