INTERNATIONAL STANDARD

IEC 60684-3-214

Second edition
2005-11

Flexible insulating sleeving –

Part 3:
Specifications for individual types of sleeving –
Sheet 214: Heat-shrinkable, polyolefin sleeving, not flame retarded, shrink ratio 3:1 –
Thick and medium wall



Reference number
IEC 60684-3-214:2005(E)

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Sheet 214: Heat-shrinkable, polyolefin sleeving, not flame retarded, shrink ratio 3:1 –
Thick and medium wall

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CONTENTS

FOREWORD 3
INTRODUCTION 5

1 Scope 6
2 Normative references 6
3 Designation 7
4 Conditions of test 7
5 Requirements 7
6 Sleeving conformance 7

Table 1 – Dimensional and mass requirements – Type A 8
Table 2 – Dimensional and mass requirements – Type B 8
Table 3 – Property requirements 9
Table 4 – Requirements for breakdown voltage 10
Table 5 – Resistance to selected fluids 11
Table 6 – Additional property requirements 11

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FLEXIBLE INSULATING SLEEVING –

Part 3: Specifications for individual types of sleeving – Sheet 214: Heat-shrinkable, polyolefin sleeving, not flame retarded, shrink ratio 3:1 – Thick and medium wall

FOREWORD

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International Standard IEC 60684-3-214 has been prepared by IEC technical committee 15: Standards on specifications for electrical Insulating materials.

This second edition replaces the first edition (2001) and constitutes a technical revision.

The main change with respect to the previous edition is as follows:

The thermal endurance test method according to IEC 60216 has been replaced with a long term ageing test i.e. 3 000 h (see Amendment 1 to IEC 60684-2), at the recommended maximum temperature found suitable for use, to provide safe thermal test data within a workable time scale.

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

FDIS	Report on voting
15/230/FDIS	15/248/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.

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

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- 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 214: Heat-shrinkable, polyolefin sleeving, not flame retarded, shrink ratio 3:1 – Thick and medium wall

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FLEXIBLE INSULATING SLEEVING –

Part 3: Specifications for individual types of sleeving – Sheet 214: Heat-shrinkable, polyolefin sleeving, not flame retarded, shrink ratio 3:1 – Thick and medium wall

1 Scope

This standard gives the requirements for two types of heat-shrinkable, not flame retarded, polyolefin sleeving with a nominal shrink ratio of 3:1 and with thick and medium wall. This sleeving has been found suitable at temperatures up to 135 °C.

– Type A: Medium wall – internal diameter of up to 180,0 mm.

– Type B: Thick wall – internal diameter of up to 160,0 mm.

These sleevings are normally supplied in black.

Sizes or colours other than those specifically listed in this standard may be available as custom items. These items are in compliance with this standard if they comply with the property requirements listed in Tables 3, 4, 5 and 6 except for dimensions and mass.

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 60296:2003, *Fluids for electotechnical applications – Unused mineral insulating oils for transformers and switchgear*
Amendment 1 (2003)

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)

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

ISO 846:1997, *Plastics – Evaluation of the action of microorganisms*

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3 Designation

This sleeving shall be identified by the following designation:

Description	IEC publication number	IEC Part number	IEC Sheet number	Type	Size (expanded/ recovered internal diameter, in mm)	Colour
↓	↓	↓	↓	↓	↓	↓
Sleeving	IEC 60684	-3	-214	B	- 85,0/25,0	- BK

Any colour abbreviation shall comply with IEC 60757, where applicable. 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 150 °C ± 3 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 to 6.

6 Sleeving conformance

Conformance to the requirements of this specification shall normally be based on the results obtained for black sleevings of the following sizes:

– Type A: 85,0 mm/25,0 mm;
– Type B: 85,0 mm/25,0 mm.

The colour fastness to light shall be determined for all colours.

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Table 1 – Dimensional and mass requirements – Type A

Size code	Internal diameter mm		Recovered wall thickness mm	Mass per unit length g/m Max.
	Expanded Min.	Recovered Max.		
10,0/3,0	10,0	3,0	1,20 ± 0,20	21,4
16,0/5,0	16,0	5,0	1,70 ± 0,30	53,7
25,0/8,0	25,0	8,0	2,30 ± 0,30	106
35,0/12,0	35,0	12,0	2,30 ± 0,30	147
50,0/16,0	50,0	16,0	2,30 ± 0,30	196
63,0/19,0	63,0	19,0	2,80 ± 0,40	285
75,0/22,0	75,0	22,0	3,20 ± 0,50	385
85,0/25,0	85,0	25,0	3,30 ± 0,50	430
95,0/29,0	95,0	29,0	3,60 ± 0,50	552
115,0/34,0	115,0	34,0	3,70 ± 0,60	636
140,0/42,0	140,0	42,0	3,70 ± 0,60	716
160,0/50,0	160,0	50,0	3,80 ± 0,60	894
180,0/60,0	180,0	60,0	3,80 ± 0,60	1 072

Table 2 – Dimensional and mass requirements – Type B

Size code	Internal diameter mm		Recovered wall thickness mm	Mass per unit length g/m Max.
	Expanded Min.	Recovered Max.		
9,0/3,0	9,0	3,0	2,30 ± 0,30	55,0
13,0/4,0	13,0	4,0	2,80 ± 0,40	87,0
20,0/6,0	20,0	6,0	2,90 ± 0,40	115
33,0/8,0	33,0	8,0	3,75 ± 0,55	210
43,0/12,0	43,0	12,0	4,90 ± 0,60	360
51,0/16,0	51,0	16,0	5,00 ± 0,65	466
70,0/21,0	70,0	21,0	5,00 ± 0,65	572
85,0/25,0	85,0	25,0	5,00 ± 0,65	691
90,0/30,0	90,0	30,0	5,00 ± 0,65	815
130,0/36,0	130,0	36,0	5,00 ± 0,70	986
160,0/50,0	160,0	50,0	5,00 ± 0,70	1 307

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Table 3 – Property requirements

Property	IEC 60684-2 Clause or subclause	Units	Max. or Min.	Requirements	Remarks
Dimensions	3				
– Internal diameter	3.1.2	mm		Tables 1 and 2	
– Wall thickness	3.3.2	mm		Tables 1 and 2	
– Concentricity	3.3.3	%			
• Expanded			Min.	50	
• Recovered			Min.	85	
Heat shock	6				Heat at 200 °C ± 5 K
Tensile strength	19.1 and 19.2	MPa	Min.	10	
Elongation at break	19.1 and 19.2	%	Min.	200	
Longitudinal change	9	%	Max.	–15 +5	Heat expanded sleeving at 150 °C ± 3 K for (10 ± 1) min
Bending at low temperature	14	–	–	No cracking shall be visible	Test at –40 °C after conditioning at the same temperature for 4 h For strips, the mandrel shall be between 20 and 22 times the wall thickness Full section sleeving is tested unfilled, and the mandrel shall be between 20 and 22 times the outer diameter
Dimensional stability on storage	16	–	–	The dimensions shall be as specified in Tables 1 and 2	
Tensile strength	19.1 and 19.2	MPa	Min.	13	Use a jaw separation rate of 100 mm/min. For internal diameters of <6,5 mm, use sleeving samples for testing. For diameters of 6,5 mm and more, use dumb-bell samples cut from sleeving
Elongation at break	19.1 and 19.2	%	Min.	350	
Secant modulus at 2 % elongation	19.4				
		MPa	Min.	80	
		MPa	Max.	160	
Volume resistivity	23				
– at room temperature	23.4.2	Ωm	Min.	10^{12}	
– after damp heat	23.4.4	Ωm	Min.	10^{11}	
Copper corrosion	33	%	Max.	None above the allowable 8 %	Heat the specimens for (16 ± 0,5) h at 150 °C ± 3 K

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Table 3 – Property requirements *(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 un-exposed 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				Use the fluids and test temperatures specified in Table 5
Tensile strength	19.1 and 19.2	MPa	Min.	10	
Elongation at break	19.1 and 19.2	%	Min.	350	
Change in weight		%	Max.	10	
Mass per unit length	38	g/m	Max.	Tables 1 and 2	
Heat ageing	39				Heat at 150 °C ± 3 K
Tensile strength	19.1 and 19.2	MPa	Min.	10	
Elongation at break	19.1 and 19.2	%	Min.	200	
Water absorption	40	%	Max.	0,2	
Long term ageing	50 (Amendment 1) 19.1 and 19.2	%	Min	175	The test to establish failure shall be elongation at break. The ageing temperature shall be 135 °C ± 3 K

Table 4 – Requirements for breakdown voltage

Expanded wall thickness mm	Electric strength* MV/m Min
All dimensions	10
* Measure the expanded wall thickness and calculate the electric strength by dividing the breakdown voltage by this value.	
The breakdown voltage shall be determined by the method described in 21.4 of IEC 60684-2. The central value shall comply with the minimum value in this table. The sleeving shall be tested in the expanded condition. The rate of application of the voltage shall be 500 V/s.	

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Table 5 – Resistance to selected fluids

Fluids	Type	Standard or symbol	Immersion temperature °C
Insulating oil	Mineral base	IEC 60296	23 ± 2 K
Corrosion protection	Liquid	Creosote	23 ± 2 K
Cleaning fluids	Solvent	Paraffin	23 ± 2 K
		Isopropyl alcohol	23 ± 2 K
–	Water	Deionized	85 ± 2 K
NOTE Other fluids and/or temperatures may be specified for customers with specific needs. These additional fluids and/or temperatures are applicable when incorporated into agreements between the supplier and the customer.			

Table 6 – Additional property requirements

Property	IEC 60684-2 Clause	Units	Max. or Min.	Requirements	Remarks
Fungus resistance					The test method shall be ISO 846, Method B, 56-day exposure
Tensile strength	19.1 and 19.2	MPa	Min.	13	
Elongation at break		%	Min.	350	
Shelf life*	–	–	–	The dimensions shall be as specified in Tables 1 and 2	Condition the sleeving for 60 months at ambient temperature prior to testing; interim measurements are to be made every 12 months
* Due to the length of time required for this test, lack of completion shall not preclude certification according to this specification. Additional evidence of compliance with this requirement in the interim is as agreed between the supplier and/or the approval authority and/or the customer.					

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ISBN 2-8318-8282-6



ICS 29.035.20

Typeset and printed by the IEC Central Office
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