

CONSOLIDATED VERSION

VERSION CONSOLIDÉE



**Flexible insulating sleeving –
Part 3: Specifications for individual types of sleeving – Sheet 280: Heat-
shrinkable, polyolefin sleeving, anti-tracking**

**Gaines isolantes souples –
Partie 3: Spécifications pour types particuliers de gaines – Feuille 280: Gaines
thermorétractables, en polyoléfine, anti-cheminement**

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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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VERSION REDLINE



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FLEXIBLE INSULATING SLEEVING –

**Part 3: Specifications for individual types of sleeving –
Sheet 280: Heat-shrinkable, polyolefin sleeving,
anti-tracking**

FOREWORD

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This Consolidated version of IEC 60684-3-280 bears the edition number 1.1. It consists of the first edition (2010) [documents 15/562/FDIS and 15/585/RVD] and its amendment 1 (2013) [documents 15/686/CDV and 15/703/RVC]. The technical content is identical to the base edition and its amendment.

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through. A separate Final version with all changes accepted is available in this publication.

This publication has been prepared for user convenience.

International Standard IEC 60684-3-280 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

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 the base publication and its amendment 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

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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 280: Heat-shrinkable, polyolefin sleeving, anti-tracking

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INTRODUCTION TO THE AMENDMENT

This amendment changes the test method for resistance to weathering since it is quoted incorrectly as ISO 4892-3 method 1. This method does not exist in the 2006 edition of ISO 4892-3. Also after consulting with users of these types of sleeveings, it was decided that a period of 3 000 hours exposure to this method was adequate.

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FLEXIBLE INSULATING SLEEVING –

Part 3: Specifications for individual types of sleeving – Sheet 280: Heat-shrinkable, polyolefin sleeving, anti-tracking

1 Scope

This part of IEC 60684 gives the requirements for heat-shrinkable, polyolefin sleeving, anti-tracking with a nominal shrink ratio of 3:1.

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

Typically: medium wall, internal diameter up to 110 mm.

These sleeveings are normally supplied in the colours red or brown.

Since these types of sleeveings cover a significantly large range of sizes and wall thicknesses, Table A.1 in this standard provides guidance on the range of sizes available. The actual size shall be agreed between the user and the 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 should be based on the actual requirements necessary for adequate performance in that application and not based on this specification alone.

This sleeving is designed to be used in medium voltage cable accessories and as such electrical performance must be proven as part of the assembly. Examples of this are described in HD 629 and IEC 60502 series.

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 electrotechnical applications – Unused mineral insulating oils for transformers and switchgear*

IEC 60502 (all parts), *Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV)*

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*

ISO 846:1997, *Plastics – Evaluation of the action of micro-organisms*

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

HD 629, *Test requirements on accessories for use on power cables of rated voltages from 3,6/6(7,2)kV up to 20,8/36 (42)kV – Part 1: Cables with extruded insulation*

3 Designation

The sleeving shall be identified by the following designation:

Description	IEC publication number	IEC part number	IEC sheet number	Size (expanded and recovered internal diameter in millimetres)	Colour	Table 4 ^a code
↓	↓	↓	↓	↓	↓	↓
Sleeving	IEC 60684	- 3	-280	- 60,0/19,0	- Red	X

^a 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 supplier.

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

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

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 ± 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 of Tables 1, 2, 3, and 4 where applicable.

6 Sleeving conformance

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

- Recovered ID 20 mm - 30 mm

Table 1 – Property requirements

Property	IEC 60684-2 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 and 19.2 19.1 and 19.2	MPa %	Min. Min.	8 200	Heat at 150 °C ± 5 K
Longitudinal change	9	%	Max.	+5 –10	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. 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 remain as agreed.	See Clause 1 Scope.
Tensile strength Elongation at break	19.1 and 19.2 19.1 and 19.2	MPa %	Min. Min.	10 300	Use a jaw separation rate of 100 mm/min. Below 6,5 mm Ø as sleeving. At 6,5 mm Ø and above as dumbbells.
Secant modulus at 2 % elongation	19.4	MPa MPa	Min. Max.	80 160	
Dielectric strength	See Table 2 of this document.	kV/mm	Min.	Table 2	
Volume resistivity at room temperature	23 23.4.2	Ω·m	Min.	10 ¹²	
Resistance to tracking	25	–	Min.	Class 2A 2,5 kV – 1 h 2,75 kV – 1h 3,0 kV – 1 h 3,25 kV – 20 min	Specimens shall be prepared from cross-linked moulded plaques of thickness (6 ± 1) mm. Specimens should not be abraded but cleaned with an appropriate solvent. The method of cleaning shall be recorded.
Resistance to selected fluids Tensile strength Elongation at break	36 19.1 and 19.2 19.1 and 19.2	MPa %	Min. Min.	8 200	Use the fluids and test temperatures specified in Table 3. Immersion (24 ± 1)h
Heat ageing Tensile strength Elongation at break	39 19.1 and 19.2 19.1 and 19.2	MPa %	Min. Min.	8 200	Heat at 150 °C ± 3 K.
Long term ageing Elongation at break	50 19.2	%	Min.	150	The ageing temperature shall be 100 °C ± 3 K.

Table 2 – Requirements for dielectric strength

Expanded wall thickness mm	Dielectric strength ^a Min.	
	Expanded ID	Dielectric strength kV/mm
All dimensions	10-25	14
	26-59	12
	60-120	10
^a Measure the expanded wall thickness and calculate the dielectric 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 sleeving shall be tested in the expanded condition.

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

NOTE Care should be taken on selection of sizes based on these values. Refer to the manufacturer for actual values on installed condition.

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	-	-	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.