INTERNATIONAL STANDARD

IEC 60684-3-246

Third edition
2007-02

Flexible insulating sleeving –

Part 3:
Specifications for individual types of sleeving –
Sheet 246: Heat-shrinkable polyolefin sleeving, dual wall, non-flame retarded

Reference number
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FLEXIBLE INSULATING SLEEVING –

Part 3: Specifications for individual types of sleeving – Sheet 246: Heat-shrinkable polyolefin sleeving, dual wall, non-flame retarded

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60684-3-246 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

This third edition cancels and replaces the second edition published in 2001, and constitutes a technical revision.

The major technical changes with regard to the second edition concern a better alignment with existing national specifications.

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The text of this standard is based on the following documents:

FDIS	Report on voting
15C/358/FDIS	15C/371/RVD

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

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

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

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

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

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

This International Standard is one of a series 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 standard comprises one of the sheets of Part 3 as follows:

Sheet 246: Heat-shrinkable polyolefin sleeving, dual wall, non-flame retarded

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FLEXIBLE INSULATING SLEEVING –

Part 3: Specifications for individual types of sleeving – Sheet 246: Heat-shrinkable polyolefin sleeving, dual wall, non-flame retarded

1 Scope

This part of IEC 60684 defines requirements for dual wall, non-flame retarded, heat shrinkable, polyolefin sleeving. This sleeving has been found suitable for use up to 110 °C.

The sleeving consists of an outer layer made of a semi-rigid cross-linked material.

The inner layer is a substantially non-cross-linked polyolefin that flows and fuses during the shrinkage process to provide a seal.

It is normally offered for sale with an internal diameter up to 25 mm in the following colours: black, white, red, yellow, blue and translucent.

Sizes or colours other than those listed in this standard may be available as custom items. These items are considered to comply with this standard if they comply with the property requirements listed in Tables 2, 3, 4 and 5, excluding dimensions.

Materials which conform to this specification meet established levels of performance. However, the selection of a material by a user for a specific application should 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 referenced documents are indispensable for the application 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 60684-1:2003, *Flexible insulating sleeving – Part 1: Definitions and general requirements*

IEC 60684-2:1997, *Flexible insulating sleeving – Part 2: Methods of test*[1)]
Amendment 1 (2003)
Amendment 2 (2005)

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

ISO 1817:2005, *Rubber, vulcanized – Determination of the effect of liquids*

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1) A consolidated edition 2.1 exists, including IEC 60684-2:1997 and its Amendment 1 (2003).

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3 Designation

The sleeving shall be identified by the following designation, as shown in the following example:

Description		IEC publication number		IEC part number		IEC sheet number		Size (expanded/ recovered internal diameter, in millimetres)		Colour
↓		↓		↓		↓		↓		↓
Sleeving	-	IEC 60684	-	3	-	246	-	12,7/5,0	-	NC

NOTE NC is used for “Natural colour” / “No colour pigmentation”.

Any abbreviation of colour shall comply with IEC 60757. Where no abbreviation is given, the colour shall be written in full.

4 Conditions of test

Unless otherwise specified, the sleeving shall be shrunk in a forced air circulation oven for (10 ± 1) min at 200 °C ± 5 K prior to testing.

5 Requirements

In addition to the general requirements given in IEC 60684-1, the sleeving shall comply with the requirements in Tables 1, 2, 3, 4 and 5.

6 Sleeving conformance

Conformance to the requirements of this specification shall normally be based on the results from 12,7 mm/5,0 mm black sleeving. The colour fastness to light shall be determined for all colours.

7 Sealing performance test method

Condition a nominal 150 mm length of sleeving at 200 °C ± 5 K for (5 ± 1) min and condition a pair of pliers (clamping tool, see Figure 1) at the same temperature for at least 10 min. Within 5 s after removal from the oven, grip approximately 6 mm of one end of the sleeving with the pliers with sufficient pressure so that the inner surfaces of the sleeving are in full contact. Hold the pressure for at least 40 s, then release the pressure and condition the sleeving at a temperature of 23 °C ± 2 K for at least 10 min.

Submerge the sealed end of the sleeving in at least 25 mm of water and pressurize the open end with at least 20,7 kPa of air pressure for at least 5 s.

Observe whether any air bubbles escape from the sealed end of the sleeving.

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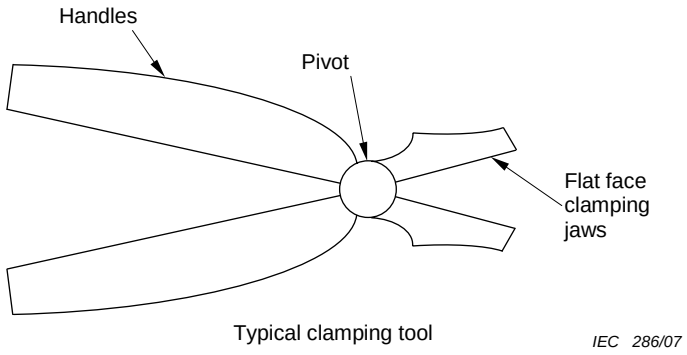

Figure 1 – Clamping tool for sealing performance test

Table 1 – Dimensional requirements

Size code [a]	Internal diameter mm		Total recovered wall thickness [b] mm
	Expanded min.	Recovered [c] max.	
3,2/0,6	3,2	0,6	0,95 ± 0,20
4,7/1,5	4,7	1,5	1,10 ± 0,20
6,4/2,0	6,4	2,0	1,20 ± 0,25
9,5/3,4	9,5	3,4	1,30 ± 0,25
12,7/5,0	12,7	5,0	1,40 ± 0,25
19,1/8,0	19,1	8,0	1,65 ± 0,25
25,4/10,2	25,4	10,2	1,90 ± 0,25
7,6/1,3	7,6	1,3	2,50 ± 0,25

a) These sizes are based on past industry practices for this type of sleeving.

b) The ratio of the inner wall thickness to the total wall thickness will typically lie between 0,3 and 0,7 .

c) In those cases where the inner wall distorts or flows during recovery, it may not be possible to determine the recovered inside diameter accurately. In such cases, the sleeving may be recovered over a mandrel or gauge of the specified diameter for the size being measured, and then shall be examined for complete contact with the mandrel or plug gauge to establish compliance with the requirements for the recovered diameter.

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Table 2 – Property requirements

Property	IEC 60684-2 clause or subclause	Units	Max. or min.	Requirements	Remarks
Dimensions – internal diameter – wall thickness	3 3.1.2 3.3.2	 mm mm		 Table 1 Table 1	
Density	4	g/cm^3	Max.	1,0	Test specimens shall be cut from full sections of sleeving
Heat shock	6	–	–	No observable dripping, cracking or flowing of the outer wall	Heat at 250 °C ± 5 K
Longitudinal change	9	%	Max.	+1 –10	Heat the expanded sleeving at 200 °C ± 5 K for (10 ± 1) min. The final measurement shall be on the outer wall only
Brittleness temperature	15	–	–	No visible cracking or breaking	Test at –40 °C ± 3 K after conditioning at the same temperature. The test shall be carried out on specimens taken from sleeving in the expanded (as supplied) form
Dimensional stability on storage	16	–	–	The dimensions shall be as specified in Table 1	
Tensile strength Elongation at break	19.1 and 19.2 19.1 and 19.2	MPa %	Min. Min.	10 200	Test in the expanded form. Use a jaw separation rate of 100 mm/min. For internal diameters <6,5 mm, use sleeving samples for testing. At internal nominal diameters ≥6,5 mm, use dumb-bell samples cut from sleeving. The cross-sectional area shall be calculated based on the jacket only
Secant modulus at 2 % elongation	19.4	MPa	Min.	175	Test in the expanded form. The cross-sectional area shall be calculated based on the jacket only
Breakdown voltage	21	kV	Min.	See Table 4	
Volume resistivity at room temperature	23 23.4.2	Ω×m	Min.	10^{12}	
Copper corrosion	33	%	Max.	None above the allowable 8 %	Heat the specimens for (16 ± 0,5) h at 130 °C ± 2 K

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Table 2 (*continued*)

Property	IEC 60684-2 clause or subclause	Units	Max. or min.	Requirements	Remarks
Colour fastness to light	34			The colour standard contrast between the exposed and unexposed parts of the specimen shall be equal to or less than that of the fastness standard	Fastness standard No. 5
Resistance to selected fluids	36				Test in the expanded form. Use the fluids and test temperatures specified in Table 5. The cross-sectional area shall be calculated based on the jacket only
Tensile strength	19.1 and 19.2	MPa	Min.	7	
Elongation at break	19.1 and 19.2	%	Min.	200	
Heat ageing	39				Heat at 175 °C ± 3 K
Elongation at break	19.1 and 19.2	%	Min.	100	
Water absorption	40	%	Max.	0,2	Test in the expanded form

Table 3 – Additional property requirements

Property	IEC 60684-2 clause or subclause	Units	Max. or min.	Requirements	Remarks
Sealing performance (see Clause 7 below)	–	–	–	No observed air bubbles escape from the sealed end of the sleeving	

The breakdown voltage shall be determined by any of the methods described in 21.2, 21.3 or 21.4 of IEC 60684-2. The central value shall comply with the minimum value in Table 4.

The rate of application of the voltage shall be 500 V/s.

Table 4 – Requirements for breakdown voltage

Nominal recovered wall thickness mm	**Breakdown voltage min.** kV
0,95	19
1,10	22
1,20	24
1,30	26
1,40	28
1,65	33
1,90	38
2,50	50
For non-standard wall thicknesses, the breakdown voltage shall be at least that of the next smaller standard wall thickness. For wall thicknesses smaller than 0,95 mm, the electric strength shall be at least 20,0 kV/mm.	

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Table 5 – Resistance to selected fluids

Fluids	Type	Standard or symbol	Immersion temperature °C ± 2 K
Fuel	Gasoline	ISO 1817 Liquid B	23
Oil	Mineral based	ISO 1817 Oil No. 2	23
Oil	Synthetic based	ISO 1817 Liquid 101	23
Deicing fluid	Aircraft deicer	Ethylene glycol 80 %, water 20 %	23
Other fluids and/or temperatures may be specified for customers with specific needs. These additional fluids and/or temperatures shall be applicable when incorporated into agreements between the supplier and customer.			

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