IEC 60684-3-247

Edition 2.0 2019-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Flexible insulating sleeving –
Part 3: Specifications for individual types of sleeving –
Sheet 247: Heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded, thick and medium wall

Gaines isolantes souples –
Partie 3: Spécifications pour types particuliers de gaines –
Feuille 247: Gaines thermorétractables en polyoléfine, à double paroi, non ignifugées à paroi épaisse et moyenne

IEC 60684-3-247:2019-08(en-fr)

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FOREWORD

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International Standard IEC 60684-3-247 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

This second edition cancels and replaces the first edition published in 2011 and Amendment 1:2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous editions:

a) removal of the colour fastness to light test, as this is covered by the test for carbon black content;
b) change of low temperature flexibility test to -20 °C to align with sheet 214;
c) change of final conditioning temperature of peel strength samples to 200 ºC to align with the temperature in Clause 5;

d) removal of the fungus resistance test as there is no evidence that fungus growth is an issue either by testing or in use.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
15/890/FDIS	15/900/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 60684 series, under the general title *Flexible insulating sleeving*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This document is one of a series of standards which deals with flexible insulating sleeving for electrical purposes.

The series consists of three parts:

Part 1: Definitions and general requirements (IEC 60684-1)

Part 2: Methods of test (IEC 60684-2)

Part 3: Specifications for individual types of sleeving (IEC 60684-3)

This document comprises one of the sheets of Part 3 as follows:

Sheet 247: Heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded, thick and medium wall

FLEXIBLE INSULATING SLEEVING –

Part 3: Specifications for individual types of sleeving – Sheet 247: Heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded, thick and medium wall

1 Scope

This part of IEC 60684 gives the requirements for two types of heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded with a nominal shrink ratio of 3:1.

This sleeving has been found suitable for use at temperatures of up to 100 °C.

- Type A: Medium wall, internal diameter up to 200,0 mm typically.
- Type B: Thick wall, internal diameter up to 200,0 mm typically.

These sleevings are normally supplied in colour black.

Since these types of sleving cover a significantly large range of sizes and wall thicknesses, Annex A (Tables A.1 and A.2) provides a guide to the range of sizes available. The actual size will be agreed between the user and supplier.

Materials which conform to this specification meet established levels of performance. However, the selection of a material by a user for a specific application will be based on the actual requirements necessary for adequate performance in that application and not based on this specification alone.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60296:2012, *Fluids for electrotechnical applications – Unused mineral insulating oils for transformers and switchgear*

IEC 60684-1:2003, *Flexible insulating sleeving – Part 1: Definitions and general requirements*

IEC 60684-2:2011, *Flexible insulating sleeving – Part 2: Methods of test*

IEC 60757:1983, *Code for designation of colours*

ISO 868:2003, *Plastics and ebonite – Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 11357-3:2018, Plastics – *Differential scanning calorimetry (DSC) – Part 3: Determination of temperature and enthalpy of melting and crystallization*

ISO 11358-1:2014, *Plastics – Thermogravimetry (TG) of polymers – Part 1: General principles*

3 Terms and definitions

No terms and definitions are listed this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Designation

The sleeving shall be identified by the following designation:

Description	IEC publication number	IEC part number	IEC sheet number	Type	Size (expanded and recovered internal diameter in mm)	Colour
↓	↓	↓	↓	↓	↓	↓
Sleeving	IEC 60684	- 3	- 247	- B	- 85,0/25,0	- BK

Any colour abbreviation shall comply with IEC 60757, where applicable. Non-standard colours shall be written out in full.

NOTE This information is for package labelling only, in accordance with IEC 60684-1.

5 Conditions of test

Unless otherwise specified, the sleeving shall be shrunk in a forced air circulation oven for (10 ± 1) min at 200 °C ± 3 K prior to testing.

6 Requirements

In addition to the general requirements given in IEC 60684-1, the sleeving shall comply with the requirements of Tables 1, 2, and 3 where applicable.

7 Sleeving conformance

Conformance to the requirements of this specification shall normally be based on the results from typical sizes:

- Type A: Recovered internal diameter 25 mm to 30 mm
- Type B: Recovered internal diameter 25 mm to 30 mm

For the peel strength test, select a size to comply with the dimensions as detailed under the remarks in Table 1.

Table 1 – Property requirements *(1 of 3)*

Property	IEC 60684-2:2011 clause or subclause	Units	Max. or min.	Requirements	Remarks
Dimensions	3				
Internal diameter	3.1.2	mm			
Wall thickness	3.3.2	mm		To be agreed between purchaser and supplier	
Concentricity	3.3.3	%			
expanded			Min.	50	
recovered			Min.	85	
Heat shock	6	-	-		Heat at 200 °C ± 5 K
Tensile strength	19.2 and 19.3	MPa	Min.	10	Jacket only, ignore flowing adhesive
Elongation at break	19.2 and 19.3	%	Min.	200	Use a jaw separation rate of 100 mm/min. For internal diameters < 6,5 mm, use sleeving samples for testing. On 6,5 mm and larger diameter sleeving, use dumb-bell samples cut from the sleeving
Longitudinal change	9	%	Max.	–10 + 5	
Bending at low temperature	14	-	-	No cracking shall be visible	Test at -20 °C For strips, the mandrel shall be between 20 times and 22 times the wall thickness. Full section sleeving is tested unfilled and the mandrel shall be between 20 times and 22 times the outer diameter.
Dimensional stability on storage	16	-	-	The dimensions shall remain as agreed	See Clause 1
Tensile strength	19.2 and 19.3	MPa	Min.	13	Jacket only
Elongation at break	19.2 and 19.3	%	Min.	350	Use a jaw separation rate of 100 mm/min. For internal diameters <6,5 mm, use sleeving samples for testing. On 6,5 mm and larger diameter sleeving, use dumb-bell samples cut from the sleeving.
Secant modulus at 2 % elongation	19.5	MPa MPa	Min. Max.	80 160	Calculate cross- section area without adhesive.
Breakdown voltage	21.2	kV	Min.	Table 2	
Volume resistivity at room temperature after damp heat	23 23.5.2 23.5.4	 Ω·m Ω·m	 Min. Min.	 10^{12} 10^{11}	

Table 1 *(2 of 3)*

Property	IEC 60684-2:2011 clause or subclause	Units	Max. or min.	Requirements	Remarks
Resistance to selected fluids	36				Use the fluids and test temperatures specified in Table 3
Tensile strength	19.2 and 19.3	MPa	Min.	10	Immersion time (24 ± 1) h
Elongation at break	19.2 and 19.3	%	Min.	250	Use a jaw separation rate of 100 mm/min. For internal diameters < 6,5 mm, use sleeving samples for testing. On 6,5 mm and larger diameter sleeving, use dumb-bell samples cut from the sleeving
Heat ageing	39				Heat at 150 °C ± 3 K
Tensile strength	19.2 and 19.3	MPa	Min.	10	Jacket only
Elongation at break	19.2 and 19.3	%	Min.	200	Use a jaw separation rate of 100 mm/min. For internal diameters < 6,5 mm, use sleeving samples for testing. On 6,5 mm and larger diameter sleeving, use dumb-bell samples cut from the sleeving
Long term ageing	50				The ageing temperature shall be 100 °C ± 3 K
Elongation at break	19.2 and 19.3	%	Min.	175	Use a jaw separation rate of 100 mm/min. For internal diameters < 6,5 mm, use sleeving samples for testing. On 6,5 mm and larger diameter sleeving, use dumb-bell samples cut from the sleeving
Carbon black content	ISO 11358-1	%	Min.	2,5	Identify carbon black peak and report weight loss %
Hardness	ISO 868	Shore D	Min.	40	
Water absorption	40	%	Max.	0,5	

Table 1 *(3 of 3)*

Property	IEC 60684-2:2011 clause or subclause	Units	Max. or min.	Requirements	Remarks
Peel strength	54	N/25 mm	Min.	Cu – 50 Al – 75 PO-X – 100	Use a Cu or Al tube with a minimum outer diameter of 25 mm and at least 20 % above the fully recovered internal diameter of the sleeving. The sleeving under test shall have a thickness of 2,0 mm ± 0,5 mm when recovered on the tube. Other substrate materials and methods are subject to agreement between the supplier and the user. Prepare the Cu and Al tubes in the manner defined in IEC 60684-2:2011, 54.3. Precondition the prepared Cu and Al tubes in an oven at 100 ºC for at least 30 min. Immediately place the sleeving on the prepared Cu or Al tubes and condition at 200 ºC ± 3 K for (10 ± 1) min. To make the cross-linked polyolefin (PO-X) specimens shrink the sleeving onto the Cu or Al tubes by conditioning at 200 °C ± 3 K for (10 ± 1) min. Allow to cool, then abrade and clean the outer surface as detailed in IEC 60684-2:2011, 54.3. Finally, fix the narrow strip of adhesive masking tape longitudinally on the sleeving, then place the same sleeving on top and condition at 200 ºC ± 3 K for (10 ± 1) min.
Melting temperature	ISO 11357-3	° C	Min.	100	Adhesive only Value to be recorded is peak melting temperature (T_{pm})