

INTERNATIONAL STANDARD



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

Document Preview

[IEC 60684-3-216:2019](https://standards.iteh.ai/catalog/standards/iec/cd29ff52-78f1-42e8-aea9-fe2088f92d50/iec-60684-3-216-2019)

<https://standards.iteh.ai/catalog/standards/iec/cd29ff52-78f1-42e8-aea9-fe2088f92d50/iec-60684-3-216-2019>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

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

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

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

International
Standards
IEC Standards
Document Preview

[IEC 60684-3-216:2019](https://standards.iteh.ai/catalog/standards/iec/cd29ff52-78f1-42e8-aea9-fe2088f92d50/iec-60684-3-216-2019)

<https://standards.iteh.ai/catalog/standards/iec/cd29ff52-78f1-42e8-aea9-fe2088f92d50/iec-60684-3-216-2019>



IEC 60684-3-216

Edition 2.0 2019-08
REDLINE VERSION

INTERNATIONAL STANDARD



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

Document Preview

[IEC 60684-3-216:2019](https://standards.iteh.ai/catalog/standards/iec/cd29ff52-78f1-42e8-aea9-fe2088f92d50/iec-60684-3-216-2019)

<https://standards.iteh.ai/catalog/standards/iec/cd29ff52-78f1-42e8-aea9-fe2088f92d50/iec-60684-3-216-2019>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.035.20

ISBN 978-2-8322-7287-9

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	2
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	7
4 Designation	7
5 Conditions of test	7
6 Requirements	7
7 Sleeving conformance	7
Bibliography.....	19
Table 1 – Dimensional and mass requirements – Class A	8
Table 2 – Dimensional and mass requirements – Class B	8
Table 3 – Dimensional and mass requirements – Class C	9
Table 4 – Dimensional and mass requirements – Class D	9
Table 5 – Property requirements	9
Table 6 – Requirements for breakdown voltage	16
Table 7 – Resistance to selected fluids	17
Table 8 – Additional property requirements	18

[IEC 60684-3-216:2019](https://standards.iteh.ai/catalog/standards/iec/cd29ff52-78ff-42e8-aea9-fe2088f92d50/iec-60684-3-216-2019)

<https://standards.iteh.ai/catalog/standards/iec/cd29ff52-78ff-42e8-aea9-fe2088f92d50/iec-60684-3-216-2019>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FLEXIBLE INSULATING SLEEVING –

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

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60684-3-216 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

This second edition cancels and replaces the first edition published in 2001, Amendment 1:2005 and Amendment 2:2013. This edition constitutes a technical revision.

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

- a) the temperature at which the sleeving is shrunk in a forced-air circulation oven for (5 ± 1) min has been increased from (150 ± 5) °C to (200 ± 5) °C.

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

FDIS	Report on voting
15/888/FDIS	15/902/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 parts in the IEC 60684 series, published under the general title *Flexible insulating sleeving*, can be found on the IEC website.

The committee has decided that the contents of 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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 document comprises one of the sheets of Part 3 as follows:

Sheet 216: Heat-shrinkable, flame-retarded, limited-fire-hazard sleeving

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 60684-3-216:2019](https://standards.iteh.ai/catalog/standards/iec/cd29ff52-78f1-42e8-aea9-fe2088f92d50/iec-60684-3-216-2019)

<https://standards.iteh.ai/catalog/standards/iec/cd29ff52-78f1-42e8-aea9-fe2088f92d50/iec-60684-3-216-2019>

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~~ part 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 document ~~may be~~ are available as custom items. These items ~~shall be~~ are considered to comply with this document 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~~ 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 60684-1: ~~1980~~2003, ~~Specification for~~ Flexible insulating sleeving – Part 1: Definitions and general requirements

IEC 60684-2: ~~1997~~2011, Flexible insulating sleeving – Part 2: Methods of test

IEC 60757:1983, Code for designation of colours

ISO 846: ~~1997~~2019, Plastics – Evaluation of the action of microorganisms

ISO 1817: ~~1999~~2015, Rubber, vulcanized or thermoplastic – Determination of the effect of liquids ~~(available in English only)~~

3 Terms and definitions

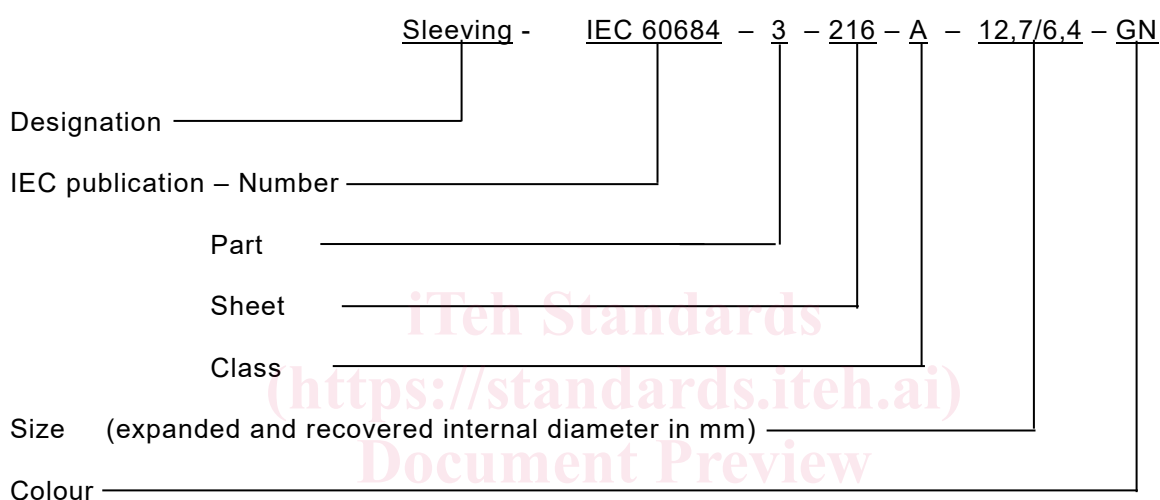
No terms and definitions are listed in this document.

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

This sleeving shall be identified by the following designation:



IEC 60684-3-216:2019

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

5 Conditions of test

Unless otherwise specified, the sleeving shall be shrunk in a forced-air circulation oven for (5 ± 1) min at (200 ± 5) °C, prior to testing.

6 Requirements

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

7 Sleeving conformance

Conformance to the requirements of this specification shall normally be based on the results from for black colour of the following sizes:

- Class A: 12,7 mm/6,4 mm
- Class B: 12,0 mm/6,0 mm
- Class C: 12,7 mm/6,4 mm
- Class D: 18,0 mm/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 (1 of 3)

Property	IEC 60684-2 clause or subclause	Units	Max. or Min.	Requirements	Remarks
Dimensions	3				
— internal diameter	3.1.2	mm	Min.	Tables 1 to 4	
— wall thickness	3.3.2	mm		Tables 1 to 4	
— concentricity	3.3.3	%			
— expanded				65	
— recovered				85	
Heat shock	6				
— tensile strength	19.1 and 19.2	MPa	Min.	6	Heat the expanded sleeving at $(150 \pm 5) ^\circ\text{C}$ for (5 ± 1) min
— elongation at break	19.1 and 19.2	%	Min.	100	
Longitudinal change	9	%	Max.	-10 <u>+5</u>	The test is done on expanded sleeving
Bending at low temperature	14	—	—	No cracking shall be visible	Test at $-30 ^\circ\text{C}$ 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

iTeh Standards
<https://standards.itih.ai>
 Document Preview

IEC 60684-3-216:2019

<https://standards.itih.ai/catalog/standards/iec/cd29ff52-78ff-42e8-aea9-fe2088f92d50/iec-60684-3-216-2019>

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}	
— after damp heat	23.4.4	Ωm	Min.	10^{10}	
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	$^{\circ}\text{C}$	Min.	250	
Copper corrosion	33	%	Max.	8	Heat the specimens for $(16 \pm 0,5)$ h at $(150 \pm 3)^{\circ}\text{C}$
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

Property	IEC 60684-2 clause or subclause	Units	Max. or Min.	Requirements	Remarks
Resistance to selected fluids	36				Use the fluids and test temperatures specified in table 7
— Tensile strength	19.1 and 19.2	MPa	Min.	4	
— Elongation at break	19.1 and 19.2	%	Min.	100	
Thermal endurance Temperature index	37		Min.	105	The test to establish failure shall be elongation to break; the end-point shall be 50 % absolute elongation at break
Mass per unit length	38	g/m	Max.	Tables 1 to 4	
Heat ageing	39				Heat at (135 ± 3) °C.
— Tensile strength	19.1 and 19.2	MPa	Min.	5	
— Elongation at break	19.1 and 19.2	%	Min.	150	
Water absorption	40	%	Max.	1,0	
Smoke index	43	–	Max.	20	
Toxicity index	44	–	Max.	5	
Halogen content	45				Expressed as chlorine
	45.1	%	Max.	0,2	
	45.2	%	Max.	0,1	
Acid gas generation	46				
	46.2	pH	Min.	3,5	
		pH	Max.	10,5	
		µS/mm	Max.	10,0	