# SLOVENSKI STANDARD
# SIST EN 60811-1-1:1999

**01-julij-1999**

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**Materiali za izoliranje in oplaščenje električnih in optičnih kablov - Splošne preskusne metode - 1-1. del: Področje uporabe – Merjenje debeline in splošnih mer - Preskusi za ugotavljanje mehanskih lastnosti (IEC 60811-1-1:1993)**

Insulating and sheathing materials of electric and optical cables - Common test methods - Part 1-1: General application - Measurement of thickness and overall dimensions - Tests for determining the mechanical properties



Isolier- und Mantelwerkstoffe für Kabel und isolierte Leitungen - Allgemeine Prüfverfahren - Teil 1-1: Allgemeine Anwendung - Messung der Wanddicke und der Außenmaße - Verfahren zur Bestimmung der mechanischen Eigenschaften



Matériaux d'isolation et de gainage des câbles électriques et des câbles optiques - Méthodes d'essais communes - Partie 1-1: Application générale - Mesure des épaisseurs et des dimensions extérieures - Détermination des propriétés mécaniques

**Ta slovenski standard je istoveten z:** **EN 60811-1-1:1995**

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**ICS:**

| | | |
|---|---|---|
| 29.035.01 | Izolacijski materiali na splošno | Insulating materials in general |
| 29.060.20 | Kabli | Cables |

**SIST EN 60811-1-1:1999** **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 60811-1-1

April 1995

ICS 29.060.20

Supersedes HD 505.1.1 S3:1991

Descriptors: Electric cable, insulated cable, electrical insulation, sheath, insulation, measurement of dimension, thickness, mechanical property

English version

# Insulating and sheathing materials of electric cables
## Common test methods
## Part 1: General application
## Section 1: Measurement of thickness and overall dimensions
## Tests for determining the mechanical properties
## (IEC 811-1-1:1993)

Matériaux d'isolation et de gainage des câbles électriques
Méthodes d'essais communes
Partie 1: Application générale
Section 1: Mesure des épaisseurs et des dimensions extérieures - Détermination des propriétés mécaniques
(CEI 811-1-1:1993)

Isolier- und Mantelwerkstoffe für Kabel und isolierte Leitungen
Allgemeine Prüfverfahren
Teil 1: Allgemeine Anwendung
Hauptabschnitt 1: Messung der Wanddicke und der Außenmaße
Verfahren zur Bestimmung der mechanischen Eigenschaften
(IEC 811-1-1:1993)



This European Standard was approved by CENELEC on 1995-03-06. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of the International Standard IEC 811-1-1:1993, prepared by IEC TC 20, Electric cables, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 60811-1-1 on 1995-03-06 without any modification.

This European Standard supersedes HD 505.1.1 S3:1991.
Where reference is made to HD 505.1.1 S3:1991 in another standard, users should refer to this EN 60811-1-1 for the current information.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-03-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-12-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annex A is informative.
Annex ZA has been added by CENELEC.



## Endorsement notice



The text of the International Standard IEC 811-1-1:1993 was approved by CENELEC as a European Standard without any modification.

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

| Publication | Year | Title [1] | EN/HD | Year |
|---|---|---|---|---|
| IEC 811-1-2 | 1985 | Insulating and sheathing materials of electric cables<br>Common test methods - Part 1: General application<br>Section 2: Thermal ageing methods | EN 60811-1-2[2] | 1995 |
| IEC 811-1-3 | 1985 | Section 3: Methods for determining the density<br>Water absorption tests - Shrinkage test | HD 505.1.3 S3[3] | 1991 |
| IEC 811-2-1 | 1986 | Part 2: Methods specific to elastomeric compounds<br>Section 1: Ozone resistance test - Hot set test<br>Mineral oil immersion test | EN 60811-2-1[4] | 1995 |



1) The main title and title of Part 1 have been adapted to the new title decided by IEC/TC 20.
2) EN 60811-1-2 includes a corrigendum May 1986 and A1:1989 to IEC 811-1-2:1985
3) HD 505.1.3 S3:1991 is superseded by EN 60811-1-3:1995, which is based on IEC 811-1-3:1993
4) EN 60811-2-1 includes A1:1992 and A2:1993 to IEC 811-2-1:1986

# NORME INTERNATIONALE
# INTERNATIONAL STANDARD

**CEI**
**IEC**
**811-1-1**

Deuxième édition
Second edition
1993-10

## Méthodes d'essais communes pour les matériaux d'isolation et de gainage des câbles électriques –

## Partie 1:
Méthodes d'application générale –
Section 1: Mesure des épaisseurs et des dimensions extérieures –
Détermination des propriétés mécaniques



## Common test methods for insulating and sheathing materials of electric cables –

## Part 1:
Methods for general application –
Section 1: Measurement of thickness and overall dimensions –
Tests for determining the mechanical properties



Bureau Central de la Commission Electrotechnique Internationale 3, rue de Varembé Genève, Suisse

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE R

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

# COMMON TEST METHODS FOR INSULATING AND SHEATHING MATERIALS OF ELECTRIC CABLES –

## Part 1: Methods for general application – Section 1: Measurement of thickness and overall dimensions – Tests for determining the mechanical properties

## FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. 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. The 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 the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.



3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.

4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

International Standard IEC 811-1-1 has been prepared by IEC technical committee 20: Electric cables.

This second edition cancels and replaces the first edition published in 1985, the corrigendum to the IEC 811 series, published in 1986, amendment No. 2, 1989, incorporating amendment No. 1, 1988, and constitutes a technical revision.

The text of this standard is based on the first edition (1985) and its amendment No. 2 (1989) (sub-clause 9.1.4 c)) as well as the following documents:

| DIS | Report on voting |
|---|---|
| 20(CO)205 | 20(CO)208 |

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

Annex A is for information only.

# COMMON TEST METHODS FOR INSULATING AND SHEATHING MATERIALS OF ELECTRIC CABLES –

## Part 1: Methods for general application – Section 1: Measurement of thickness and overall dimensions – Tests for determining the mechanical properties

### 1 Scope

The International Standard IEC 811-1 specifies the test methods to be used for testing polymeric insulating and sheathing materials of electric cables for power distribution and telecommunications including cables used on ships.

This section of IEC 811-1 gives the methods for measuring thicknesses and overall dimensions, and for determining the mechanical properties, which apply to the most common types of insulating and sheathing compounds (elastomeric, PVC, PE, PP, etc.).

### 1.1 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 811-1. At the time of publication of this standard, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 811-1 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.



IEC 811-1-2: 1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Two: Thermal ageing methods*

IEC 811-1-3: 1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Three: Methods for determining the density – Water absorption tests – Shrinkage test*

IEC 811-2-1: 1986, *Common test methods for insulating and sheathing materials of electric cables – Part 2: Methods specific to elastomeric compounds – Section 1: Ozone resistance test – Hot set test – Mineral oil immersion test*

### 2 Test values

Full test conditions (such as temperatures, durations, etc.) and full test requirements are not specified in this standard; it is intended that they should be specified by the standard dealing with the relevant type of cable.

Any test requirements which are given in this section may be modified by the relevant cable standard to suit the needs of a particular type of cable.

## 3 Applicability

Conditioning values and testing parameters are specified for the most common types of insulating and sheathing compounds and of cables, wires and cords.

## 4 Type tests and other tests

The test methods described in this section are intended, in the first instance, to be used for type tests. In certain tests, where there are essential differences between the conditions for type tests and those for more frequent tests, such as routine tests, these differences are indicated.

## 5 Pre-conditioning

All the tests shall be carried out not less than 16 h after the extrusion or vulcanization (or cross-linking), if any, of the insulating or sheathing compounds.

Unless otherwise specified, before any test, all test pieces, aged and unaged, shall be kept for at least 3 h at a temperature of (23 ± 5) °C.

## 6 Test temperature

Unless otherwise specified, tests shall be made at ambient temperature.



## 7 Definitions



For the purposes of this section of IEC 811-1, the following definitions apply:

7.1 **maximum tensile force**: Highest value reached by the load during the test.

7.2 **tensile stress**: Tensile force per unit of the cross-sectional area of the unstretched test piece.

7.3 **tensile strength**: Maximum tensile stress recorded in extending the test piece to breaking point.

7.4 **elongation at break**: Increase of the reference length of the test piece, expressed as the percentage of the reference length of the unstretched test piece, at breaking point.

7.5 **median value**: When several test results have been obtained and ordered in an increasing or decreasing succession, the median value is the middle value if the number of available values is odd, and is the mean of the two middle values if the number is even.

## 8 Measurement of thicknesses and overall dimensions

### 8.1 *Measurement of insulation thickness*

#### 8.1.1 *General*

Measurement of insulation thickness may be required as an individual test, or as a step in the procedure for carrying out other tests, such as the determination of mechanical properties.

In each case, the methods of selection of samples shall be in accordance with the relevant cable standard.

8.1.2 *Measuring equipment*

A measuring microscope or a profile projector of at least 10 x magnification. Both types of equipment shall allow a reading of 0,01 mm and an estimated reading to three decimal places when measuring insulation with a specified thickness less than 0,5 mm.

In case of doubt, the measuring microscope shall be taken as the reference method.

8.1.3 *Preparation of test pieces*

Any covering shall be removed from the insulation, and the conductor(s), together with separator (if any) shall be withdrawn, care being taken to avoid damage to the insulation. Semi-conducting inner and/or outer layers, if bonded to the insulation, shall not be removed.

Each test piece shall consist of a thin slice of insulation. The slice shall be cut with a suitable device (sharp knife, razor blade, etc.) along a plane perpendicular to the longitudinal axis of the conductor.

The cores of non-sheathed flat cords shall not be separated.

If the insulation carries an indented marking, thus giving rise to a local reduction in thickness, the test piece shall be taken so as to include such marking.



8.1.4 *Measuring procedure*



The test piece shall be placed under the measuring equipment with the plane of the cut perpendicular to the optical axis.

a) When the inner profile of the test piece is of circular form, six measurements shall be made radially as shown in figure 1. For sector-shaped cores, six measurements shall be made as shown in figure 2.

b) When the insulation is taken from a stranded conductor, six measurements shall be made radially as shown in figures 3 and 4.

c) When the outer profile shows unevenness, the measurement shall be carried out as shown in figure 5.

d) When there are unremovable screening layers under and/or over the insulation, they shall be excluded from the measurements.

If unremovable screening layers are present under and/or over an opaque insulation, a measuring microscope shall be used.

e) Flat non-sheathed cords shall be measured according to figure 6, the thickness of insulation in the direction of the other core being taken as half the distance between the conductors.

In all cases, the first measurement shall be taken where the insulation is thinnest.

If the insulation carries an indented marking, this shall not be included in the measurements made for the calculation of mean thickness. In any case, the thickness at the position of the indented marking shall comply with the minimum requirement specified in the relevant cable standard.