

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Electric and optical fibre cables – Test methods for non-metallic materials –  
Part 505: Mechanical tests – Elongation at low temperature for insulations  
and sheaths**

**Câbles électriques et à fibres optiques – Méthodes d'essai pour les matériaux  
non-métalliques –  
Partie 505: Essais mécaniques – Essai d'allongement à basse température  
pour les enveloppes isolantes et les gaines**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2012 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

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://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.

#### Useful links:

IEC publications search - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

The advanced search enables you 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](http://webstore.iec.ch/justpublished)

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

Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - [webstore.iec.ch/csc](http://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: [csc@iec.ch](mailto:csc@iec.ch).

### 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.

#### Liens utiles:

Recherche de publications CEI - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,...).

Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

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

Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [csc@iec.ch](mailto:csc@iec.ch).

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Electric and optical fibre cables – Test methods for non-metallic materials –  
Part 505: Mechanical tests – Elongation at low temperature for insulations  
and sheaths**

**Câbles électriques et à fibres optiques – Méthodes d'essai pour les matériaux  
non-métalliques –  
Partie 505: Essais mécaniques – Essai d'allongement à basse température  
pour les enveloppes isolantes et les gaines**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX



ICS 29.035.01; 29.060.20

ISBN 978-2-88912-980-5

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references .....	6
3 Terms and definitions .....	6
4 Test method .....	6
4.1 General.....	6
4.2 Elongation test at low temperature for insulation .....	7
4.2.1 Sampling .....	7
4.2.2 Preparation of test pieces.....	7
4.2.3 Apparatus.....	7
4.2.4 Procedure and test conditions .....	8
4.2.5 Evaluation of results .....	8
4.3 Elongation test at low temperature for sheaths .....	8
4.3.1 Sampling .....	8
4.3.2 Preparation of test pieces.....	8
4.3.3 Apparatus.....	9
4.3.4 Procedure and test conditions .....	9
4.3.5 Evaluation of results .....	9
5 Test report.....	9
Bibliography.....	11
	<a href="https://standards.iteh.ai/catalog/standards/sist/b00da112-79a3-4cdb-8711-ada190c38367/iec-60811-505-2012">https://standards.iteh.ai/catalog/standards/sist/b00da112-79a3-4cdb-8711-ada190c38367/iec-60811-505-2012</a>
Figure 1 – Dumb-bell test piece .....	10
Figure 2 – Small dumb-bell test piece .....	10

Iteh STANDARD PREVIEW  
 (standards.iteh.ai)

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRIC AND OPTICAL FIBRE CABLES –  
TEST METHODS FOR NON-METALLIC MATERIALS –****Part 505: Mechanical tests –  
Elongation at low temperature for insulations and sheaths**

## 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 60811-505 has been prepared by IEC technical committee 20: Electric cables.

This Part 505 of IEC 60811 cancels and replaces 8.3 and 8.4 of IEC 60811-1-4:1985, which is withdrawn. Full details of the replacements are shown in Annex A of IEC 60811-100:2012.

There are no specific technical changes with respect to the previous edition, but see the Foreword to IEC 60811-100:2012.

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

FDIS	Report on voting
20/1301/FDIS	20/1350/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.

This part of IEC 60811 shall be used in conjunction with IEC 60811-100.

A list of all the parts in the IEC 60811 series, published under the general title *Electric and optical fibre cables – Test methods for non-metallic materials*, 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.

**ITEH STANDARD PREVIEW**  
**(standards.iteh.ai)**

[IEC 60811-505:2012](#)

<https://standards.iteh.ai/catalog/standards/sist/b00da112-79a3-4cdb-8711-ada190c38367/iec-60811-505-2012>

## INTRODUCTION

The IEC 60811 series specifies the test methods to be used for testing non-metallic materials of all types of cables. These test methods are intended to be referenced in standards for cable construction and for cable materials.

NOTE 1 Non-metallic materials are typically used for insulating, sheathing, bedding, filling or taping within cables.

NOTE 2 These test methods are accepted as basic and fundamental and have been developed and used over many years principally for the materials in all energy cables. They have also been widely accepted and used for other cables, in particular optical fibre cables, communication and control cables and cables for ships and offshore applications.

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 60811-505:2012](https://standards.iteh.ai/catalog/standards/sist/b00da112-79a3-4cdb-8711-ada190c38367/iec-60811-505-2012)

<https://standards.iteh.ai/catalog/standards/sist/b00da112-79a3-4cdb-8711-ada190c38367/iec-60811-505-2012>

# ELECTRIC AND OPTICAL FIBRE CABLES – TEST METHODS FOR NON-METALLIC MATERIALS –

## Part 505: Mechanical tests – Elongation at low temperature for insulations and sheaths

### 1 Scope

This Part 505 of IEC 60811 gives the procedure for performing elongation tests at low temperature on extruded insulations and sheaths.

### 2 Normative references

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

IEC 60811-100:2012, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 100: General*

IEC 60811-501, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 501: Mechanical tests – Tests for determining the mechanical properties of insulating and sheathing compounds*

<https://standards.iteh.ai/catalog/standards/sist/b00da112-79a3-4cdb-8711-19f383677c60811-505-2012>

<https://standards.iteh.ai/catalog/standards/sist/b00da112-79a3-4cdb-8711-19f383677c60811-505-2012>

IEC 60811-504, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 504: Mechanical tests – Bending tests at low temperature for insulation and sheaths*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60811-100 apply.

### 4 Test method

#### 4.1 General

This part of IEC 60811 shall be used in conjunction with IEC 60811-100.

All the tests shall be carried out not less than 16 h after the extrusion of the insulating or sheathing compounds.

Tests shall be carried out at the temperature specified in the relevant cable standard.

For tests on insulation, the test is intended for insulated conductors of circular cross-section having an external diameter greater than 12,5 mm and for sector-shaped cores large enough to prepare dumb-bells. Where it is not possible to prepare dumb-bells, a bending test suitable for testing the performance of cores of smaller diameter is described in IEC 60811-504.

This test is intended for the sheaths of cables not subjected to the bend test as specified in IEC 60811-504. It is intended for cables with an overall diameter over 12,5 mm, or for flat cables having, a major axis dimension over 12,5 mm. Cables with an overall diameter up to



and including 12,5 mm shall be subjected to the low temperature bending test detailed in IEC 60811-504.

## 4.2 Elongation test at low temperature for insulation

### 4.2.1 Sampling

Each core to be tested shall be represented by two samples of suitable length.

### 4.2.2 Preparation of test pieces

After all covering (including outer semi-conducting layer, if any) has been removed, the insulation shall be cut open in the direction of the axis, after which the conductor and the internal semi-conducting layer, if any, shall be removed.

The insulation need not be ground or cut if the inner and outer surfaces are smooth, and its mean specified thickness does not exceed 2,0 mm. Samples having a thickness exceeding this limit, or samples having imprints or ridges on the inner side, shall be ground or cut to obtain two parallel and smooth surfaces, and a thickness which does not exceed 2,0 mm. The minimum thickness after grinding or cutting shall be 0,8 mm but if the original thickness of the insulation does not allow it, then 0,6 mm shall be permitted as the minimum thickness. Grinding and cutting shall be carefully carried out to avoid undue heating and mechanical stresses in the insulation.

All strips shall be conditioned at ambient temperature for at least 3 h.

After this preparation, two dumb-bells from each sample in accordance with Figure 1, or if necessary Figure 2, shall be punched in the direction of the axis of each sample; if possible, two dumb-bells shall be punched side by side.

For sector-shaped cores, the dumb-bells shall be punched out of the rounded “back” of the core.

If an apparatus is used which allows the direct measurement of the distance between the marker lines during the test, the dumb-bells shall be marked in accordance with IEC 60811-501.

### 4.2.3 Apparatus

The test may be carried out on a machine provided with a cooling device or on a machine installed in a cooling chamber.

Using a liquid as the refrigerant, the conditioning time shall be not less than 10 min at the specified test temperature.

When cooling in air, the conditioning time for cooling the apparatus and test piece together shall be at least 4 h. If the apparatus has been pre-cooled, this period may be reduced to 2 h, and if the apparatus and test piece have been pre-cooled, the conditioning time after the test piece has been fixed in the apparatus shall be not less than 1 h.

If a liquid mixture is used for cooling, it shall not impair the insulating or sheathing material.

An apparatus which allows direct measurement of the distance between the marker lines during the elongation test is preferred, but it is also permissible to use an apparatus with which the displacement between the grips can be measured.

#### 4.2.4 Procedure and test conditions

The grips of the tensile apparatus shall be of a non-self-tightening type. In both pre-cooled grips, the dumb-bell shall be clamped over the same length.

The free length between the grips shall be about 30 mm for both types of dumb-bells if the direct measurement of the distance between the marker lines is to be made during the test.

If the displacement of the grips is to be measured, the free length between the grips shall be  $(30 \pm 0,5)$  mm for the dumb-bell in accordance with Figure 1, and  $(22 \pm 0,5)$  mm for the dumb-bell in accordance with Figure 2.

The speed of separation of the grips of the tensile machine shall be  $(25 \pm 5)$  mm/min.

The test temperature shall be as specified for the type of compound in the standard for the type of cable.

The elongation shall be determined by measuring the distance between the marker lines, if possible, or between the grips at the moment of the rupture.

#### 4.2.5 Evaluation of results

For calculating the elongation, the increase of the distance between the marker lines shall be related to the initial distance of 20 mm (or 10 mm if the dumb-bell in accordance with Figure 2, is used), and expressed as a percentage of this distance.

If the alternative method of measuring the distance between the grips is used, the increase of this distance shall be related to the original distance, being 30 mm for the dumb-bell in accordance with Figure 1, and 22 mm for the dumb-bell according to Figure 2. When this method is used, the test piece shall be examined before being removed from the apparatus; if the test piece has partly slipped out of the grips, the result shall be ignored. At least three valid results are required for calculating the elongation, otherwise the test shall be repeated.

Unless otherwise specified, none of the valid results shall be less than 20 %. In case of dispute, the method employing marker lines shall be used.

### 4.3 Elongation test at low temperature for sheaths

#### 4.3.1 Sampling

Each sheath to be tested shall be represented by two samples of suitable length.

#### 4.3.2 Preparation of test pieces

After any covering has been removed, the sheath shall be cut open in the direction of the axis, after which the cores and fillers and others internal parts (if any) shall be removed.

The sheath need not be ground or cut if the inner and outer surfaces are smooth, and its mean specified thickness does not exceed 2,0 mm. Samples having a thickness exceeding this limit, or samples having imprints or ridges on the inner side, shall be ground or cut to obtain two parallel and smooth surfaces, and a thickness which does not exceed 2,0 mm. The minimum thickness after grinding or cutting shall be 0,8 mm but if the original thickness of the sheath does not allow it, then 0,6 mm shall be permitted as the minimum thickness. Grinding and cutting shall be carefully carried out to avoid undue heating and mechanical stresses in the sheath. For polyethylene (PE) and polypropylene (PP) sheaths, cutting only, not grinding shall be employed. An example of a cutting machine is given in Annex A of IEC 60811-501:2012.

All strips shall be conditioned at ambient temperature for at least 3 h.

After this preparation, two dumb-bells from each sample in accordance with Figure 1, or if necessary Figure 2, shall be punched in the direction of the axis of each sample; if possible, two dumb-bells shall be punched side by side.

If an apparatus is used which allows direct measurement of the distance between the marker lines during the test, the dumb-bells shall be marked in accordance with IEC 60811-501.

#### **4.3.3 Apparatus**

In accordance with 4.2.3.

#### **4.3.4 Procedure and test conditions**

In accordance with 4.2.4.

#### **4.3.5 Evaluation of results**

In accordance with 4.2.5.

### **5 Test report**

The test report shall be in accordance with that given in IEC 60811-100.

**ITeH STANDARD PREVIEW**  
**(standards.iteh.ai)**

[IEC 60811-505:2012](https://standards.iteh.ai/catalog/standards/sist/b00da112-79a3-4cdb-8711-ada190c38367/iec-60811-505-2012)

<https://standards.iteh.ai/catalog/standards/sist/b00da112-79a3-4cdb-8711-ada190c38367/iec-60811-505-2012>