

# INTERNATIONAL STANDARD



**Flexible insulating sleeving –  
Part 3: Specifications for individual types of sleeving –  
Sheet 247: Heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded,  
thick and medium wall**



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INTERNATIONAL  
ELECTROTECHNICAL  
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### FLEXIBLE INSULATING SLEEVING –

#### **Part 3: Specifications for individual types of sleeving – Sheet 247: Heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded, thick and medium wall**

#### FOREWORD

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International Standard IEC 60684-3-247 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

This second edition cancels and replaces the first edition published in 2011 and Amendment 1:2016. This edition constitutes a technical revision.

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

- a) removal of the colour fastness to light test, as this is covered by the test for carbon black content;
- b) change of low temperature flexibility test to -20 °C to align with sheet 214;
- c) change of final conditioning temperature of peel strength samples to 200 °C to align with the temperature in Clause 5;
- d) removal of the fungus resistance test as there is no evidence that fungus growth is an issue either by testing or in use.

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

| FDIS        | Report on voting |
|-------------|------------------|
| 15/890/FDIS | 15/900/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 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 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- withdrawn,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 247: Heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded, thick and medium wall

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## FLEXIBLE INSULATING SLEEVING –

### Part 3: Specifications for individual types of sleeving – Sheet 247: Heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded, thick and medium wall

#### 1 Scope

This part of IEC 60684 gives the requirements for two types of heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded with a nominal shrink ratio of 3:1.

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

- Type A: Medium wall, internal diameter up to 200,0 mm typically.
- Type B: Thick wall, internal diameter up to 200,0 mm typically.

These sleeveings are normally supplied in colour black.

Since these types of ~~sleeving~~ ~~sleeving~~ cover a significantly large range of sizes and wall thicknesses, Annex A (Tables A.1 and A.2) provides a guide to the range of sizes available. The actual size ~~shall~~ ~~will~~ be agreed between the user and 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~~ ~~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 60502-1:2004, 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) – Part 1: Cables for rated voltages of 1 kV ( $U_m = 1,2$  kV) and 3 kV ( $U_m = 3,6$  kV)~~

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 2 (2005)~~

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

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

ISO 868:2003, *Plastics and ebonite – Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 11357-3:1999/2018, *Plastics – Differential scanning calorimetry (DSC) – Part 3: Determination of temperature and enthalpy of melting and crystallization*

ISO 11358-1:1997/2014, *Plastics – Thermogravimetry (TG) of polymers – Part 1: General principles*

### 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 mm) | Colour | Table 4* code |
|-------------|------------------------|-----------------|------------------|------|-------------------------------------------------------|--------|---------------|
| ↓           | ↓                      | ↓               | ↓                | ↓    | ↓                                                     | ↓      | ↓             |
| Sleeving    | IEC 60684              | - 3             | - 247            | - B  | - 85,0/25,0                                           | - BK   | X             |

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

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

\* ~~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 supplier.~~

### 5 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.

### 6 Requirements

In addition to the general requirements given in IEC 60684-1, the sleeving shall comply with the requirements of Tables 1, 2, and 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~~ internal diameter 25 mm to 30 mm

- Type B: Recovered ~~10~~ internal diameter 25 mm to 30 mm

For the peel strength test, select a size to comply with the dimensions as detailed under the remarks in Table 1.

**Table 1 – Property requirements (1 of 3)**

| Property                                               | IEC 60684-2<br>clause<br>or<br>subclause | Units      | Max.<br>or<br>Min. | Requirements                           | Remarks                                                                                                                                                                                                       |
|--------------------------------------------------------|------------------------------------------|------------|--------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dimensions                                             | 3                                        |            |                    |                                        |                                                                                                                                                                                                               |
| Internal diameter                                      | 3.1.2                                    | mm         |                    |                                        |                                                                                                                                                                                                               |
| Wall thickness                                         | 3.3.2                                    | mm         |                    |                                        |                                                                                                                                                                                                               |
| 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                                     | Jacket only, ignore flowing adhesive                                                                                                                                                                          |
| Elongation at break                                    | 19.1 and 19.2                            | %          | Min.               | 200                                    |                                                                                                                                                                                                               |
| Longitudinal change                                    | 9                                        | %          | Max.               | -10<br>+5                              |                                                                                                                                                                                                               |
| Bending at low temperature                             | 14                                       | -          |                    | No cracking shall be visible.          | Test at -40 °C.<br>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                                       | 19.1 and 19.2                            | MPa        | Min.               | 13                                     | Jacket only.                                                                                                                                                                                                  |
| Elongation at break                                    | 19.1 and 19.2                            | %          | Min.               | 350                                    | Use a jaw separation rate of 100 mm/min. Below 6,5mm Ø as sleeving.<br>At 6,5 mm Ø and above as dumbbells.                                                                                                    |
| Secant modulus at 2% elongation                        | 19.4                                     | MPa<br>MPa | Min.<br>Max.       | 80<br>160                              | Calculate cross-section area without adhesive.                                                                                                                                                                |
| Breakdown voltage                                      | 21                                       | kV         | Min.               | Table 2                                |                                                                                                                                                                                                               |
| Volume resistivity at room temperature after damp heat | 23                                       |            |                    |                                        |                                                                                                                                                                                                               |
|                                                        | 23.4.2                                   | Ω·m        | Min.               | 10 <sup>12</sup>                       |                                                                                                                                                                                                               |
|                                                        | 23.4.4                                   | Ω·m        | Min.               | 10 <sup>11</sup>                       |                                                                                                                                                                                                               |

| Property                       | IEC 60684-2<br>clause<br>or subclause | Units   | Max.<br>or<br>Min. | Requirements                                                                                                                                       | Remarks                                                    |
|--------------------------------|---------------------------------------|---------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| Colour fastness to light       | 34                                    |         |                    | The colour standard contrast between the exposed and unexposed parts of the specimen shall be equal to or less than that of the fastness standard. | Fastness standard 5                                        |
| Standard identification number |                                       |         | Min.               |                                                                                                                                                    |                                                            |
| Resistance to selected fluids  | 36                                    |         |                    |                                                                                                                                                    | Use the fluids and test temperatures specified in Table 3. |
| Tensile strength               | 19.1 and 19.2                         | MPa     | Min.               | 10                                                                                                                                                 | Immersion time (24 ± 1)h                                   |
| Elongation at break            | 19.1 and 19.2                         | %       | Min.               | 250                                                                                                                                                |                                                            |
| Heat ageing                    | 39                                    |         |                    |                                                                                                                                                    | Heat at 150 °C ± 3 K.                                      |
| Tensile strength               | 19.1 and 19.2                         | MPa     | Min.               | 10                                                                                                                                                 | Jacket only.                                               |
| Elongation at break            | 19.1 and 19.2                         | %       | Min.               | 200                                                                                                                                                |                                                            |
| Long term ageing               | 50                                    |         |                    |                                                                                                                                                    | The ageing temperature shall be 100 °C ± 3 K.              |
| Elongation at break            | 19.2                                  | %       | Min.               | 175                                                                                                                                                |                                                            |
| Carbon black content           | ISO 11358                             | %       | Min.               | 2,5                                                                                                                                                |                                                            |
| Hardness                       | ISO 868                               | Shore D | Min.               | 40                                                                                                                                                 |                                                            |
| Water absorption               | 40                                    | %       | Max.               | 0,5                                                                                                                                                |                                                            |

| Property            | IEC 60684-2 clause or subclause | Units   | Max. or Min. | Requirements                                                                     | Remarks                                                                                                                                                                                                           |
|---------------------|---------------------------------|---------|--------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Peel strength       | 54                              | N/25 mm | Min.         | <p>Cu—50</p> <p>Al—75</p> <p>Pb—40</p> <p>PE—100</p> <p>PVC—40</p> <p>EPR—50</p> | <p>Condition at 150 °C ± 3 K for (10 ± 1) min.</p> <p>For tests in addition to aluminium replace the mandrel with cable jacket material of PE, PVC and/or EPR that conforms to IEC 60502-1.</p> <p>See note 2</p> |
| Melting temperature | ISO 11357-3                     | °C      | Min.         | 100                                                                              | Adhesive only                                                                                                                                                                                                     |

NOTE 1—Where jacket only is indicated, the tensile strength calculation for cross-sectional area is based on the thickness of the jacket.

NOTE 2—Use a substrate diameter that is a minimum of 25 mm and is at least 20% above the recovered internal diameter of the sleeving.

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| Property                                               | IEC 60684-2:2011 clause or subclause | Units | Max. or min. | Requirements                                | Remarks                                                                                                                                                                                                                      |
|--------------------------------------------------------|--------------------------------------|-------|--------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dimensions                                             | 3                                    |       |              |                                             |                                                                                                                                                                                                                              |
| Internal diameter                                      | 3.1.2                                | mm    |              |                                             |                                                                                                                                                                                                                              |
| Wall thickness                                         | 3.3.2                                | mm    |              | To be agreed between purchaser and supplier |                                                                                                                                                                                                                              |
| Concentricity                                          | 3.3.3                                | %     |              |                                             |                                                                                                                                                                                                                              |
| expanded                                               |                                      |       | Min.         | 50                                          |                                                                                                                                                                                                                              |
| recovered                                              |                                      |       | Min.         | 85                                          |                                                                                                                                                                                                                              |
| Heat shock                                             | 6                                    | -     | -            |                                             | Heat at 200 °C ± 5 K                                                                                                                                                                                                         |
| Tensile strength                                       | 19.2 and 19.3                        | MPa   | Min.         | 10                                          | Jacket only, ignore flowing adhesive                                                                                                                                                                                         |
| Elongation at break                                    | 19.2 and 19.3                        | %     | Min.         | 200                                         | 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<br>+ 5                                  |                                                                                                                                                                                                                              |
| Bending at low temperature                             | 14                                   | -     | -            | No cracking shall be visible                | Test at -20 °C<br><br>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                                       | 19.2 and 19.3                        | MPa   | Min.         | 13                                          | Jacket only                                                                                                                                                                                                                  |
| Elongation at break                                    | 19.2 and 19.3                        | %     | 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.                             |
| Secant modulus at 2 % elongation                       | 19.5                                 | MPa   | Min.         | 80                                          | Calculate cross-section area without adhesive.                                                                                                                                                                               |
|                                                        |                                      | MPa   | Max.         | 160                                         |                                                                                                                                                                                                                              |
| Breakdown voltage                                      | 21.2                                 | kV    | Min.         | Table 2                                     |                                                                                                                                                                                                                              |
| Volume resistivity at room temperature after damp heat | 23                                   |       |              |                                             |                                                                                                                                                                                                                              |
|                                                        | 23.5.2                               | Ω·m   | Min.         | 10 <sup>12</sup>                            |                                                                                                                                                                                                                              |
|                                                        | 23.5.4                               | Ω·m   | Min.         | 10 <sup>11</sup>                            |                                                                                                                                                                                                                              |

**Table 1 (2 of 3)**

| Property                      | IEC 60684-2:2011 clause or subclause | Units   | Max. or min. | Requirements | Remarks                                                                                                                                                                                         |
|-------------------------------|--------------------------------------|---------|--------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resistance to selected fluids | 36                                   |         |              |              | Use the fluids and test temperatures specified in Table 3                                                                                                                                       |
| Tensile strength              | 19.2 and 19.3                        | MPa     | Min.         | 10           | Immersion time (24 ± 1) h                                                                                                                                                                       |
| Elongation at break           | 19.2 and 19.3                        | %       | Min.         | 250          | 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                   | 39                                   |         |              |              | Heat at 150 °C ± 3 K                                                                                                                                                                            |
| Tensile strength              | 19.2 and 19.3                        | MPa     | Min.         | 10           | Jacket only                                                                                                                                                                                     |
| Elongation at break           | 19.2 and 19.3                        | %       | Min.         | 200          | 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              | 50                                   |         |              |              | The ageing temperature shall be 100 °C ± 3 K                                                                                                                                                    |
| Elongation at break           | 19.2 and 19.3                        | %       | Min.         | 175          | 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 |
| Carbon black content          | ISO 11358-1                          | %       | Min.         | 2,5          | Identify carbon black peak and report weight loss %                                                                                                                                             |
| Hardness                      | ISO 868                              | Shore D | Min.         | 40           |                                                                                                                                                                                                 |
| Water absorption              | 40                                   | %       | Max.         | 0,5          |                                                                                                                                                                                                 |

Table 1 (3 of 3)

| Property            | IEC 60684-2:2011 clause or subclause | Units              | Max. or min. | Requirements                     | Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------|--------------------------------------|--------------------|--------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Peel strength       | 54                                   | N/25 mm            | Min.         | Cu – 50<br>Al – 75<br>PO-X – 100 | <p>Use a Cu or Al tube with a minimum outer diameter of 25 mm and at least 20 % above the fully recovered internal diameter of the sleeving. The sleeving under test shall have a thickness of <math>2,0 \text{ mm} \pm 0,5 \text{ mm}</math> when recovered on the tube. Other substrate materials and methods are subject to agreement between the supplier and the user.</p> <p>Prepare the Cu and Al tubes in the manner defined in IEC 60684-2:2011, 54.3. Precondition the prepared Cu and Al tubes in an oven at <math>100 \text{ }^{\circ}\text{C}</math> for at least 30 min. Immediately place the sleeving on the prepared Cu or Al tubes and condition at <math>200 \text{ }^{\circ}\text{C} \pm 3 \text{ K}</math> for <math>(10 \pm 1) \text{ min.}</math></p> <p>To make the cross-linked polyolefin (PO-X) specimens shrink the sleeving onto the Cu or Al tubes by conditioning at <math>200 \text{ }^{\circ}\text{C} \pm 3 \text{ K}</math> for <math>(10 \pm 1) \text{ min.}</math> Allow to cool, then abrade and clean the outer surface as detailed in IEC 60684-2:2011, 54.3. Finally, fix the narrow strip of adhesive masking tape longitudinally on the sleeving, then place the same sleeving on top and condition at <math>200 \text{ }^{\circ}\text{C} \pm 3 \text{ K}</math> for <math>(10 \pm 1) \text{ min.}</math></p> |
| Melting temperature | ISO 11357-3                          | $^{\circ}\text{C}$ | Min.         | 100                              | <p>Adhesive only</p> <p>Value to be recorded is peak melting temperature (<math>T_{\text{pm}}</math>)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

**Table 2 – Requirements for breakdown voltage**

| Expanded wall thickness<br>mm                                                                                                                                                                                                                                                                                                                                                                                                                                  | Expanded ID   | Dielectric strength <sup>a</sup><br>Min.<br>kV/mm |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------|
| All dimensions                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Type A</b> |                                                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 10 to 25      | 14                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 26 to 50      | 12                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 51 to 120     | 10                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 121 and above | 8                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Type B</b> |                                                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 10 to 25      | 12                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 26 to 50      | 10                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 51 to 120     | 8                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 121 and above | 6                                                 |
| <p>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.</p> <p>The sleeving shall be tested in the expanded condition.</p> <p>The rate of application of the voltage shall be 500 V/s.</p> <p><b>NOTE</b> Care should be taken on selection of sizes based on these values. Refer to the manufacturer for actual values on installed conditions.</p> |               |                                                   |
| <p><sup>a</sup> Measure the expanded jacket wall thickness and calculate the electric strength by dividing the breakdown voltage by this value.</p>                                                                                                                                                                                                                                                                                                            |               |                                                   |

**Table 3 – Resistance to selected fluids**

| Test fluid No. | Fluids          | Type          | Standard or symbol | Immersion temperature<br>°C ± 2 K |
|----------------|-----------------|---------------|--------------------|-----------------------------------|
| 1              | Insulating oil  | Mineral based | IEC 60296          | 23                                |
| 2              | Cleaning fluids |               | 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 customer.

**Table 4 – Additional property requirements**

| Property            | IEC 60684-2<br>clause or<br>subclause | Units | Max. or<br>Min. | Requirement | Remarks                                                         |
|---------------------|---------------------------------------|-------|-----------------|-------------|-----------------------------------------------------------------|
| Fungus resistance   | 19.1 and 19.2                         |       |                 |             |                                                                 |
| Tensile strength    |                                       | MPa   | Min.            | 13          | Jacket only for the measurement of tensile strength.            |
| Elongation at break |                                       | %     | Min.            | 350         | The test method shall be ISO 846 method B.<br>56 days exposure. |

## Annex A (informative)

### Guide to the available sizes and wall thicknesses

**Table A.1 – Type A medium wall**

| Internal diameter      |                         | Wall                                                       |
|------------------------|-------------------------|------------------------------------------------------------|
| Expanded<br>Min.<br>mm | Recovered<br>Max.<br>mm | Recovered wall<br>thickness<br>(jacket only)<br>Min.<br>mm |
| 10                     | 3                       | 1,0                                                        |
| 10                     | 4                       | 1,4                                                        |
| 12                     | 3                       | 1,4                                                        |
| 16                     | 5                       | 1,4                                                        |
| 19                     | 6                       | 2,0                                                        |
| 25                     | 8                       | 2,0                                                        |
| 28                     | 10                      | 2,0                                                        |
| 33                     | 10                      | 2,0                                                        |
| 35                     | 12                      | 2,0                                                        |
| 38                     | 13                      | 2,3                                                        |
| 43                     | 13                      | 2,3                                                        |
| 50                     | 18                      | 2,3                                                        |
| 63                     | 19                      | 2,3                                                        |
| 70                     | 26                      | 2,3                                                        |
| 85                     | 25                      | 2,5                                                        |
| 90                     | 30                      | 2,5                                                        |
| 115                    | 34                      | 2,5                                                        |
| 120                    | 54                      | 2,5                                                        |
| 140                    | 42                      | 2,8                                                        |
| 152                    | 48                      | 2,8                                                        |
| 160                    | 50                      | 3,0                                                        |
| 180                    | 60                      | 3,0                                                        |
| 200                    | 77                      | 3,3                                                        |

**Table A.2 – Type B thick wall**

| Internal diameter      |                         | Wall                                                       |
|------------------------|-------------------------|------------------------------------------------------------|
| Expanded<br>Min.<br>mm | Recovered<br>Max.<br>mm | Recovered wall<br>thickness<br>(jacket only)<br>Min.<br>mm |
| 9                      | 3                       | 1,8                                                        |
| 13                     | 4                       | 2,4                                                        |
| 19                     | 6                       | 2,4                                                        |
| 20                     | 6                       | 2,4                                                        |
| 28                     | 9                       | 3,0                                                        |
| 33                     | 8                       | 3,2                                                        |
| 38                     | 12                      | 4,0                                                        |
| 43                     | 12                      | 4,0                                                        |
| 48                     | 15                      | 4,0                                                        |
| 51                     | 16                      | 4,0                                                        |
| 68                     | 22                      | 4,0                                                        |
| 70                     | 21                      | 4,0                                                        |
| 85                     | 25                      | 4,0                                                        |
| 90                     | 30                      | 4,0                                                        |
| 105                    | 26                      | 4,0                                                        |
| 105                    | 30                      | 4,0                                                        |
| 115                    | 40                      | 4,0                                                        |
| 130                    | 36                      | 4,0                                                        |
| 130                    | 40                      | 4,2                                                        |
| 150                    | 48                      | 4,3                                                        |
| 160                    | 50                      | 4,3                                                        |
| 170                    | 60                      | 4,3                                                        |
| 200                    | 77                      | 4,3                                                        |

NOTE 1 The wall thickness of the adhesive will typically lie between 0,5 mm and 1,5 mm after recovery.

NOTE 2 In those cases where the inner wall distorts or flows during recovery, it ~~may~~ might not be possible to determine the recovered inside diameter accurately. In these cases, the sleeving ~~may~~ can be recovered over a mandrel or plug gauge of the specified diameter after recovery for the size being measured.

## Bibliography

IEC 60502-1, *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) – Part 1: Cables for rated voltages of 1 kV ( $U_m = 1,2$  kV) and 3 kV ( $U_m = 3,6$  kV)*

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

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# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Flexible insulating sleeving –  
Part 3: Specifications for individual types of sleeving –  
Sheet 247: Heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded,  
thick and medium wall**

**Gaines isolantes souples –  
Partie 3: Spécifications pour types particuliers de gaines –  
Feuille 247: Gaines thermorétractables en polyoléfine, à double paroi, non  
ignifugées à paroi épaisse et moyenne**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## FLEXIBLE INSULATING SLEEVING –

**Part 3: Specifications for individual types of sleeving –  
Sheet 247: Heat-shrinkable, polyolefin sleeving, dual wall,  
not flame retarded, thick and medium wall**

## FOREWORD

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International Standard IEC 60684-3-247 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

This second edition cancels and replaces the first edition published in 2011 and Amendment 1:2016. This edition constitutes a technical revision.

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

- a) removal of the colour fastness to light test, as this is covered by the test for carbon black content;
- b) change of low temperature flexibility test to -20 °C to align with sheet 214;
- c) change of final conditioning temperature of peel strength samples to 200 °C to align with the temperature in Clause 5;

- d) removal of the fungus resistance test as there is no evidence that fungus growth is an issue either by testing or in use.

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

| FDIS        | Report on voting |
|-------------|------------------|
| 15/890/FDIS | 15/900/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 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 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 247: Heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded, thick and medium wall

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## **FLEXIBLE INSULATING SLEEVING –**

### **Part 3: Specifications for individual types of sleeving – Sheet 247: Heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded, thick and medium wall**

#### **1 Scope**

This part of IEC 60684 gives the requirements for two types of heat-shrinkable, polyolefin sleeving, dual wall, not flame retarded with a nominal shrink ratio of 3:1.

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

- Type A: Medium wall, internal diameter up to 200,0 mm typically.
- Type B: Thick wall, internal diameter up to 200,0 mm typically.

These sleeveings are normally supplied in colour black.

Since these types of sleeving cover a significantly large range of sizes and wall thicknesses, Annex A (Tables A.1 and A.2) provides a guide to the range of sizes available. The actual size will be agreed between the user and 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 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 60296:2012, *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 60684-2:2011, *Flexible insulating sleeving – Part 2: Methods of test*

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

ISO 868:2003, *Plastics and ebonite – Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 11357-3:2018, *Plastics – Differential scanning calorimetry (DSC) – Part 3: Determination of temperature and enthalpy of melting and crystallization*

ISO 11358-1:2014, *Plastics – Thermogravimetry (TG) of polymers – Part 1: General principles*

### 3 Terms and definitions

No terms and definitions are listed 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 mm) | Colour |
|-------------|------------------------|-----------------|------------------|------|-------------------------------------------------------|--------|
| ↓           | ↓                      | ↓               | ↓                | ↓    | ↓                                                     | ↓      |
| Sleeving    | IEC 60684              | - 3             | - 247            | - B  | - 85,0/25,0                                           | - BK   |

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

NOTE This information 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  $(10 \pm 1)$  min at  $200 \text{ }^{\circ}\text{C} \pm 3 \text{ K}$  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, and 3 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 internal diameter 25 mm to 30 mm
- Type B: Recovered internal diameter 25 mm to 30 mm

For the peel strength test, select a size to comply with the dimensions as detailed under the remarks in Table 1.

**Table 1 – Property requirements (1 of 3)**

| Property                                               | IEC 60684-2:2011 clause or subclause | Units | Max. or min. | Requirements                                | Remarks                                                                                                                                                                                                                      |
|--------------------------------------------------------|--------------------------------------|-------|--------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dimensions                                             | 3                                    |       |              |                                             |                                                                                                                                                                                                                              |
| Internal diameter                                      | 3.1.2                                | mm    |              |                                             |                                                                                                                                                                                                                              |
| Wall thickness                                         | 3.3.2                                | mm    |              | To be agreed between purchaser and supplier |                                                                                                                                                                                                                              |
| Concentricity                                          | 3.3.3                                | %     |              |                                             |                                                                                                                                                                                                                              |
| expanded                                               |                                      |       | Min.         | 50                                          |                                                                                                                                                                                                                              |
| recovered                                              |                                      |       | Min.         | 85                                          |                                                                                                                                                                                                                              |
| Heat shock                                             | 6                                    | -     | -            |                                             | Heat at 200 °C ± 5 K                                                                                                                                                                                                         |
| Tensile strength                                       | 19.2 and 19.3                        | MPa   | Min.         | 10                                          | Jacket only, ignore flowing adhesive                                                                                                                                                                                         |
| Elongation at break                                    | 19.2 and 19.3                        | %     | Min.         | 200                                         | 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<br>+ 5                                  |                                                                                                                                                                                                                              |
| Bending at low temperature                             | 14                                   | -     | -            | No cracking shall be visible                | Test at -20 °C<br><br>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                                       | 19.2 and 19.3                        | MPa   | Min.         | 13                                          | Jacket only                                                                                                                                                                                                                  |
| Elongation at break                                    | 19.2 and 19.3                        | %     | 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.                              |
| Secant modulus at 2 % elongation                       | 19.5                                 | MPa   | Min.         | 80                                          | Calculate cross- section area without adhesive.                                                                                                                                                                              |
|                                                        |                                      | MPa   | Max.         | 160                                         |                                                                                                                                                                                                                              |
| Breakdown voltage                                      | 21.2                                 | kV    | Min.         | Table 2                                     |                                                                                                                                                                                                                              |
| Volume resistivity at room temperature after damp heat | 23                                   |       |              |                                             |                                                                                                                                                                                                                              |
|                                                        | 23.5.2                               | Ω·m   | Min.         | 10 <sup>12</sup>                            |                                                                                                                                                                                                                              |
|                                                        | 23.5.4                               | Ω·m   | Min.         | 10 <sup>11</sup>                            |                                                                                                                                                                                                                              |

Table 1 (2 of 3)

| Property                      | IEC 60684-2:2011 clause or subclause | Units   | Max. or min. | Requirements | Remarks                                                                                                                                                                                         |
|-------------------------------|--------------------------------------|---------|--------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resistance to selected fluids | 36                                   |         |              |              | Use the fluids and test temperatures specified in Table 3                                                                                                                                       |
| Tensile strength              | 19.2 and 19.3                        | MPa     | Min.         | 10           | Immersion time (24 ± 1) h                                                                                                                                                                       |
| Elongation at break           | 19.2 and 19.3                        | %       | Min.         | 250          | 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                   | 39                                   |         |              |              | Heat at 150 °C ± 3 K                                                                                                                                                                            |
| Tensile strength              | 19.2 and 19.3                        | MPa     | Min.         | 10           | Jacket only                                                                                                                                                                                     |
| Elongation at break           | 19.2 and 19.3                        | %       | Min.         | 200          | 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              | 50                                   |         |              |              | The ageing temperature shall be 100 °C ± 3 K                                                                                                                                                    |
| Elongation at break           | 19.2 and 19.3                        | %       | Min.         | 175          | 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 |
| Carbon black content          | ISO 11358-1                          | %       | Min.         | 2,5          | Identify carbon black peak and report weight loss %                                                                                                                                             |
| Hardness                      | ISO 868                              | Shore D | Min.         | 40           |                                                                                                                                                                                                 |
| Water absorption              | 40                                   | %       | Max.         | 0,5          |                                                                                                                                                                                                 |

**Table 1 (3 of 3)**

| Property            | IEC 60684-2:2011 clause or subclause | Units              | Max. or min. | Requirements                     | Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------|--------------------------------------|--------------------|--------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Peel strength       | 54                                   | N/25 mm            | Min.         | Cu – 50<br>Al – 75<br>PO-X – 100 | <p>Use a Cu or Al tube with a minimum outer diameter of 25 mm and at least 20 % above the fully recovered internal diameter of the sleeving. The sleeving under test shall have a thickness of <math>2,0 \text{ mm} \pm 0,5 \text{ mm}</math> when recovered on the tube. Other substrate materials and methods are subject to agreement between the supplier and the user.</p> <p>Prepare the Cu and Al tubes in the manner defined in IEC 60684-2:2011, 54.3. Precondition the prepared Cu and Al tubes in an oven at <math>100 \text{ }^{\circ}\text{C}</math> for at least 30 min. Immediately place the sleeving on the prepared Cu or Al tubes and condition at <math>200 \text{ }^{\circ}\text{C} \pm 3 \text{ K}</math> for <math>(10 \pm 1) \text{ min.}</math></p> <p>To make the cross-linked polyolefin (PO-X) specimens shrink the sleeving onto the Cu or Al tubes by conditioning at <math>200 \text{ }^{\circ}\text{C} \pm 3 \text{ K}</math> for <math>(10 \pm 1) \text{ min.}</math> Allow to cool, then abrade and clean the outer surface as detailed in IEC 60684-2:2011, 54.3. Finally, fix the narrow strip of adhesive masking tape longitudinally on the sleeving, then place the same sleeving on top and condition at <math>200 \text{ }^{\circ}\text{C} \pm 3 \text{ K}</math> for <math>(10 \pm 1) \text{ min.}</math></p> |
| Melting temperature | ISO 11357-3                          | $^{\circ}\text{C}$ | Min.         | 100                              | <p>Adhesive only</p> <p>Value to be recorded is peak melting temperature (<math>T_{\text{pm}}</math>)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

**Table 2 – Requirements for breakdown voltage**

| Expanded wall thickness<br>mm                                                                                                                                                                                                                                                | Expanded ID   | Dielectric strength <sup>a</sup><br>Min.<br>kV/mm |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------|
| All dimensions                                                                                                                                                                                                                                                               | <b>Type A</b> |                                                   |
|                                                                                                                                                                                                                                                                              | 10 to 25      | 14                                                |
|                                                                                                                                                                                                                                                                              | 26 to 50      | 12                                                |
|                                                                                                                                                                                                                                                                              | 51 to 120     | 10                                                |
|                                                                                                                                                                                                                                                                              | 121 and above | 8                                                 |
|                                                                                                                                                                                                                                                                              | <b>Type B</b> |                                                   |
|                                                                                                                                                                                                                                                                              | 10 to 25      | 12                                                |
|                                                                                                                                                                                                                                                                              | 26 to 50      | 10                                                |
|                                                                                                                                                                                                                                                                              | 51 to 120     | 8                                                 |
|                                                                                                                                                                                                                                                                              | 121 and above | 6                                                 |
| <p>The sleeving shall be tested in the expanded condition.</p> <p>The rate of application of the voltage shall be 500 V/s.</p> <p>Care should be taken on selection of sizes based on these values. Refer to the manufacturer for actual values on installed conditions.</p> |               |                                                   |
| <p><sup>a</sup> Measure the expanded jacket wall thickness and calculate the electric strength by dividing the breakdown voltage by this value.</p>                                                                                                                          |               |                                                   |

**Table 3 – Resistance to selected fluids**

| Test fluid No. | Fluids          | Type          | Standard or symbol | Immersion temperature<br>°C ± 2 K |
|----------------|-----------------|---------------|--------------------|-----------------------------------|
| 1              | Insulating oil  | Mineral based | IEC 60296          | 23                                |
| 2              | Cleaning fluids |               | 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 customer.

## Annex A

(informative)

### Guide to the available sizes and wall thicknesses

**Table A.1 – Type A medium wall**

| Internal diameter      |                         | Wall                                                       |
|------------------------|-------------------------|------------------------------------------------------------|
| Expanded<br>Min.<br>mm | Recovered<br>Max.<br>mm | Recovered wall<br>thickness<br>(jacket only)<br>Min.<br>mm |
| 10                     | 3                       | 1,0                                                        |
| 10                     | 4                       | 1,4                                                        |
| 12                     | 3                       | 1,4                                                        |
| 16                     | 5                       | 1,4                                                        |
| 19                     | 6                       | 2,0                                                        |
| 25                     | 8                       | 2,0                                                        |
| 28                     | 10                      | 2,0                                                        |
| 33                     | 10                      | 2,0                                                        |
| 35                     | 12                      | 2,0                                                        |
| 38                     | 13                      | 2,3                                                        |
| 43                     | 13                      | 2,3                                                        |
| 50                     | 18                      | 2,3                                                        |
| 63                     | 19                      | 2,3                                                        |
| 70                     | 26                      | 2,3                                                        |
| 85                     | 25                      | 2,5                                                        |
| 90                     | 30                      | 2,5                                                        |
| 115                    | 34                      | 2,5                                                        |
| 120                    | 54                      | 2,5                                                        |
| 140                    | 42                      | 2,8                                                        |
| 152                    | 48                      | 2,8                                                        |
| 160                    | 50                      | 3,0                                                        |
| 180                    | 60                      | 3,0                                                        |
| 200                    | 77                      | 3,3                                                        |

**Table A.2 – Type B thick wall**

| Internal diameter      |                         | Wall                                                       |
|------------------------|-------------------------|------------------------------------------------------------|
| Expanded<br>Min.<br>mm | Recovered<br>Max.<br>mm | Recovered wall<br>thickness<br>(jacket only)<br>Min.<br>mm |
| 9                      | 3                       | 1,8                                                        |
| 13                     | 4                       | 2,4                                                        |
| 19                     | 6                       | 2,4                                                        |
| 20                     | 6                       | 2,4                                                        |
| 28                     | 9                       | 3,0                                                        |
| 33                     | 8                       | 3,2                                                        |
| 38                     | 12                      | 4,0                                                        |
| 43                     | 12                      | 4,0                                                        |
| 48                     | 15                      | 4,0                                                        |
| 51                     | 16                      | 4,0                                                        |
| 68                     | 22                      | 4,0                                                        |
| 70                     | 21                      | 4,0                                                        |
| 85                     | 25                      | 4,0                                                        |
| 90                     | 30                      | 4,0                                                        |
| 105                    | 26                      | 4,0                                                        |
| 105                    | 30                      | 4,0                                                        |
| 115                    | 40                      | 4,0                                                        |
| 130                    | 36                      | 4,0                                                        |
| 130                    | 40                      | 4,2                                                        |
| 150                    | 48                      | 4,3                                                        |
| 160                    | 50                      | 4,3                                                        |
| 170                    | 60                      | 4,3                                                        |
| 200                    | 77                      | 4,3                                                        |

NOTE 1 The wall thickness of the adhesive will typically lie between 0,5 mm and 1,5 mm after recovery.

NOTE 2 In those cases where the inner wall distorts or flows during recovery, it might not be possible to determine the recovered inside diameter accurately. In these cases, the sleeving can be recovered over a mandrel or plug gauge of the specified diameter after recovery for the size being measured.

## Bibliography

IEC 60502-1, *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) – Part 1: Cables for rated voltages of 1 kV ( $U_m = 1,2$  kV) and 3 kV ( $U_m = 3,6$  kV)*

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

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## COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

## GAINES ISOLANTES SOUPLES –

**Partie 3: Spécifications pour types particuliers de gaines –  
Feuille 247: Gaines thermorétractables en polyoléfine, à double paroi,  
non ignifugées à paroi épaisse et moyenne**

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La Norme internationale IEC 60684-3-247 a été établie par le comité d'études 15 de l'IEC: Matériaux isolants électriques solides.

Cette deuxième édition annule et remplace la première édition parue en 2011 et l'Amendement 1:2016. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) suppression de l'essai de solidité de la couleur à la lumière, cet essai étant couvert par l'essai de détermination de la teneur en noir de carbone;

- b) modification de la température de l'essai de flexion à basse température qui devient -20 °C pour aligner la valeur avec celle donnée dans la feuille 214;
- c) modification de la température de conditionnement finale des échantillons pour la résistance à l'arrachement qui devient 200 °C pour aligner la valeur avec celle donnée à l'Article 5;
- d) suppression de l'essai de résistance aux moisissures étant donné qu'il n'a pas été démontré, ni par des essais, ni en fonctionnement, que le développement de moisissures constituait un problème.

Le texte de cette Norme internationale est issu des documents suivants:

| FDIS        | Rapport de vote |
|-------------|-----------------|
| 15/890/FDIS | 15/900/RVD      |

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette Norme internationale.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2.

Une liste de toutes les parties de la série IEC 60684, publiées sous le titre général *Gaines isolantes souples*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "<http://webstore.iec.ch>" dans les données relatives au document recherché. A cette date, le document sera

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## INTRODUCTION

Le présent document fait partie d'une série de normes traitant des gaines isolantes souples à usages électriques.

Cette série est constituée de trois parties:

Partie 1: Définitions et exigences générales (IEC 60684-1)

Partie 2: Méthodes d'essai (IEC 60684-2)

Partie 3: Spécifications pour types particuliers de gaines (IEC 60684-3)

Le présent document contient l'une des feuilles qui composent la Partie 3, comme suit:

Feuille 247: Gainses thermorétractables en polyoléfine, à double paroi, non ignifugées, à paroi épaisse et moyenne

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## GAINES ISOLANTES SOUPLES –

### Partie 3: Spécifications pour types particuliers de gaines – Feuille 247: Gainés thermorétractables en polyoléfine, à double paroi, non ignifugées à paroi épaisse et moyenne

#### 1 Domaine d'application

La présente partie de l'IEC 60684 donne les exigences relatives à deux types de gaines thermorétractables en polyoléfine, à double paroi, non ignifugées, dont le rapport de rétreint nominal est 3:1.

Ces gaines se sont avérées appropriées pour une utilisation à des températures allant jusqu'à 100 °C.

- Type A: Paroi moyenne, diamètre intérieur généralement jusqu'à 200 mm
- Type B: Paroi épaisse, diamètre intérieur généralement jusqu'à 200 mm

La couleur de ces gaines est normalement le noir.

Comme ces types de gaines couvrent une plage très étendue de tailles et d'épaisseurs de paroi, l'Annexe A (Tableaux A.1 et A.2) fournit un guide des tailles disponibles dans cette plage. La taille réelle fait l'objet d'un accord entre l'utilisateur et le fournisseur.

Les matériaux conformes à la présente spécification satisfont à des niveaux de performances établis. Cependant, le choix d'un matériau par un utilisateur, pour une application spécifique, est fondé sur les exigences réelles nécessaires pour obtenir des performances adéquates pour l'application concernée, et n'est pas fondé sur cette seule spécification.

#### 2 Références normatives

Les documents suivants cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60296:2012, *Fluides pour applications électrotechniques – Huiles minérales isolantes neuves pour transformateurs et appareillages de connexion*

IEC 60684-1:2003, *Gainés isolantes souples – Partie 1: Définitions et exigences générales*

IEC 60684-2:2011, *Gainés isolantes souples – Partie 2: Méthodes d'essai*

IEC 60757:1983, *Code de désignation de couleurs*

ISO 868:2003, *Plastiques et ébonite – Détermination de la dureté par pénétration au moyen d'un duromètre (dureté Shore)*

ISO 11357-3:2018, *Plastiques – Analyse calorimétrique différentielle (DSC) – Partie 3: Détermination de la température et de l'enthalpie de fusion et de cristallisation*