chanhvinh.com

AEROSPACE, DEFENSE & MARINE

RW-2070 Revision 2

Raychem brand Moulded Components
Flame Retarded, Semi-Rigid, Heat Shrinkable, Elastomer (-25)

SCOPE

This Quality Assurance Specification establishes the quality standard for moulded components manufactured from cross-linked, electrically-insulating, flame retarded semi-rigid material. The dimensions of these components shrink to a pre-determined size on the application of heat.

Approved Signatories*

TE Connectivity Electronics : **Approved electronically via DMTec**

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

chanhvinh.com

1. REVISION HISTORY

Revision Number	Change Request	Date	Incorporated By
0	Formerly RK 6713 Revn 2		
1	CR/	January 2002	Paul Dixon
2	CR10-DM-009	3 August 2010	Paul Dixon

2. REQUIREMENTS

2.1 Composition, Appearance and Colour

The moulded components shall be homogeneous and essentially free from pinholes, bubbles, flaws, cracks and inclusions. The colour shall be black unless otherwise specified.

2.2 Dimensions

Dimensions shall be as specified in the relevant SCD.

2.3 Test Requirements

The moulded components and material from which they are made shall meet the requirements contained in Table 1.

3. TEST METHODS

3.1 Preparation of Test Specimens

Unless otherwise specified, tests shall be carried out on a moulded test sheet of the material 150 mm x 150 mm x 2.0 ± 0.3 mm (*6 x 6 x 0.075 ± 0.01 inches*) or on a moulded component of suitable size. For tests on the recovered moulded component, the component shall be recovered by conditioning in an oven at 200 ± 3°C for 10 mins 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 ± 2°C (*73 ± 5 °F*) and at 50 ± 5% relative humidity.

3.2 Tensile Strength and Ultimate Elongation

The test method shall be as specified in ISO 37 (*or ASTM D2671*).
Five Type 2 (*die D ASTM D 412*) dumb-bell specimens cut from the moulded test sheet shall be tested. Initial jaw separation shall be 50 mm and rate of jaw separation shall be 100 ± 10 mm per minute. The test shall be carried out at a temperature of 23 ± 2°C (*73 ± 5 °F*).

chanhvinh.com

TEST METHODS (Cont'd)

3.3 Elastic Memory

A 150 mm x 3.2 mm (*6 x 1/8 inches*) specimen cut from a test sheet shall be marked with two parallel gauge lines 25 mm apart in the central portion of the specimen. The distance between gauge lines shall be recorded as the original length. A 50 mm (*2 inch*) portion of the specimen including both gauge lines then shall be heated for 1 minute in an oven at 175 ± 2 °C (*347 ± 4 °F*), removed from the oven and stretched within 10 seconds until the gauge lines are 100 mm (*4 inches*) apart. The extended specimen shall be cooled to room temperature then released from tension. After 24 hours at room temperature, the distance between the gauge lines shall be measured and recorded as the extended length. The portion of the specimen including both gauge lines shall then be reheated in an oven for 1 minute at 175 ± 2 °C (*347 ± 4 °F*) and the distance between the gauge line shall be measured and recorded as the retracted length.

Expansion and retraction calculations

$$E = \frac{Le - Lo}{Lo} \times 100$$

$$R = \frac{Le - Lr}{Le - Lo} \times 100$$

Where: E = Expansion (percent)
R = Retraction (percent)
Lo = Original length [mm (inches)]
Le = Extended length [mm (inches)]
Lr = Retracted length [mm (inches)]

3.4 Secant Modulus at 2% Strain

The test method shall be as specified in Method A of ASTM D882.
Five strip specimens 20 mm x 150 mm cut from the moulded test sheet shall be tested. Initial jaw separation shall be 100 mm and rate of jaw separation 10 ± 1 mm per minute.
The test shall be carried out at a temperature of 23 ± 2°C (*73 ± 5 °F*) between 4 and 24 hours after moulding the test sheet.

3.5 Specific Gravity

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

3.6 Heat Shock

The test method shall be as specified in ASTM D2671.
Five strip specimens 6 mm x 150 mm (*¼ x 6 inches*) cut from the moulded test sheet shall be tested. The specimens shall be conditioned in a fan assisted air circulating oven as specified in Table 1.

chanhvinh.com

TEST METHODS (Cont'd)

3.7 Heat Ageing

The test method shall be as specified in ISO 188.
Five tensile test specimens prepared as in Clause 3.2 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 3.2.

3.8 Low Temperature Flexibility

The ends of five strip specimens 6 mm x 150 mm (*¼ x 6 inches*) cut from the moulded test sheet shall be inserted 25 mm (1 inch) into the grips of a bending device (comprising two parallel grips 65 mm (*2½ inches*) apart) securely holding the specimens in a loop position. The specimens and bending device shall be conditioned as specified in Table 1. While still at the low temperature, the grips shall be moved to a position 25 mm (*1 inch*) apart in less than two seconds.

3.9 Flammability

The test method shall be as specified in ASTM D635.

3.10 Electric Strength

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

3.11 Volume Resistivity

The test method shall be as described in ASTM D 149

3.12 Copper Mirror Corrosion

The test method shall be as specified in ASTM D2671 Paragraph 93 procedure A.

3.13 Water Absorption

The test method shall be as specified in Method 1 of ISO 62.
Three disc specimens of diameter 25 ± 1 mm (*1 inch*) shall be tested.

3.14 Fluid Resistance

The test method shall be as specified in ISO 1817.
Five tensile test specimens prepared as in Clause 3.2 shall be completely immersed in each of the fluids for the times and temperatures specified in *Table 1*. The volume of the fluid shall not be less than 20 times that of the specimen. After immersion, lightly wipe the specimens and allow to air dry at 23 ± 2°C (*73 ±5 °F*) for 1h ± 15m. The Tensile Strength and Ultimate Elongation of each specimen shall be tested according to Clause 3.2. The test shall be repeated on the remaining specified fluids.

chanhvinh.com

Test Methods (continued)

3.15 Fungus Resistance

The test method shall be as specified in ISO 846 Method B. The specimens shall be conditioned for 56 days, followed by testing as per clause 3.2

4. RELATED STANDARDS & issue

ASTM D149-09	Test Methods For Dielectric Breakdown Voltage And Dielectric Strength Of Solid Electrical Insulating Materials At Commercial Power Frequencies
ASTM D257-07	Standard Test Methods for DC Resistance or Conductance of Insulating Materials R(1998)
ASTM D635-10	Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM D88210	Standard Test Methods for Tensile Properties of Thin Plastic Sheeting
ASTM D2671-09	Standard Test Methods for Heat-Shrinkable Tubing for Electrical Use
IEC 60212: 1971	Standard Conditions for Use Prior to and During Testing of Solid Electrical Insulating Materials

chanhvinh.com

4. RELATED STANDARDS & issue (cont)

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 846: 1997	Methods for Determining Resistance of Synthetic Polymeric Materials to Fungi
ISO 1183-1: 2004	Plastics - Methods For Determining The Density Of Non-Cellular Plastics - Part 1: Immersion Method, Liquid Pyknometer Method And Titration Method
ISO 1817: 2005	Rubber, vulcanized - Determination of the effect of liquids

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 of material taken at random from each batch of moulding compound. A batch of moulding compound is defined as that quantity of moulding compound manufactured at any one time. Testing frequency shall be Production Routine or Qualification. Production Routine tests consisting of Visual Examination, Dimensions, Secant Modulus at 2% Strain, Tensile Strength, Ultimate Elongation, Heat Shock at 215°C, Specific Gravity, Flammability and Electric Strength shall be carried out on every batch of moulding compound. 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 quantity, part number and batch number. Additional information shall be supplied as specified in the contract or order.

chanhvinh.com

TABLE 1 Test Requirements

Test	Test Method	Test Requirements
Visual Examination	-	As per Clause 2.1
Dimensions	ASTM D2671	As per SCD
Tensile Strength	ISO 37	12 MPa minimum (*1740 psi*)
Ultimate Elongation	ISO 37	400 % minimum
Elastic Memory - Tensile Strength - Ultimate Elongation		 200 % minimum expansion 90 % minimum retraction
Secant Modulus at 2% Strain	ASTM D882	80 - 160 Mpa (*11600 – 23200* psi)
Specific Gravity	ISO 1183	1.4 maximum
Heat Shock (4h ± 15m at 215 (*420 °F*) ± 5°C) - Tensile Strength - Ultimate Elongation	ASTM D2671 ISO 37	 12 MPa minimum (*1740 psi*) 400% minimum
Heat Ageing (168h ± 2h at 160 (*320 °F*) ± 3°C) - Ultimate Elongation	ISO 188 ISO 37	 400% minimum
Low Temperature Flexibility (4h ± 15m at –75 (*-100 °F*) ± 2°C)	*Clause 3.8*	No cracking
Flammability - Average time of burning - Average extent of burning	ASTM D 635	 120 seconds maximum 25 mm (*1 inch*) maximum
Electric Strength	IEC 243	12 MV/m minimum
Volume Resistivity	ASTM D 257	10^{12} ohm-cm minimum
Copper Mirror Corrosion (16h ± 30m at 150 (*302 °F*) ± 3°C)	ASTM D2671	No corrosion of mirrors
Water Absorption (24 ± 2h immersion at 23 (*75 °F*) ± 2°C)	ISO 62	 0.5 % maximum
Fungus Resistance - Tensile Strength - Ultimate Elongation	ISO 846 ISO 37	 12 MPa minimum (1740 psi) 400% minimum

chanhvinh.com

TABLE 1 Test Requirements (Cont'd)

Test	Test Method	Temperature °C (°F)	Time (Hours)	Test Requirements
Fluid Resistance	ISO 1817			
• Propan-2-ol (S737)		23 ± 2 (*75 ±5*)	24 ± 2	
• Anti Icing fluid (MIL-A-8243)		23 ± 2 (*75 ±5*)	24 ± 2	
• Cleaning fluid EU (TL6850-017)		23 ± 2 (*75 ±5*)	1 ± 5 min	
• Cleaning compound US *(P-C-437)*		23 ± 2 (*75 ±5*)	24 ± 2	
• Iso Octane/Toluene (70/30)		40 ± 2 (*104 ± 5*)	24 ± 2	
• Hydraulic fluid (H-542) (*SAE J 170 3*)		40 ± 2 (*104 ± 5*)	24 ± 2	
• Hydraulic fluid (H-544) (*MIL-H-46170*)		50 ± 2 (*122 ± 5*)	24 ± 2	
• Hydraulic fluid (PX-26) (*MIL-H-6083*)		70 ± 2 (*149 ± 5*)	24 ± 2	
• Lubricating oil (0-190) (*VV-L-800C*)		70 ± 2 (*149 ± 5*)	24 ± 2	
• Damping fluid (S-1724) (*VV-D-1078B*)		70 ± 2 (*149 ± 5*)	24 ± 2	
• Aircraft grease (G-354 (*MIL-G-23827B*)		70 ± 2 (*149 ± 5*)	24 ± 2	
• Hydraulic fluid (H-515) (*MIL-H-5606*)		70 ± 2 (*149 ± 5*)	24 ± 2	
• Automotive diesel fuel ** (*ISO 1817 Fluid F*)		70 ± 2 (*149 ± 5*)	24 ± 2	
• Automotive gasolene ** (*MIL-G-3056*)		70 ± 2 (*149 ± 5*)	24 ± 2	
• Lubricating oil (O-236)		100 ± 2 (*212 ± 5*)	24 ± 2	
• Lubricating oil (O-156) (*MIL-L23699*)		100 ± 2 (*212 ± 5*)	24 ± 2	
- Tensile Strength				10 MPa minimum (*1450psi minimum*)
- Ultimate Elongation				300 % minimum

In line with a policy of continual product development, TE Connectivity reserves the right to make changes in construction, materials and dimensions without further notice. You are advised, therefore, to contact TE Connectivity Electronics, should it be necessary to ensure that this document is the latest issue.

** Use of "from the pump" fluids allowed – baseline standard shown in italics below.