

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Flexible insulating sleeving –**  
**Part 3: Specifications for individual types of sleeving –**  
**Sheet 281: Heat-shrinkable, polyolefin sleeving, semiconductive**

**Gaines isolantes souples –**  
**Partie 3: Spécifications pour types particuliers de gaines –**  
**Feuille 281: Gaines thermorétractables en polyoléfine, semiconductrices**



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## FLEXIBLE INSULATING SLEEVING –

**Part 3: Specifications for individual types of sleeving –  
Sheet 281: Heat-shrinkable, polyolefin sleeving,  
semiconductive**

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International Standard IEC 60684-3-281 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

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

FDIS	Report on voting
15/563/FDIS	15/586/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, 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

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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 281: Heat-shrinkable, polyolefin sleeving, semiconductive

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## FLEXIBLE INSULATING SLEEVING –

### Part 3: Specifications for individual types of sleeving – Sheet 281: Heat-shrinkable, polyolefin sleeving, semiconductive

#### 1 Scope

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

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

- Type A: Thin wall                      Internal diameter up to 195,0 mm typically
- Type B: Medium wall                  Internal diameter up to 120,0 mm typically

These sleeveings are normally supplied in the colour black.

Since these types of sleeveings cover a significantly large range of sizes and wall thicknesses, Tables A.1 and A.2 in this standard provides guidance to 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 MV 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*



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	Type	Size (expanded and recovered internal diameter in millimetres)	Colour
↓	↓	↓	↓	↓	↓	↓
Sleeving	IEC 60684	- 3	-281	- A	- 50/20	Black

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  $(10 \pm 1)$  min at  $200 \text{ }^\circ\text{C} \pm 3 \text{ K}$  prior to testing.

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### 5 Requirements

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

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### 6 Sleeving conformance

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

- Type A, Thin wall: Recovered ID 20 mm - 30 mm
- Type B, Medium wall: 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.	8 175	Heat at 150 °C ± 5 K.
Longitudinal change	9	%	Max.	+5 –10	
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.	10 200	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	Max.	250	
Resistance to selected fluids Tensile strength Elongation at break	36 19.1 and 19.2 19.1 and 19.2	MPa %	Min. Min.	8 175	Use the fluids and test temperatures specified in Table 2. 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.	8 175	Heat at 135 °C ± 3 K.
Volume resistivity at room temperature	23 23.4.2	Ω·m	Min.	10 <sup>3</sup>	See note.
Long term ageing Elongation at break	50 19.2	%	Min.	100	The ageing temperature shall be 100 °C ± 3 K.

NOTE This value is set so as to define the tube as conductive. It does not indicate any guarantee of suitable performance in an accessory and further testing by the supplier will be needed to prove this. Note also that the value may change with applied voltage.

**Table 2 – Resistance to selected fluids**

Test fluid No.	Fluids	Type	Standard or symbol	Immersion temperature at °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.

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