Raychem S1297 and /97
Hot Melt Adhesive

1.0 SCOPE

This specification covers the requirements for one type of hot melt adhesive for use with Raychem sleeving and molded components. It is available in tape form or pre-coated in tubing and molded components. It is suitable for bonding to various cable jacket substrates including polyethylene, PVC and polychloroprene (neoprene) as well as metals such as steel and aluminum.

2.0 REQUIREMENTS

Composition and Appearance

The hot melt adhesive shall be in tape form or pre-coated on molded shapes or tubing. It shall be homogeneous and free of foreign particles or other contaminants.

3.0 PROPERTIES

The adhesive shall meet the requirements of Tables 1 and 2. The product is capable of a continuous operating temperature of up to 90°C *(194°F)*.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Classification of Tests

4.1.1 Qualification Tests

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

4.1.2 Production Routine Tests

Production Routine Tests shall be performed on every batch, unless otherwise specified and shall consist of the following: visual, ring and ball softening and Brookfield viscosity.

5.0 SAMPLING INSTRUCTIONS

5.1 Test Sample Preparation

Test samples shall be in the form of compression-molded sheets prepared from the adhesive pellets or from a standard tape form, 1 inch wide by 0.010 inch thick *(25 mm X 0.25 mm)*. The sheets shall be 6 inch X 6 inch X 0.035 inch *(152 mm X 152 mm X 0.89 mm,* nominal) except where otherwise specified. Sheets shall be prepared in a heated press at a temperature of 150 ± 5°C *(302 ± 9°F)*. The sheets shall be homogeneous and free from voids.

5.2 Qualification Test Samples

Sufficient adhesive samples must be available to satisfy all the test requirements listed in this specification.

5.3 Production Routine Test Samples

Production Routine test samples shall be taken from each batch of material. A batch shall consist of all adhesive from the same production run offered for inspection at the same time.

6.0 TEST PROCEDURES - Physical

6.1 Visual Inspection

The test specimens shall be visually examined to insure that the material is homogenous and free of foreign particles or other contaminants**.**

6.2 Adhesive Peel Strength

Peel strength shall be determined using an uncoated BSTS outer tubing recovered and adhered to a mandrel 1 to 2 inches in diameter. Mandrel materials shall be one or more of the following materials: polyethylene heat shrink tubing or molded parts, polychloroprene heat shrink tubing or rigid aluminum pipe.

6.2.1 The specific mandrel materials and their respective surface preparation and bonding techniques are described in Appendices A and B.

6.2.2 After applying and cooling to room temperature, the sleeving shall be cut into 1 inch wide sections as illustrated in Figure 1. Each specimen shall be cut along the edge of the adhesive-free areas as illustrated in Figure 1.

6.2.3 The specimen shall be placed in a tensile testing machine, with the specimen around the positioning mandrel and the free end of the specimen inserted into the tensile testing machine jaw as illustrated in Figure 2. The holding fixture shall be constructed so that the yoke is free to rotate during testing. Testing shall be with a jaw separation speed of 2 inches *(51 mm)* per minute. Readings of peel force shall be taken at every ½ inch of jaw separation after a one inch initial separation (electronic measurments shall be programmed accordingly). The results of five specimens shall be averaged and recorded as the peel strength for a given lot.

6.3 Corrosive Effect

The corrosive effect shall be determined in accordance with ASTM D 2671 Procedure B. Uncoated BSTS tubing (2 inch *(51 mm)* diameter) shall be used to hold the adhesive in contact with 1 inch copper tubing. The heat shrinkable sleeving shall be recovered over the copper tubing and the adhesive material. The samples shall be heated in an air-circulating oven for 16 hours at 120 ± 2 °C *(248 ± 4°F)*. If removal for audit is difficult, specimens may be immersed in toluene at 50°C *(122°F)* for two hours to aid in the release from the copper tubing**.**

6.4 Lap Shear Test (Aluminum to Aluminum)

The lap shear shall be determined in accordance with ASTM D1002. The test assemblies shall be conditioned for 20 minutes at 150 ± 5°C *(302 ± 9°F)* under a pressure of 2 pounds /in ^{2} (psi). The test shall be run using a 1 inch x 1 inch x 0.035 inch *(25 mm x 25 mm x 0.89 mm)* adhesive piece to bond the 1 inch wide aluminum strips together.

6.5 Fluid Resistance

Three 1 inch x 1 inch x 0.035 inch thick *(25 mm x 25 mm x 0.89 mm)* square specimens are to be prepared for fluid resistance. The specimens shall be weighed before and after immersion in the listed fluids. The specimens shall be placed in the fluids shown in Table 2 for the time and temperature indicated. The amount of fluid shall not be less than 20 times the volume of the specimens. The specimens shall remain in the fluid for the specified period and then shall be removed, wiped off with a towel or kimwipe and allowed to sit for 30 ± 5 minutes prior to weighing the second time. The average change in weight of the three specimens shall be reported in terms of % weight uptake.

6.6 Viscosity

Viscosity shall be tested in accordance with ASTM D1084 on specimens prepared in accordance with paragraph 5.1.

7. 0 PREPARATION FOR DELIVERY

7.1 Packaging

Unless otherwise specified, the adhesive shall be in a package containing a measured quantity of material, in conformance with good commercial practice**.**

7.2 Marking

Unless otherwise specified, each package of adhesive shall be marked with the product designation, the batch or lot number and manufacturing date.

8. 0 RELATED DOCUMENTS

ASTM D149	Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
ASTM D257	Test Methods for D-C Resistance or Conductance of Insulating Materials
ASTM D412	Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
ASTM D570	Water Absorption of Plastics
ASTM D792	Density and Specific Gravity of Plastics by Displacement
ASTM D1002	Test Method for Shear Strength of Adhesives by Tension Loading (Metal to Metal)
ASTM D1084	Viscosity of Adhesives
ASTM D2671	Test Methods for Heat-Shrinkable Tubing for Electrical Use
ASTM E28	Softening Point by Ring and Ball Apparatus

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

TABLE 1

TAPE DIMENSIONS			
Description	**Width – nominal in *(mm)***	**Thickness – nominal in *(mm)***	**Standard Roll Length ft *(m)***
S1297-01	1.00 (25)	0.010 (0.25)	10 (3.2)

Table 2 – Material Properties

PROPERTY	Unit	S1297	METHOD OF TEST
PHYSICAL Visual		Pass	Section 6.1
Water Absorption	Percent	0.33 Maximum	ASTM D570
Specific Gravity		1.2 Maximum	ASTM D792
Tensile Strength	psi	250 Minimum	ASTM D412
Ultimate Elongation	Percent	500 Minimum	ASTM D412
Adhesion XLPE (BSTS) to XLPE (-3) XLPE (BSTS) to Aluminum XLPE to Polychloroprene (-3 to NTFR) Z-Hal to Z-Hal (-100 to XFFR)	Pounds/in width (N/25 mm)	 25 *(110)* Minimum 25 *(110)* Minimum 25 *(110)* Minimum 25 *(110)* Minimum	Section 6.2 Appendix A Appendix B Appendix A Appendix A
Lap Shear (Al/Al)	Lb/in^2 (*kN/25 mm*$^{2)}$	700 *(3.0)* Minimum	Section 6.4 ASTM D1002
Viscosity, Brookfield @ 177C	cps	20,000 ± 5000	Section 6.6 ASTM D1084
Softening Point (Ring and Ball)	°C	100 ± 5	ASTM E28
ELECTRICAL Dielectric Strength	V/mil (*kV/mm*)	250 Minimum. *(9.8)*	ASTM D 149
Volume Resistivity	Ohm-cm	10^{10} Min	ASTM D 257
CHEMICAL Corrosive Effect		Non-Corrosive	Section 6.3 ASTM D2671 Procedure B
Fungus Resistance	Visual growth	1 or less	ASTM G21
Fluid Resistance 4 hours at 23 ± 3°C JP-8 Fuel (MIL-DTL-83133) Hydraulic Fluid (MIL-H-5606) De-icing Fluid (MIL-A-8243) Lube Oil (MIL-PRF-7808) Lube Oil (MIL-L-23699) 5% NaCl (A-A-694)	% weight uptake	5 maximum	Section 6.5

Adhesive Peel fixture

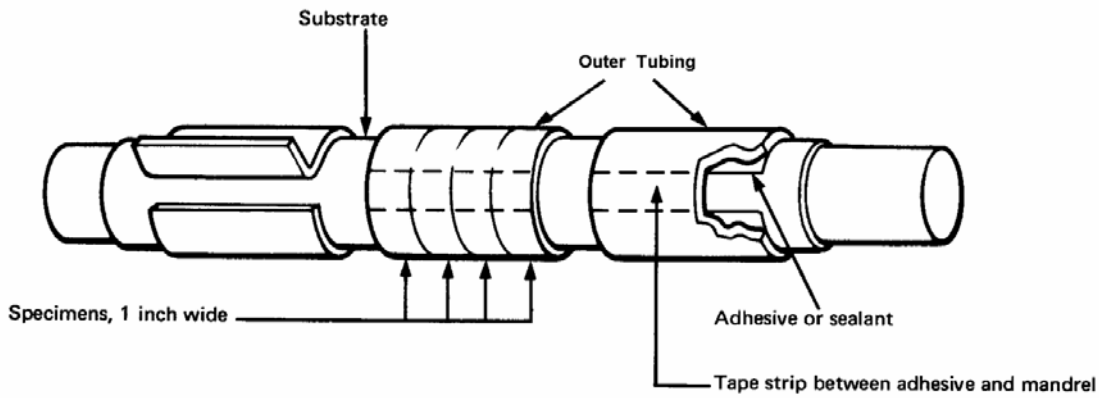

Figure 1. Peel Specimen Preparation

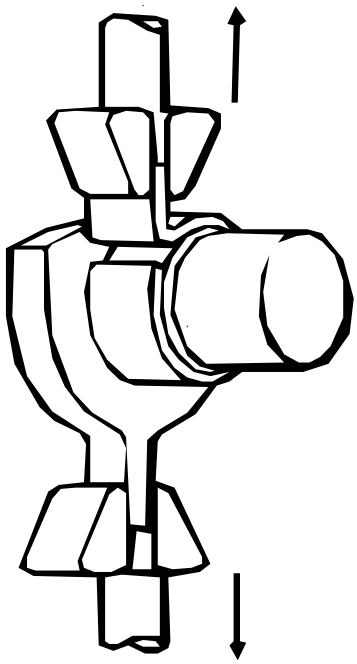

Figure 2. Part Specimen in Tensile Tester – (Rolling Drum Method Illustrated)

APPENDIX A
PEEL SPECIMEN PREPARATION OF POLYMER TO POLYMER
T-Peel Method

A.l SAMPLE DESCRIPTION

The mandrel specimen shall be as indicated in Table 1. If two heat shrink products are being bonded together, a core mandrel of metal, PTFE or temperature resistant plastic may act as the hold out system.

A.2 SPECIMEN PREPARATION

A.2.1 Recover substrate tubing onto a clean 1 inch *(25 mm)* OD mandrel.

A.2.2 Lightly abrade the substrate material with No. 320 emery paper.

A.2.3 Wipe particles from abrasion off the substrate with a clean dry cloth.

A.2.4 Spiral–wrapped 1 inch *(25 mm)* tape adhesive on the substrate material with a 50% overlap.

A.2.5 Lay down a break strip of ¾ inch *(19 mm)* wide masking tape along the longitudinal length of the specimen.

A.2.6 Preheat a heat gun* (see note) and reflector 30 seconds on the appropriate setting for the product.

A.2.7 Completely recover the outer polyethylene sleeve onto the adhesive, leaving no chill marks.

A.2.8 Post-heat adhesive assembly using the heat gun for 30 seconds after complete recovery.

A.2.9 Allow 4 hours for cooling prior to performing peel tests.

A.2.10 Cut the specimen into 1 inch *(25 mm)* long sections. Score both layers of the tubing along the edge of the tape and remove from the mandrel. Separate the layers at the tape to provide an opening to insert into the jaws of the test machine. Perform a T peel-type test.

A.2.11 Calibrate the test equipment and set the jaw separation speed at 2 inches *(51 mm)* per minute.

A.2.12 Average the results of 5 pulls and record and the T-peel stength value in lbs /inch width.

* Note: Use a Raychem Thermogun or equal with 2000W output minimum.

APPENDIX B
PEEL SPECIMEN PREPARATION OF POLYMER TO ALUMINUM PIPE
Rolling Drum Method

B.l SAMPLE DESCRIPTION

The mandrel specimen shall be an 18 inch length of 1 inch OD aluminum pipe.

B.2 SPECIMEN PREPARATION

B.2.1 The mandrel shall be prepared to be steel wool, wire brush or sander to expose a smooth, uniform, unoxidized surface.

B.2.2 Solvent wipe the mandrel surface with Isopropyl Alcohol (IPA) or equivalent.

B.2.3 Wipe clean and dry.

B.2.4 Apply a break point piece of masking tape longitudinally along the pipe , prior to applying the adhesive.

B.2.5 Preheat mandrel until warm (approximately 50° C (*122° F)*).

B.2.6 Spiral wrap a strip of the 1 inch *(25 mm)* wide adhesive over the mandrel using a 50% overlap.

B.2.7 Completely recover * (see note) the outer sleeve over the mandrel, leaving no chill marks on the sleeve.

B.2.8 Postheat adhesive assembly 30 seconds after complete recovery.

B.2.9 Allow 4 hours for cooling prior to performing peel tests.

B.2.10 Cut the specimen (pipe and tubing) into 1 inch *(25 mm)* wide sections. Score the tubing along the edge of the masking tape to remove from the mandrel and provide an opening area to insert into the upper jaw of the test machine.

B.2.11 Calibrate the test equipment and set the jaw separation speed at 2 inches *(51 mm)* per minute.

B.2.12 Average the results of 5 rolling drum-type pulls and record and the peel strength value in lbs /inch width.

* Note: Use a Raychem Thermogun or equal with 2000W output minimum.