

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Flexible insulating sleeving –
Part 3: Specifications for individual types of sleeving –
Sheet 209: Heat-shrinkable, polyolefin sleeving, general purpose, flame retarded**

**Gaines isolantes souples –
Partie 3: Spécifications pour types particuliers de gaines –
Feuille 209: Gaines thermorétractables, en polyoléfine, d'utilisation générale,
ignifugées**



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IEC 60684-3-209

Edition 3.0 2010-06

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

J

ICS 29.035.20

ISBN 978-2-88910-965-4

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FLEXIBLE INSULATING SLEEVING –

**Part 3: Specifications for individual types of sleeving –
Sheet 209: Heat-shrinkable, polyolefin sleeving,
general purpose, flame retarded**

FOREWORD

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International Standard IEC 60684-3-209 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

This third edition cancels and replaces the second edition published in 2003 and constitutes a technical revision. This edition has been aligned with UL 224 for 125 °C flexible heat-shrinkable polyolefin tubing.

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

FDIS	Report on voting
15/561/FDIS	15/584/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 the parts in 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 stability 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- withdrawn,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
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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 209: Heat-shrinkable, polyolefin sleeving, general purpose, flame retarded

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FLEXIBLE INSULATING SLEEVING –

Part 3: Specifications for individual types of sleeving – Sheet 209: Heat-shrinkable, polyolefin sleeving, general purpose, flame retarded

1 Scope

This part of IEC 60684 gives the requirements for two types of general purpose, flexible, flame retarded, heat-shrinkable polyolefin sleeving. This sleeving has been found suitable for use at temperatures up to 125 °C.

- Type A – Highly flame retarded
- Type B – Flame retarded

The minimum supplied and maximum recovered internal diameters shall be specified by the manufacturer and shall meet the minimum wall thicknesses given in Table 2.

It is normally available in bore sizes up to 75 mm as supplied and in the following colours: black, brown, white, red, yellow, green, blue, orange, violet, grey and yellow/green.

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.

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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*
Amendment 1 (2003)
Amendment 2 (2005)

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

3 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 millimetres)	Colour
↓	↓	↓	↓	↓	↓	↓
Sleeving	IEC 60684	-3	-209	A	-12,7/6,4	- BK

Any abbreviation used for 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 5 min \pm 1 min at 200 °C \pm 5 K prior to testing.

5 Requirements

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

6 Sleeving conformance

Conformance to the requirements of this specification shall be normally based on results from black and white sleeving in the following sizes and designated tests.

Table 1 – Required test samples

	Size	Test
1	The largest recovered internal diameter produced for the sleeving having the smallest wall thickness	All tests
2	Recovered internal diameter between 5,4 mm and 12,7 mm	Flammability
3	The largest internal diameter produced	Wall thickness and flammability

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Table 2 – Minimum recovered wall thicknesses for maximum recovered internal diameters

Maximum recovered internal diameter mm	Minimum wall thicknesses mm
Up to 0,58	0,33
0,59 to 0,79	0,36
0,80 to 2,36	0,44
2,37 to 6,35	0,56
6,36 to 9,53	0,69
9,54 to 12,70	0,77
12,71 to 20,00	0,87
20,01 to 25,40	0,97
25,41 to 32,00	1,07
32,01 to 75,20	1,17

Table 3 – Property requirements

Property	IEC 60684-2 clause or subclause	Units	Max. or min.	Requirements	Remarks
Dimensions	3				
Recovered internal diameter	3.1.2	mm	Max.	Table 2	
Wall thickness	3.3.2	mm	Min.	Table 2	
Concentricity expanded	3.3.3	%	Min.	Shrink ratio 2:1 65 Shrink ratio 3:1 50	
Concentricity recovered				85	
Heat shock					
Visual	6	–	–	No signs of dripping and cracking	The heating temperature shall be 250 °C ± 5 K.
Flow		%	Max.	10	
Visual after bending				No cracking when cooled and wound 360° around a mandrel.	See Table 4 for mandrel diameters. Below 8,4 mm internal diameter test as full section sleeving. At and above 8,4 mm test as 150 mm long × 13 mm wide strips.
Longitudinal change	9	%	Max.	+5 –10	Heat expanded sleeving at 200 °C ± 5 K for (5 ± 1) min.
Bending at low temperature	14	–	–	No visible cracking	Condition at –30 °C ± 3 K. See Table 4 for mandrel diameters. For sleeving up to and including 10 mm test as filled sleeving
Tensile strength	19.1 and 19.2	MPa	Min.	10,3	
Elongation at break	19.1 and 19.2	%	Min.	200	Use a jaw separation rate of 100 mm/min. Below 6,5 mm nominal bore, test as sleeving. At and above 6,5 mm nominal bore, test as dumbbells in accordance with IEC 60684-2, Figure 5; or use a jaw separation rate of 500 mm/min. Below 8,4 nominal bore, test as sleeving. At and above 8,4 mm test as dumb-bells in accordance with IEC 60684-2, Figure 5.
Secant modulus at 2 % elongation	19.4	MPa	Max.	173	Test expanded sleeving
Breakdown voltage	21	kV	Min.	2,5	
Volume resistivity at room temperature	23 23.4.2	Ω·m	Min.	10 ¹²	
Flame propagation	26	s	Max.	60	Use method A for Type B sleeving and method B for Type A sleeving
Time of burning				No burning or charring of indicator flag and no ignition of cotton.	
Visual					Burning includes flaming and glowing.

Property	IEC 60684-2 clause or subclause	Units	Max. or min.	Requirements	Remarks
Corrosion resistance	32	%	Min.	No chemical interaction	
Elongation	19.1 and 19.2	%		100	
Restricted shrinkage Visual	41	–	–	No cracking or splitting	Perform the visual determination only.
Heat ageing	39				Heat at 160 °C ± 2 K.
Tensile strength Elongation at break	19.1 and 19.2 19.1 and 19.2	MPa %	Min. Min.	7,3 100	Use the conditions specified above for tensile strength and elongation at break.
Breakdown voltage	21	kV	Min.	2,5 kV and not less than 50 % breakdown of the un-aged sleeving	For the breakdown voltage test, prepare the samples as described in IEC 60684-2, 21.3. Heat as described above, and allow to cool to ambient conditions before testing. The rate of application of the voltage shall be 500 V/s.

Table 4 – Mandrel diameters for heat shock and low temperature bending

Recovered internal diameter mm	Mandrel diameter mm
0,5 to 3,2	7,9 ± 0,05
3,3 to 6,4	9,5 ± 0,08
6,5 to 25,4	11,1 ± 0,10
25,5 to 50,8	22,2 ± 0,13