

# INTERNATIONAL STANDARD

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**Flexible insulating sleeving –  
Part 3: Specifications for individual types of sleeving –  
Sheet 284: Heat-shrinkable sleeveings, for oil barrier applications**



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## FLEXIBLE INSULATING SLEEVING –

**Part 3: Specifications for individual types of sleeving –  
Sheet 284: Heat-shrinkable sleeveings, for oil barrier applications**

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International Standard IEC 60684-3-284 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

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

CDV	Report on voting
15/693/CDV	15/726A/RVC

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 parts in the IEC 60684 series, published under the general title *Flexible insulating sleeving*, can be found on the IEC website.

A bilingual version of this publication may be issued at a later date.

## 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 gives one of the sheets comprising Part 3, as follows:

Sheet 284: Heat-shrinkable sleeveings, for oil barrier applications.

## **FLEXIBLE INSULATING SLEEVING –**

### **Part 3: Specifications for individual types of sleeving – Sheet 284: Heat-shrinkable sleeveings, for oil barrier applications**

#### **1 Scope**

This part of IEC 60684 gives the requirements for heat-shrinkable sleeveings for oil barrier, medium voltage cable jointing and termination applications, with nominal shrink ratios of up to 3:1.

These sleeveings have been found suitable for use up to temperatures of 80 °C.

Type A: polyolefin based.

Type B: fluoropolymer based, enhanced oil resistance.

These sleeveings are normally supplied as translucent.

Since these types of sleeveings cover a significantly large range of sizes and wall thicknesses, Annex A, Tables A.1 and A.2, in this document, provide a guide to the range of sizes available. The actual size will be agreed between the purchaser and supplier.

Materials which conform to this standard 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 standard alone.

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

#### **2 Normative references**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60055-2, *Paper-insulated metal-sheathed cables for rated voltages up to 18/30 kV (with copper or aluminium conductors and excluding gas-pressure and oil-filled cables) Part 2: General and construction requirements*

IEC 60296, *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 60684-2:2011, *Flexible insulating sleeving – Part 2: Methods of test*



### 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 mm)
↓	↓	↓	↓	↓	↓
Sleeving	IEC 60684	- 3	-284	-B	- 51,0/19,0

NOTE This information is for package 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  $175\text{ °C} \pm 3\text{ K}$  for Type A, and at  $200\text{ °C} \pm 3\text{ K}$  for Type B, 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 standard shall normally be based on the results from a typical size.

Recovered ID 15 mm to 25 mm

**Table 1 – Property requirements for Type A**

Property	IEC 60684-2: 2011 Clause or Subclause	Units	Max. or Min.	Requirements	Remarks
Dimensions	3				
Internal diameter	3.1.2	mm	Min.	To be agreed between purchaser and supplier	
Wall thickness	3.3.2	mm	Min.	50	
Concentricity	3.3.3	%		85	
expanded					
recovered					
Longitudinal change	9	%	Max.	– 10 + 5	Heat expanded sleeving at $175\text{ °C} \pm 5\text{ K}$ for $(10 \pm 1)$ min
Bending at low temperature	14	–	–	No cracking shall be visible	Condition at $-20\text{ °C} \pm 3\text{ K}$ For strips, the mandrel shall be no more than 10 times the wall thickness. Full section sleeving is tested unfilled and the mandrel shall be no more than 10 times the outer diameter.

Property	IEC 60684-2: 2011 Clause or Subclause	Units	Max. or Min.	Requirements	Remarks
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 200 °C ± 5 K
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.	10 250	Use a jaw separation of 100 mm/min. Below 6,5 mm diameter test as sleeving, at 6,5 mm and above test as dumb-bells.
Secant modulus at 2 % elongation	19.5	MPa	Min. Max.	50 175	
Breakdown voltage	21	kV	Min.	See Table 3	
Volume Resistivity at room temperature	23 23.5.2	Ω.m	Min.	10 <sup>12</sup>	
Resistance to selected fluids Tensile strength Elongation at break Change in mass	36 19.1 and 19.2 19.1 and 19.2	MPa % %	Min. Min. Max.	7 200 10	Use the fluids and test temperatures specified in Table 4. Immersion time 24 ± 1 h Test after recovery period of 1 h ± 15 min.
Heat ageing Tensile strength Elongation at break	39 19.1 and 19.2 19.1 and 19.2	MPa %	Min. Min.	10 150	Heat at 150 °C ± 3 K.
Long term heat ageing (3 000 h) Elongation at break	50 19.2	%	Min.	125	The ageing temperature shall be 135 °C ± 3 K.

**Table 2 – Property requirements for Type B**

Property	IEC 60684-2: 2011 Clause or Subclause	Units	Max. or Min.	Requirements	Remarks
Dimensions					
Internal diameter	3	mm	Min.	To be agreed between purchaser and supplier.	
Wall thickness	3.1.2	mm	Min.		
Concentricity	3.3.2	%	Min.	60	
Expanded	3.3.3			85	
Recovered					
Longitudinal change	9	%	Max.	– 10 + 5	Heat expanded sleeving at 200 °C ± 5 K for (10 ± 1) min
Bending at low temperature	14	–	–	No cracking shall be visible	Test at –20 °C ± 3 K. For strips, the mandrel shall be no more than 10 times the wall thickness. Full section sleeving is tested unfilled and the mandrel shall be no more than 10 times the outer diameter.
Heat shock				No dripping, flowing or cracking.	
Tensile strength	6				Heat at 275 °C ± 5 K.
Elongation at Break					
Dimensional stability on storage	16			The dimensions shall remain as agreed.	See Scope.
Tensile strength	19.1 and 19.2	MPa	Min.	24	Use a jaw separation of 100 mm/min. Below
Elongation at break	19.1 and 19.2	%	Min.	200	6,5 mm diameter test as sleeving, at 6,5 mm and above test as dumb-bells.
Secant modulus at 2% elongation	19.5	MPa	Min.	170	
Breakdown voltage	21	kV	Min.	See Table 3.	
Volume Resistivity at room temperature	23 23.5.2	Ω m	Min.	10 <sup>9</sup>	
Resistance to selected fluids	36	MPa	Min.	24	Use the fluids and test temperatures specified in Table 3.
Tensile strength	19.1 and 19.2	%	Min.	200	Immersion time
Elongation at break	19.1 and 19.2	%	Max.	10	(24 ± 1) h
Change in mass					Test after recovery period of 1 h ± 15 min.
Heat ageing	39	%	Min.	100	
Elongation at break	19.1 and 19.2				Heat at 225 °C ± 5 K.
Long term heat ageing (3 000 h)	50	%	Min.	100	
Elongation at break	19.2				The ageing temperature shall be 150 °C ± 2 K.

**Table 3 – Requirements for breakdown voltage, Types A and B**

Expanded wall thickness (mm)	Electric strength <sup>a</sup>	
	Min.	
All dimensions	Expanded ID All sizes	Electric strength kV/mm 12
<sup>a</sup> 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 60684-2:2011. The central value shall comply with the minimum value in the above Table 3.

The sleeving shall be tested in the expanded condition.

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

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

**Table 4 – Resistance to selected fluids**

Test fluid No.	Fluids	Type	Standard or symbol	Type A; Immersion temperature °C ± 2 K	Type B; Immersion temperature °C ± 2 K
1	Insulating oil	Mineral based	IEC 60296 Transformer oil	Not suitable	110
2	Cleaning fluid	Solvent	Isopropyl alcohol	23	23
3	–	Water	De-ionized	85	85
4	Insulating oil	Synthetic	Poly-isobutylene	Not suitable	110
5	M.I.N.D	Mineral based	IEC 60055-2	60	60

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 customer.

## Annex A (informative)

### Guide to the typical sizes and wall thicknesses

The tables below represent a guide to available sizes and wall thicknesses.

**Table A.1 – Dimensions Type A**

Internal diameter		Wall
EXPANDED MIN. (mm)	RECOVERED MAX. (mm)	RECOVERED WALL THICKNESS (mm) ( $\pm 20\%$ )
19	9,5	0,76
25	12,7	0,89
32	16	0,90
38	19	1,02
50	25,4	1,14
76	38,1	1,27

**Table A.2 – Dimensions Type B**

Internal diameter		Wall
EXPANDED MIN. (mm)	RECOVERED MAX. (mm)	RECOVERED WALL THICKNESS (mm) ( $\pm 20\%$ )
19,0	7,0	1,0
35,0	12,0	1,0
51,0	19,0	1,0
67,0	30,0	3,0

## Bibliography

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 60684-3 (all sheets), *Flexible insulating sleeving – Part 3: Specifications for individual types of sleeving*

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*

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