

CONSOLIDATED VERSION

VERSION CONSOLIDÉE



**Flexible insulating sleeving –
Part 3: Specifications for individual types of sleeving – Sheet 216: Heat-
shrinkable, flame-retarded, limited-fire-hazard sleeving**

**Gaines isolantes souples –
Partie 3: Spécifications pour types particuliers de gaines – Feuille 216: Gaines
thermorétractables, retardées à la flamme, au risque de feu limité**

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REDLINE VERSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FLEXIBLE INSULATING SLEEVING –

**Part 3: Specifications for individual types of sleeving –
Sheet 216: Heat-shrinkable, flame-retarded,
limited-fire-hazard sleeving**

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In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions and deletions are displayed in red, with deletions being struck through. A separate Final version with all changes accepted is available in this publication.

This publication has been prepared for user convenience.

International Standard IEC 60684-3-216 has been prepared by subcommittee 15C: Specifications, of IEC technical committee 15: Insulating materials.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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WITHDRAWN

INTRODUCTION

This International Standard is one of a series which deals with flexible insulating sleeving for electrical purposes.

The series consists of three parts:

Part 1: Definitions and general requirements (IEC 60684-1);

Part 2: Methods of test (IEC 60684-2);

Part 3: Specifications for individual types of sleeving (IEC 60684-3).

This standard is one of the sheets comprising Part 3.

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INTRODUCTION TO THE AMENDMENT

This amendment changes the requirement for volume resistivity at room temperature to $10^{10} \Omega\text{m}$ for dry test at room temperature and changes the value after damp heat to one decade lower, to align with all other Part 3 sheets in this series.

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FLEXIBLE INSULATING SLEEVING –

Part 3: Specifications for individual types of sleeving – Sheet 216: Heat-shrinkable, flame-retarded, limited-fire-hazard sleeving

1 Scope

This sheet of IEC 60684-3 gives the requirements for four types of heat-shrinkable, flame-retarded, limited-fire-hazard sleeving with a thermal endurance rating of 105 °C as shown below:

Class A:	thin wall	shrink ratio 2:1	internal diameter up to 102,0 mm
Class B:	medium wall	shrink ratio 2:1	internal diameter up to 60,0 mm
Class C:	thick wall	shrink ratio 2:1	internal diameter up to 51,0 mm
Class D:	medium wall	shrink ratio 3:1	internal diameter up to 40,0 mm

These sleeveings are normally supplied in the following colours: black, red, green, blue, white, yellow and green/yellow.

Sizes or colours other than those listed in this standard may be available as custom items. These items shall be considered to comply with this standard if they comply with the property requirements listed in tables 5, 6, 7 and 8, excluding dimensions and mass.

Materials which conform to this specification meet established levels of performance. However, the selection of a material by a user for a specific application should be based on the actual requirements necessary for adequate performance in that application and not based on this specification alone.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this sheet of IEC 60684. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this sheet of IEC 60684 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60684-1:1980, *Specification for flexible insulating sleeving – Part 1: Definitions and general requirements*

IEC 60684-2:1997, *Flexible insulating sleeving – Part 2: Methods of test*

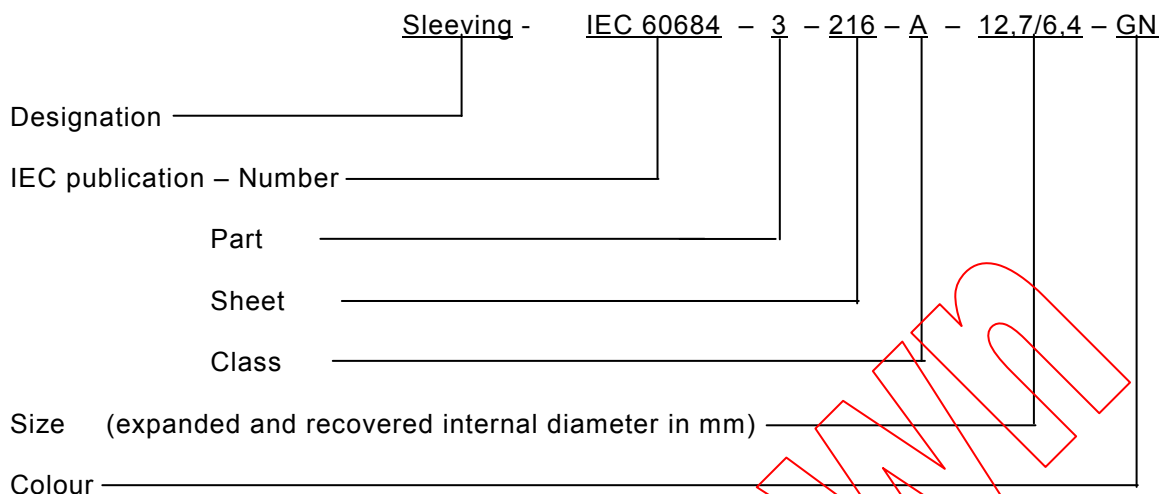
IEC 60757:1983, *Code for designation of colours*

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

ISO 1817:1999, *Rubber, vulcanized – Determination of the effect of liquids* (available in English only)

3 Designation

This sleeving shall be identified by the following designation:



Any abbreviation of colour shall comply with IEC 60757. Where no abbreviation is given, the colour shall be written in full.

4 Conditions of test

Unless otherwise specified, the sleeving shall be shrunk in a forced-air circulation oven for (5 ± 1) min at (150 ± 5) °C, prior to testing.

5 Requirements

In addition to the general requirements given in IEC 60684-1, the sleeving shall comply with the requirements in tables 1 through 8.

6 Sleeving conformance

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

- class A: 12,7/6,4 mm,
- class B: 12,0/6,0 mm,
- class C: 12,7/6,4 mm,
- class D: 18,0/6,0 mm,

of black colour. The colour fastness to light shall be determined for all colours.

Table 1 – Dimensional and mass requirements – Class A

Size code	Internal diameter mm		Recovered wall thickness mm	Mass per unit length g/m Max.
	Expanded Min.	Recovered Max.		
3,2/1,6	3,2	1,6	0,50 ± 0,10	6,0
4,8/2,4	4,8	2,4	0,50 ± 0,10	8,2
6,4/3,2	6,4	3,2	0,65 ± 0,15	13,5
9,5/4,8	9,5	4,8	0,65 ± 0,15	19,5
12,7/6,4	12,7	6,4	0,65 ± 0,15	25,0
19,0/9,5	19,0	9,5	0,75 ± 0,15	43,0
25,4/12,7	25,4	12,7	0,90 ± 0,15	67,0
38,0/19,0	38,0	19,0	1,00 ± 0,20	112
51,0/25,4	51,0	25,4	1,15 ± 0,25	175
76,0/38,0	76,0	38,0	1,25 ± 0,25	281
102,0/51,0	102,0	51,0	1,40 ± 0,25	404

Table 2 – Dimensional and mass requirements – Class B

Size code	Internal diameter mm		Recovered wall thickness mm	Mass per unit length g/m Max.
	Expanded Min.	Recovered Max.		
3,0/1,5	3,0	1,5	0,70 ± 0,10	8,5
5,0/2,5	5,0	2,5	0,75 ± 0,15	13,5
8,0/4,0	8,0	4,0	0,80 ± 0,15	21,0
12,0/6,0	12,0	6,0	0,90 ± 0,15	33,0
18,0/9,0	18,0	9,0	1,00 ± 0,20	54,0
24,0/12,0	24,0	12,0	1,10 ± 0,20	77,0
40,0/20,0	40,0	20,0	1,30 ± 0,25	146
60,0/30,0	60,0	30,0	1,50 ± 0,30	250

Table 3 – Dimensional and mass requirements – Class C

Size code	Internal diameter mm		Recovered wall thickness mm	Mass per unit length g/m Max.
	Expanded Min.	Recovered Max.		
3,2/1,6	3,2	1,6	0,75 ± 0,15	9,9
4,8/2,4	4,8	2,4	0,85 ± 0,20	15,8
6,4/3,2	6,4	3,2	0,90 ± 0,20	21,0
9,5/4,8	9,5	4,8	1,00 ± 0,20	32,0
12,7/6,4	12,7	6,4	1,20 ± 0,30	53,6
19,0/9,5	19,0	9,5	1,45 ± 0,35	91,6
25,4/12,7	25,4	12,7	1,80 ± 0,45	155
38,0/19,0	38,0	19,0	2,40 ± 0,50	294
51,0/25,4	51,0	25,4	2,80 ± 0,50	435

Table 4 – Dimensional and mass requirements – Class D

Size code	Internal diameter mm		Recovered wall thickness mm	Mass per unit length g/m Max.
	Expanded Min.	Recovered Max.		
3,0/1,0	3,0	1,0	0,60 ± 0,10	5,5
6,0/2,0	6,0	2,0	0,70 ± 0,10	10,5
9,0/3,0	9,0	3,0	0,80 ± 0,15	17,0
12,0/4,0	12,0	4,0	0,85 ± 0,15	23,0
18,0/6,0	18,0	6,0	1,00 ± 0,20	39,0
24,0/8,0	24,0	8,0	1,20 ± 0,20	61,0
40,0/13,0	40,0	13,0	1,25 ± 0,20	98,5

Table 5 – Property requirements

Property	IEC 60684-2 clause or subclause	Units	Max. or Min.	Requirements	Remarks
Dimensions	3				
– internal diameter	3.1.2	mm		Tables 1 to 4	
– wall thickness	3.3.2	mm	Min.	Tables 1 to 4	
– concentricity	3.3.3	%			
• expanded				65	
• recovered				85	
Heat shock	6				Heat the expanded sleeving at (150 ± 5) °C for (5 ± 1) min
– tensile strength	19.1 and 19.2	MPa	Min.	6	
– elongation at break	19.1 and 19.2	%	Min.	100	
Longitudinal change	9	%	Max.	–10 +5	The test is done on expanded sleeving
Bending at low temperature	14	–	–	No cracking shall be visible	Test at –30 °C after conditioning at that temperature for 4 h. 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

Table 5 – Property requirements (continued)

Property	IEC 60684-2 clause or subclause	Units	Max. or Min.	Requirements	Remarks
Dimensional stability during storage	16	–	–	The dimensions shall be as specified in tables 1 to 4	
Tensile strength	19.1 and 19.2	MPa	Min.	7	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
Elongation at break	19.1 and 19.2	%	Min.	200	
Secant modulus at 2 % elongation	19.4	MPa	Min.	40	
		MPa	Max.	130	
Breakdown voltage	21	kV	Min.	Table 6	
Volume resistivity	23				
– at room temperature	23.4.2	Ωm	Min.	10 ^{14,10}	
– after damp heat	23.4.4	Ωm	Min.	10 ^{10,9}	
Flame propagation	26 Method C				
– Time of burning		s	Max.	30	
– Length burned		mm	Max.	75	
Oxygen index	27				
– at ambient temperature	27.1	%	Min.	29	
– at elevated temperature	27.2	°C	Min.	250	
Copper corrosion	33	%	Max.	8	Heat the specimens for (16 ± 0,5) h at (150 ± 3) °C
Colour fastness to light	34			The colour 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