IEC 60684-3-283

Edition 2.0 2019-08
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Flexible insulating sleeving –
Part 3: Specifications for individual types of sleeving –
Sheet 283: Heat-shrinkable, polyolefin sleeving for bus-bar insulation

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FLEXIBLE INSULATING SLEEVING –

Part 3: Specifications for individual types of sleeving – Sheet 283: Heat-shrinkable, polyolefin sleeving for bus-bar insulation

FOREWORD

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International Standard IEC 60684-3-283 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

This second edition cancels and replaces the first edition published in 2010 and Amendment 1:2013. This edition constitutes a technical revision.

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

a) change of moulded plaque thickness for resistance to tracking and weathering tests to (6 ± 0,5) mm.

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

FDIS	Report on voting
15/892/FDIS	15/901/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 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 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- withdrawn,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.

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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 283: Heat-shrinkable, polyolefin sleeving for bus-bar insulation.

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FLEXIBLE INSULATING SLEEVING –

Part 3: Specifications for individual types of sleeving – Sheet 283: Heat-shrinkable, polyolefin sleeving for bus-bar insulation

1 Scope

This part of IEC 60684 gives the requirements for two types of heat-shrinkable, polyolefin sleeving for bus-bar insulation, with a nominal shrink ratio of 2,5:1.

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

- Type A: Medium wall – internal diameter up to 170,0 mm typically
- Type B: Thick wall – internal diameter up to 165,0 mm typically

These sleevings are normally supplied in colour, red or brown.

Since these types of sleeving~~s~~ cover a significantly large range of sizes and wall thicknesses, Annex A (Tables A.1 and A.2) provides guidance to the range of sizes available. The actual size and wall thickness ~~shall~~ will be agreed between the user and supplier depending on the electric strength of the installed tubing offered and the requirements of the user.

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~~ 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:~~2003~~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:~~1997~~2011, *Flexible insulating sleeving – Part 2: Methods of test*
~~Amendment 1 (2003)~~
~~Amendment 2 (2005)~~

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

ISO 846:~~1997~~2019, Plastics – *Evaluation of the action of microorganisms*

ISO 4892-3:~~2006~~2016, Plastics – *Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps*

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3 Terms and definitions

No terms and definitions are listed in 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 millimetres)	Colour	Table 4 [a] code
↓	↓	↓	↓	↓	↓	↓	↓
Sleeving	IEC 60684	- 3	-283	A	- 75,0/30,0	-Red	X

[a] NOTE 1 The addition of "X" at the end of the designation indicates that the properties contained in Table 4 have been agreed upon between the user and the supplier.

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

NOTE 2 This 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, 3, and 4 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 ID 25 mm to 30 mm
- Type B: Recovered ID 25 mm to 40 mm

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Table 1 – Property requirements

Property	IEC 60684-2: 2011 clause or subclause	Units	Max. or min.	Requirements	Remarks
Dimensions Internal diameter Wall thickness Concentricity – expanded – recovered	3 3.1.2 3.3.2 3.3.3	 mm mm %	 Min. Min.	To be agreed between the purchaser and the supplier 60 85	
Heat shock Tensile strength Elongation at break	6 19.~~1~~2 and 19.~~2~~3 19.~~1~~2 and 19.~~2~~3	 MPa %	 Min. Min.	 5 200	Heat at 150 °C ± 5 K 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 –40 °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 Elongation at break	19.~~1~~2 and 19.~~2~~3 19.~~1~~2 and 19.~~2~~3	MPa %	Min. Min.	8 400	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.~~4~~5	MPa	Max.	160	
~~Dielectric strength~~	~~21~~	~~kV/mm~~	~~Min.~~	~~See Table 2.~~	
Breakdown voltage	21.2	kV/mm	Min.	See Table 2	
Volume resistivity at room temperature	23 23.~~4~~5.2	Ω·m	Min.	10^{11}	

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Property	IEC 60684-2: 2011 clause or subclause	Units	Max. or min.	Requirements	Remarks
Flame propagation	26 Method C	s mm	Max. Max.	60 100	Burning includes flaming and glowing
Corrosion resistance Elongation	32 19.~~1~~2 and 19.~~2~~3	%	Min.	No chemical interaction	Heat at 150 °C ± 3 K 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
Resistance to selected fluids Tensile strength Elongation at break	36 19.~~1~~2 and 19.~~2~~3 19.~~1~~2 and 19.~~2~~3	 MPa %	 Min. Min.	 5 200	Use the fluids and test temperatures specified in Table 3 Immersion (24 ± 1) h 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 Tensile strength Elongation at break	39 19.~~1~~2 and 19.~~2~~3 19.~~1~~2 and 19.~~2~~3	 MPa %	 Min. Min.	 5 200	Heat at 150 °C ± 3 K 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 Elongation at break	50 19.2 and 19.3	 %	 Min.	 150	The ageing temperature shall be 100 °C ± 3 K 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

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Table 2 – Requirements for dielectric strength

Expanded wall thickness mm	Dielectric strength [a] Min.	
All dimensions	Expanded ID Types A+B All sizes	Dielectric strength kV/mm 12
~~NOTE~~ Care should be taken on selection of sizes based on these values. Refer to the manufacturer for actual values on installed conditions.		
[a] 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 of IEC 60684-2. All values 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.

Table 3 – Resistance to selected fluids

Test fluid No.	Fluids	Type	Standard or symbol	Immersion temperature °C ± 2 K
1	Insulating oil	Mineral based	IEC 60296	23
2	Cleaning fluid	Solvent	Isopropyl alcohol	23
3	-	Water	De-ionized	85

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 the customer.

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Table 4 – Additional property requirements

Property	IEC 60684-2: 2011 clause or subclause	Units	Max. or min.	Requirement	Remarks
Fungus resistance					The test method shall be ISO 846 Method B
Tensile strength	19.~~1~~2 and 19.~~2~~3	MPa	Min.	7	56 days exposure
Elongation		%	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
Resistance to weathering	ISO 4892-3 Method C After ~~5 000~~ 3 000 h Test to				Test method to ISO 4892-3
	~~19.1~~	MPa	Min.	8	Samples for test 19.~~1~~2 and 19.~~2~~3 should be taken from recovered sleeving which is flattened. Use a jaw separation rate of 100 mm/min
	19.2 and 19.3	%	Min.	200	
	19.2 and 19.3		Min.	2,5 kV for 20 min	Samples for Test 25 should be taken from specially prepared test sheets (6 ± ~~0,1~~ 0,5) mm thick. All samples should be cut to the appropriate size to fit the sample holders.
	25				Intermediate tests may also be done at 1 000 h intervals as an intermediate check on performance.
Resistance to tracking	25	–	Min.	Class 2A 2,5 kV for 1 h	Specimens shall be prepared from cross-linked moulded plaques of thickness (6 ± ~~1~~ 0,5) mm
					Specimens shall not be abraded but cleaned with an appropriate solvent. The method of cleaning shall be recorded.

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Annex A
(informative)

Guidance to the available sizes and wall thicknesses

Table A.1 – Type A, medium wall

Internal diameter		Wall
Expanded Min. mm	**Recovered** Max. mm	**Recovered wall thickness** **± 20 %**
15,0	6,0	2,0
30,0	12,0	2,3
50,0	20,0	2,5
70,0	25,0	3,0
75,0	30,0	2,5
90,0	30,0	3,0
100,0	40,0	2,5
120,0	50,0	3,0
170,0	60,0	3,0

Table A.2 – Type B, thick wall

Internal diameter		Wall
Expanded Min. mm	**Recovered** Max. mm	**Recovered wall thickness** **± 20 %**
25,0	10,0	4,0
40,0	16,0	4,0
65,0	25,0	4,0
100,0	40,0	4,0
165,0	60,0	4,0

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