RK 6747 Revision 6

GPO-135 SLEEVING

SCOPE

This Quality Assurance Specification establishes the quality standard for a types of heat-shrinkable, electrically-insulating, semi-flexible, polyolefin sleeving.

Approved Signatories

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

1. REVISION HISTORY

Revision Number	Change Request	Date	Incorporated By
3	CRF P1109	08 Jul 97	C. Woosnam
4	CR98-DM-0220 CR98-DM-0199	27 Oct 98 24 Sep 98	C. Woosnam L. Abrams
5	CR02-DM-0155	01 Aug 02	L. Abrams
6	Via DMTEC	05-03-14	C.Diss

2. REQUIREMENTS

2.1 Composition, Appearance and Colour

The sleeving shall be homogeneous and free from pinholes, bubbles, cracks and inclusions. Colour shall be as specified in the contract or order.

2.2 Dimensions

Size	Inside Diameter as supplied (min) mm	Inside Diameter after recovery (max) mm	Wall Thickness after recovery mm
1.2/0.6	1.2	0.6	0.45 ± 0.10
1.6/0.8	1.6	0.8	0.45 ± 0.10
2.4/1.2	2.4	1.2	0.50 ± 0.10
3.2/1.6	3.2	1.6	0.50 ± 0.10
4.8/2.4	4.8	2.4	0.50 ± 0.10
6.4/3.2	6.4	3.2	0.65 ± 0.15
9.5/4.8	9.5	4.8	0.65 ± 0.15
12.7/6.4	12.7	6.4	0.65 ± 0.15
19.0/9.5	19.0	9.5	0.75 ± 0.15
25.4/12.7	25.4	12.7	0.90 ± 0.15
32.0/16.0	32.0	16.0	0.95 ± 0.20
38.0/19	38.0	19.0	1.00 ± 0.20
51.0/25.4	51.0	25.4	1.15 ± 0.25
76.0/38.0	76.0	38.0	1.25 ± 0.25
102.0/51.0	102.0	51.0	1.40 ± 0.25

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 200 ± 5°C for 4 ± 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 ± 2°C and at 50 ± 5% relative humidity.

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.

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 100 ± 10mm per minute.
The test shall be carried out at a temperature of 23 ± 2°C.

3.4 Specific Gravity

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

3.5 Heat Shock

The test method shall be as specified in ASTM D2671.
For sleeving of recovered bore 6mm or less, apply the test to cut lengths of that 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 10x specimen thickness ± 10%. For tubular specimens the thickness is the outside diameter.
The specimens shall be conditioned as specified in Table 1.

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 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 10 x specimen thickness ± 10%. For tubular specimens the thickness is the outside diameter.
The specimens and mandrel shall be conditioned as specified in Table 1.

3.8 Flammability

The test method shall be as specified in ASTM D876.
The test shall be carried out on size 12.7/6.4

3.9 Electric Strength

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

3.10 Water Absorption

The test method shall be as specified in Method 1 of ISO 62.
For sleeving of recovered bore greater than 8mm, three disc specimens of diameter 25 ± 1mm shall be cut from the sleeving. For sleeving of recovered bore less than or equal to 8mm, three tubular specimens 50mm long shall be cut from the sleeving.

3.11 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 1h ± 15m. 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.

4. RELATED STANDARDS & issue

ASTM D876-00	Standard Test Methods for Nonrigid Vinyl Chloride Polymer Tubing Used for Electrical Insulation
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
IEC 60243-1: 1998	Electrical Strength Of Insulating Materials - Test Methods - Tests At Power Frequencies
ISO 37: 1994	Rubber, vulcanized or thermoplastic - Determination of Tensile Stress-Strain Properties
ISO 62: 1999	Determination of Water Absorption
ISO 188: 1998	Rubber, vulcanized - Accelerated Ageing or Heat Resistance Tests.
ISO 1183: 1987	Methods for determining the density and relative density of non-cellular plastics
ISO 1817: 1999	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 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 and Longitudinal Change 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
Longitudinal Change	ASTM D2671	+5 to -10 %
Tensile Strength	ISO 37	8 MPa minimum
Ultimate Elongation	ISO 37	175 % minimum
Specific Gravity	ISO 1183	1.35 maximum
Heat Shock (4h ± 15m at 175 ± 5°C)	ASTM D2671	No dripping, cracking or flowing
Heat Ageing (168 ± 2h at 135 ± 3°C) - Ultimate Elongation	ISO 188 ISO 37	 150% minimum
Heat Ageing (3000 ± 3h at 125 ± 3°C) - Ultimate Elongation	ISO 188 ISO 37	 50% minimum
Low Temperature Flexibility (4h ± 15m at -30 ± 2°C)	ASTM D2671	No cracking
Flammability	ASTM D876	Duration of burning 30s maximum. No burning or charring of indicator
Electric Strength Sizes 25.4/12.7 and below Sizes above 25.4/12.7	IEC 243	 20 MV/m minimum 10 MV/m minimum
Water Absorption (24 ± 2h immersion at 23 ± 2°C)	ISO 62	0.5 % maximum

TABLE 1 Test Requirements (Cont'd)

Test	Test Method	Test Requirements
Fluid Resistance (24 ± 2h immersion at 23 ± 2°C) • Gasoline Fuel to ISO 1817 Test liquid B • Engine Oil to SAE 20W/50 • Hydraulic Fluid to SAE J1703	ISO 1817	
- Tensile Strength	ISO 37	7 MPa minimum
- Ultimate Elongation		200% minimum