

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Flexible insulating sleeving –
Part 2: Methods of test**

**Gaines isolantes souples –
Partie 2: Méthodes d'essai**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2011 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: 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 corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

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 It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00



IEC 60684-2

Edition 3.0 2011-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Flexible insulating sleeving –
Part 2: Methods of test**

**Gaines isolantes souples –
Partie 2: Méthodes d'essai**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE **XC**
CODE PRIX

ICS 17.220.99

ISBN 978-2-88912-618-7

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 General	8
2 Test conditions	10
3 Measurements of bore, wall thickness and concentricity	10
4 Density	12
5 Resistance to splitting after heating.....	13
6 Heat shock (resistance to heat).....	13
7 Resistance to soldering heat	14
8 Loss in mass on heating of uncoated textile glass sleeving.....	14
9 Longitudinal change	15
10 Deformation under load (resistance to pressure at elevated temperature).....	16
11 Thermal stability of PVC sleeving	18
12 Volatile content of silicone sleeving.....	19
13 Bending after heating.....	19
14 Bending at low temperature	20
15 Brittleness temperature.....	20
16 Dimensional stability on storage (applicable to heat-shrinkable sleeving only).....	21
17 Hydrolysis of coating.....	21
18 Flexibility (extruded sleeving only).....	22
19 Tensile strength, tensile stress at 100 % elongation, elongation at break and secant modulus at 2 % elongation	22
20 Fraying resistance test.....	26
21 Breakdown voltage	27
22 Insulation resistance	29
23 Volume resistivity.....	30
24 Permittivity and dissipation factor	31
25 Resistance to tracking	32
26 Flame propagation tests.....	32
27 Oxygen index.....	35
28 Transparency.....	35
29 Ionic impurities test.....	35
30 Silver staining test	36
31 Electrolytic corrosion resistance	36
32 Corrosion resistance (tensile and elongation).....	37
33 Copper corrosion (presence of corrosive volatiles)	37
34 Colour fastness to light	38
35 Resistance to ozone	39
36 Resistance to selected fluids.....	39
37 Thermal endurance.....	40
38 Mass per unit length	40
39 Heat ageing	41

40	Water absorption	42
41	Restricted shrinkage (applicable to heat-shrinkable sleeving only)	42
42	Colour stability to heat	43
43	Smoke index.....	43
44	Toxicity index.....	48
45	Halogen content.....	53
46	Acid gas generation	55
47	Hot elongation and hot set	55
48	Tension set (applicable to elastomeric sleeving only)	56
49	Tear propagation (applicable to elastomeric sleeving only)	56
50	Long term heat ageing (3 000 h).....	57
51	Dynamic shear at ambient temperature	57
52	Dynamic shear at elevated temperature	58
53	Dynamic shear after heat shock and heat ageing	58
54	Rolling drum peel to aluminium	59
55	Aluminium rod dynamic shear	59
56	Sealing	60
57	Adhesive T peel strength of two bonded heat-shrinkable substrates	61
58	Circumferential extension	62
59	Voltage proof.....	63
60	Thermal shock.....	63
	Bibliography.....	82
	Figure 1 – Specimen for test resistance to soldering heat	64
	Figure 2 – Examples of sleeving after being subjected to test for resistance to soldering heat	65
	Figure 3 – Arrangement for the test for resistance to pressure at elevated temperature (Method A).....	65
	Figure 4 – Arrangement for deformation under load (Method B)	66
	Figure 5 – Dumb-bell specimen for tensile strength test (ISO 37 Type2)	67
	Figure 6 – Dumb-bell specimen for tensile strength test (ISO 37 Type 1)	67
	Figure 7 – Sketch of fray test arrangement	68
	Figure 8 – Specimen for insulation resistance test	69
	Figure 9 – Standard propane burner for flame propagation test (sectional view)	70
	Figure 10 – Flame propagation test – Method A.....	71
	Figure 11 – Flame propagation test – Method B.....	72
	Figure 12 – Flame propagation test – Method C.....	73
	Figure 13 – Mandrel for restricted shrinkage test	74
	Figure 14 – Schematic details of burner for smoke index test.....	75
	Figure 15 – Schematic front view of smoke test sample holder, showing vertically mounted sleeving samples	76
	Figure 16 – Assembly and fixture for dynamic shear at ambient temperature.....	77
	Figure 17 – Assembly for heat shock and heat ageing	78
	Figure 18 – Schematic arrangement of rolling drum peel.....	78

Figure 19 – Assembly preparation for aluminium rod dynamic shear	79
Figure 20 – Test specimen for aluminium rod dynamic shear	79
Figure 21 – Assembly for sealing test	80
Figure 22 – Mandrel assembly.....	80
Figure 23 – Slab specimen	81
Figure 24 – T peel strength specimen.....	81

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FLEXIBLE INSULATING SLEEVING –**Part 2: Methods of test****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.

International Standard IEC 60684-2 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

This third edition cancels and replaces the second edition published in 1997, and constitutes a minor revision and technical updating. The main changes from the previous edition are as follows: three additional methods for circumferential extension, voltage proof and thermal shock and alignment with North American methods.

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

FDIS	Report on voting
15/634/FDIS	15/644/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

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

- 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. 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)