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RK 6214 Revision 3

RPPM

SCOPE

This Quality Assurance Specification establishes the quality standard for a dual wall sleeving which shall consist of a non-meltable, heat-shrinkable jacket and a meltable adhesive inner liner. The sleeving will shrink fully and the adhesive will melt on the application of heat at 80°C or above.

Approved Signatories*

	Quality Assurance	Technical	Product Management
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* This document is electronically reviewed and approved - therefore no signatures will appear.

1. REVISION HISTORY

Revision Number	Change Request	Date	Incorporated By
3	T0246 CR/IND/0006 CR98-DM-0199	July 1993 July 1996 October 1998	Mike Jones Eddie Bedwell Linda Abrams

2. REQUIREMENTS

2.1 Composition, Appearance and Colour

The sleeving shall be homogeneous and free from pinholes, bubbles, cracks and inclusions. The standard product shall be clear. Other colours are possible by special contract.

2.2 Dimensions

Size	Inside Diameter as supplied (min) mm	Inside Diameter after recovery (max) mm	Total Wall Thickness after recovery mm	Outer Jacket Wall Thickness after recovery mm
4/1	4.0	1.0	0.8 ± 0.15	0.5 ± 0.12
8/2	8.0	2.0	0.9 ± 0.20	0.6 ± 0.12
12/3	12.0	3.0	1.2 ± 0.25	0.8 ± 0.15
16/4	16.0	4.0	1.5 ± 0.25	1.0 ± 0.20

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

3.1.1 Preparation of Test Specimen

Unless otherwise specified, tests shall be carried out on specimens of sleeving recovered by conditioning in a fan assisted air circulating oven at 150 ± 5°C for 3 minutes ± 10 seconds 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 and at 50 ± 5% relative humidity.

TEST METHODS (continued)

3.1.2 Preparation of Test Specimen (Installed Product)

For these tests the product shall be installed onto a metal pipe as defined below.

Size	Pipe / Mandrel Dimensions
4/1	3.17 mm (1/8”)
8/2	6.35 mm (1/4”)
12/3	9.52 mm (3/8”)
16/4	12.50 mm (1/2”)

The sleeving shall be installed by heating in an air circulating oven at a temperature not exceeding 150°C (or with a hot air gun) until the product is just recovered and the adhesive has melted onto the substrate. (Note: with this rapidly recovering product excessive heating must be avoided to prevent splitting.) Samples shall then be allowed to cool at room temperature for 10 minutes minimum.

3.2 Dimensions and Longitudinal Change

The test method shall be as specified in ASTM D2671.
The length and inside diameter of three 150 mm 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.

3.3 Tensile Strength and Ultimate Elongation

The test method shall be as specified in ISO 37.
Determine the Tensile Strength based on the cross-sectional area of the jacket only. Use suitable optical method (e.g. microscope) to measure the thickness of the outer wall for this calculation. For sleeving of recovered bore greater than 6 mm, five Type 2 dumb-bell specimens shall be tested. For sleeving of recovered bore less than or equal to 6 mm, five tubular specimens 125 mm long shall be tested. Initial jaw separation shall be 50 mm and rate of jaw separation shall be 100 ± 10 mm/minute.
The test shall be carried out at a temperature of 23 ± 2°C.

3.4 Flame Resistance

The test method shall be as specified in MVSS 302.

TEST METHODS (continued)

3.5 Inner Wall Adhesion

The test shall be carried out on Size 16/4 RPPM. Five cylindrical aluminium rolling drum adhesion test mandrels 25 mm long by 12.7 mm diameter shall be abraded and degreased. Specimens of Size 16/4 RPPM approximately 50 mm long shall be recovered on to the mandrels by conditioning in a fan assisted air circulating oven at 150 ± 3°C for 5 minutes. After conditioning the specimens shall be removed from the oven and allowed to cool naturally to room temperature. Surplus lengths of RPPM shall be trimmed level with the ends of the mandrels. The specimens shall be slit axially and peeled from the mandrels in a suitable tensile testing machine such that the sleeving peels off at a rate of 50 ± 5 mm length per minute as the mandrel rotates. The test shall be carried out at a temperature of 23 ± 2°C. The mean peel-off force for each specimen shall be recorded, and the mean of the five recorded measurements reported as the Inner Wall Adhesion.

3.6 Split Resistance

For these tests the product shall be installed onto a metal pipe or mandrel selected as being conveniently close to the dimensions recommended in Clause 3.1.2, according to the size of sleeving being tested. Five samples each 100 mm in length, cut with a sharp blade from the sleeving supplied, shall be installed as specified in Clause 3.1.2. The samples 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 for 10 minutes minimum and examined for splitting.

3.7 Cold Impact

The test method shall be as described in RTM 2574 which is based on VDE 0472 Part 611. Drop height shall be 100 mm. Conditioning shall be -40 ± 2°C for 4 hours. The falling weight shall have a mass of 1 kg.

3.8 Scrape Wear

The test method shall be as described in RTM 2575 which is based on VG 95343 Part 2. Five tests shall be carried out with a load of 500 grams on the specified steel wire.

3.9 Fluid Resistance

The test method shall be as specified in ISO 1817.
Five tensile test specimens prepared as in Clause 3.3. 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 for 1 h ± 15 min. The Tensile Strength and Ultimate Elongation of each specimen shall be tested according to Clause 3.3. The test shall be repeated on the remaining specified fluids.

TEST METHODS (continued)

4. RELATED STANDARDS & issue

ASTM D2671-00	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
ISO 37: 1994	Rubber, vulcanized or thermoplastic - Determination of Tensile Stress-Strain Properties
ISO 1817: 1999	Rubber, vulcanized - Determination of the effect of liquids
MVSS 302: 1975	Flammability of Materials - Passenger Cars, Multiple Passenger Vehicles, Trucks and Buses (Docket N. 3-3;Notice 4)
RTM 2574	Raychem Test Method – Cold Impact Test
RTM 2575	Raychem Test Method – Scrape Wear Test
VDE 0472-611: 1985	Testing Of Cables, Wires & Flexible Cords - Cold Impact Test
VG 95343-2: 1999	Heat Shrinkable Components – Generic Specification

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 or Qualification. Production Routine tests consisting of Visual Examination, Dimensions, Longitudinal Change and Split Resistance shall be carried out on every batch of sleeving.
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 and batch number. 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 or the relevant SCD
Longitudinal Change	ASTM D2671	0 to -15%
Tensile Strength	ISO 37	15.0 MPa minimum
Ultimate Elongation	ISO 37	150 % minimum
Flame Resistance	MVSS 302	100 mm/min maximum
Inner Wall Adhesion - RPPM to Aluminium	Clause 3.5	 60 N /25 mm minimum
Split Resistance (20 min ± 15 sec at 100 ± 2 °C)	Clause 3.6	No splitting
Cold Impact (4 h ± 15 min at -40 ± 2°C)	RTM 2574	No cracking of outer jacket
Scrape Wear	RTM 2575	5000 strokes minimum to penetration
Fluid Resistance 24 ± 2 h immersion at 23 ± 2°C • Diesel Fuel • Hydraulic Fluid to SAE J1703 • Lubricating Oil to O-149 • Hydraulic Fluid DTD900/4881 • Antifreeze (Ethylene Glycol/Water 50/50 v/v) Battery Acid to BS 3031 - Tensile Strength - Ultimate Elongation	ISO 1817 ISO 37	 15 MPa minimum 150% minimum

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