



## **RW-2057 Revision 3**

# **Raychem brand SRFR Sleeving**

## **SCOPE**

**This Quality Assurance Specification establishes the quality standard for a heat-shrinkable, highly flexible, electrically-insulating, non-burning, silicone rubber sleeving.**

### **Approved Signatories\***

**Tyco Electronics :                      Approved electronically via DMTEC**

**\* This document is electronically reviewed and approved - therefore no signatures will appear.**

**1. REVISION HISTORY**

Revision Number	Change Request	Date	Incorporated By
0	Formerly RK6066 Revn 8		
1	CR/IND/0086 CRF T1020	11 December 1996 27 August 1997	R. Maunder C. Woosnam
2	CR00-DM-0216	13 December 2000	Ann Edwards
3	CR10-DM-009	3 August 2010	Paul Dixon

**2. REQUIREMENTS****2.1 Composition, Appearance and Colour**

The sleeving shall be homogeneous and free from pinholes, bubbles, cracks and inclusions. Colour shall be grey unless otherwise specified.

**2.2 Dimensions**

Size	Inside Diameter as supplied (min) mm	Inside Diameter after recovery (max) mm	Wall Thickness after recovery mm
2.9/1.7	2.9	1.7	1.0 ± 0.5
4.0/2.9	4.0	2.9	1.0 ± 0.5
7.8/4.6	7.8	4.6	1.0 ± 0.5
10/6.5	10.0	6.5	1.5 ± 0.5
15/9.6	15.0	9.6	1.5 ± 0.5
21/13	21.0	13.0	2.0 ± 0.75
29/20	29.0	20.0	2.0 ± 0.75
41/27	41.0	27.0	3.0 ± 1.0
51/33	51.0	33.0	3.0 ± 1.0

**Sleeving of special expanded or recovered dimensions may be supplied as specified in the contract or order.**

**2.3 Test Requirements**

The test requirements shall be as specified in Table 1.

### 3. TEST METHODS

#### 3.1 Preparation of Test Specimens

Unless otherwise specified, tests shall be carried out on specimens of sleeving recovered by conditioning in a fan assisted air circulating oven at  $175 \pm 5^\circ\text{C}$  for  $6 \pm 1$  minutes and allowed to cool in air to ambient temperature. No pre-conditioning period is required prior to testing. Unless otherwise specified, all tests shall be made under standard ambient conditions according to IEC Publication 212. In cases of dispute the tests shall be carried out at a temperature of  $23 \pm 2^\circ\text{C}$  and at  $50 \pm 5\%$  relative humidity.

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#### 3.2 Dimensions and Longitudinal Change

The test method shall be as specified in ASTM D2671. The length and inside diameter of three 150mm long specimens of expanded sleeving shall be measured. The specimens shall be recovered in a fan assisted air circulating oven and the length and inside diameter of each shall be measured. The longitudinal change shall be expressed as a percentage of the original length. The minimum and maximum recovered wall thickness shall be determined.

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#### 3.3 Tensile Strength and Ultimate Elongation

The test method shall be as specified in ISO 37. For sleeving of recovered bore greater than 6mm, five Type 2 dumb-bell specimens shall be tested. For sleeving of recovered bore less than or equal to 6mm, five tubular specimens 125mm long shall be tested. Initial jaw separation shall be 50 mm and rate of jaw separation shall be  $500 \pm 10\text{mm}$  per minute. The test shall be carried out at a temperature of  $23 \pm 2^\circ\text{C}$ .

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#### 3.4 Specific Gravity

The test method shall be as specified in Method A of ISO 1183.

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#### 3.5 Heat Shock

The test method shall be as specified in ASTM D2671. The specimens shall be conditioned in a fan assisted air circulating oven as specified in Table 1.

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#### 3.6 Heat Ageing

The test method shall be as specified in ISO 188. Five tensile test specimens prepared as in Clause 3.3 shall be conditioned in a fan assisted air circulating oven as specified in Table 1. After conditioning the specimens shall be removed from the oven, allowed to cool naturally to room temperature and tested for Tensile Strength and Ultimate Elongation according to clause 3.3.

**TEST METHODS (Cont'd)****3.7 Low Temperature Flexibility**

The test method shall be as specified in Procedure C of ASTM D2671.

For sleeving of recovered bore 6mm or less, apply the test to whole sections of recovered sleeving. For sleeving of recovered bore greater than 6mm, apply the test to strips 6mm wide, cut from the recovered sleeving, with their lengths parallel to the extruded axis. Mandrel diameter shall be 20 x specimen thickness  $\pm$  10%. For tubular specimens the thickness is the outside diameter. The specimens and mandrel shall be conditioned as specified in Table 1.

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**3.8 Flammability**

The test method shall be as specified in UL224 all tubing flame test.

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**3.9 Electric Strength**

The test method shall be as specified in IEC 243 (Short time test).

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**3.10 Volume Resistivity**

The test method shall be as specified in IEC 93.

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**3.11 Copper Contact Corrosion**

The test method shall be as specified in ASTM D2671.

The specimens shall be conditioned in a fan assisted air circulating oven as specified in Table 1, allowed to cool naturally to room temperature and tested for Ultimate Elongation according to Clause 3.3.

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**3.12 Hardness**

The test method shall be as specified in ASTM D 2240

**4. RELATED STANDARDS & issue**

ASTM D2240-05	Standard Test Method for Rubber Property - Durometer Hardness
ASTM D2671-09	Standard Test Methods for Heat-Shrinkable Tubing for Electrical Use
IEC 60093: 1980	Method of test for volume resistivity and surface resistivity of solid electrical insulating materials.
IEC 60212: 1971	Standard Conditions for Use Prior to and During Testing of Solid Electrical Insulating Materials
IEC 60243-1: 1998	Methods of Test for Electric Strength of Solid Insulating Materials Part 1 Tests at Power Frequencies
ISO 37: 2005	Rubber, vulcanized or thermoplastic - Determination of Tensile Stress-Strain Properties
ISO 62: 2008	Determination of Water Absorption
ISO 188: 2007	Rubber, vulcanized - Accelerated Ageing or Heat Resistance Tests.
ISO 1183-1: 2004	Plastics - Methods For Determining The Density Of Non-Cellular Plastics - Part 1: Immersion Method, Liquid Pyknometer Method And Titration Method
UL 224: 2007	Standard for Extruded Insulating Tubing

**Subsequent amendments to, or revisions of, any of the above publications apply to this standard only when incorporated in it by updating or revision.**

**5. SAMPLING**

Tests shall be carried out on a sample taken at random from each batch of finished sleeving. A batch of sleeving is defined as that quantity of sleeving extruded at any one time. Testing frequency shall be Production Routine, 5th Batch, 10th Batch or Qualification. Production Routine tests consisting of Visual Examination and Dimensions shall be carried out on every batch of sleeving. 5th batch tests shall consist of Longitudinal Change. 10th batch tests shall consist of Tensile Strength, Ultimate Elongation, Specific Gravity, Heat Shock, Flammability and Hardness. Qualification tests shall be carried out to the requirements of the Design Authority.

**6. PACKAGING**

Packaging shall be in accordance with good commercial practice. Each package shall bear an identification label showing material quantity, description, size, colour, batch number and maximum storage temperature of 30°C. Additional information shall be supplied as specified in the contract or order.

**TABLE 1 Test Requirements**

Test	Test Method	Test Requirements
Visual Examination	-	As per Clause 2.1
Dimensions	ASTM D2671	As per Clause 2.2
Longitudinal Change	ASTM D2671	± 15%
Tensile Strength	ISO 37	4.1 MPa minimum
Ultimate Elongation	ISO 37	250 % minimum
Specific Gravity	ISO 1183	1.25 maximum
Heat Shock (4h ± 15m at 275 ± 5°C)	ASTM D2671	No dripping, cracking or flowing
Heat Ageing (168h ± 2h at 200 ± 3°C) - Tensile Strength - Ultimate Elongation	ISO 188  ISO 37	3.5 MPa minimum  150% minimum
Low Temperature Flexibility (4h ± 15m at -75 ± 2°C)	ASTM D2671	No cracking
Flammability	UL 224	Flame or glow time 60s maximum No ignition of cotton wool, less than 25% charring of indicator
Electric Strength	IEC 243-1	10 MV/m minimum
Volume Resistivity	IEC 93	10 <sup>12</sup> ohm.cm minimum
Copper Contact Corrosion (24 ± 2h on copper mandrel at 90-95% RH, 23 ± 2°C, followed by 168 ± 2h on mandrel at 175 ± 3°C) - Ultimate Elongation	ASTM D2671  ISO 37	No corrosion of mandrel  200% minimum
Hardness - Durometer A	ASTM D2240	60 ± 8

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