# IEC 60811-201

Edition 1.2 2023-11
CONSOLIDATED VERSION

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

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## Electric and optical fibre cables – Test methods for non-metallic materials – Part 201: General tests – Measurement of insulation thickness

## Câbles électriques et à fibres optiques – Méthodes d'essai pour les matériaux non-métalliques – Partie 201: Essais généraux – Mesure de l'épaisseur des enveloppes isolantes

IEC 60811-201:2012-03+AMD1:2017-07+AMD2:2023-11 CSV(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

## Part 201: General tests – Measurement of insulation thickness

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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 are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.**

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International Standard IEC 60811-201 has been prepared by IEC technical committee 20: Electric cables.

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

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

This part of IEC 60811 shall be read 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 document and its amendments will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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# 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.

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

## Part 201: General tests – Measurement of insulation thickness

## 1 Scope

This Part 201 of IEC 60811 gives the methods for measuring the insulation thicknesses which apply to the most common types of insulating compounds (cross-linked, PVC, PE, PP, etc.).

## 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*

## 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.

~~Unless otherwise specified, tests shall be carried out at room temperature.~~

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 method of selecting samples shall be in accordance with the relevant cable standard.

### 4.2 Measuring equipment

A measuring microscope or a profile projector of at least 10 x magnification or an optical digital image analyser shall be used. These ~~two~~ of equipment shall allow ~~a~~ the reading of 0,01 mm ~~and~~. An estimated reading to three decimal places shall be made 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.

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### 4.3 Sample and test pieces preparation

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 along a plane perpendicular to the longitudinal axis of the conductor.

The cores of non-sheathed flat cables 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.

### 4.4 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, each approximately 60°, 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.

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

f) Flat non-sheathed cables 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~~ all cases, the thickness at the position of the indented marking shall comply with the minimum requirement specified in the relevant standard.

The readings shall be made in millimetres to two decimal places if the specified thickness is 0,5 mm or above and to three estimated decimal places if the specified thickness of the insulation is less than 0,5 mm.

### 4.5 Evaluation of the measurement results

The results shall be evaluated as specified in the test requirements of the relevant cable standard.

## 5 Test report

The test report shall be in accordance with that given in IEC 60811-100 and shall include ~~measuring equipment specifications~~ the type of equipment used (microscope, profile projector or an optical digital image analyser) and the magnification used in the test.

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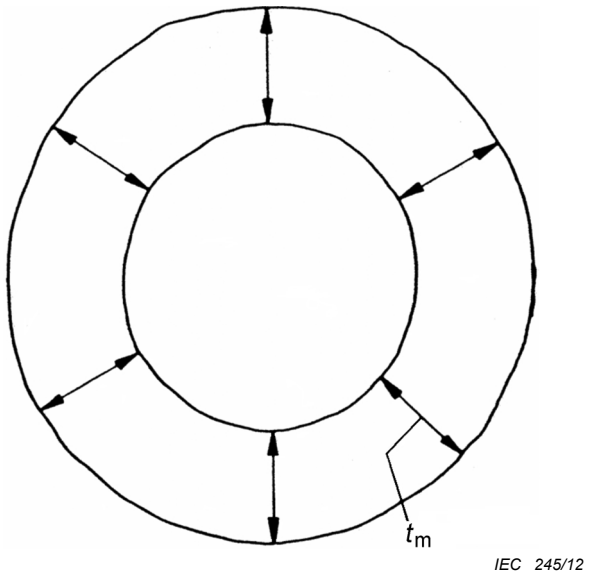
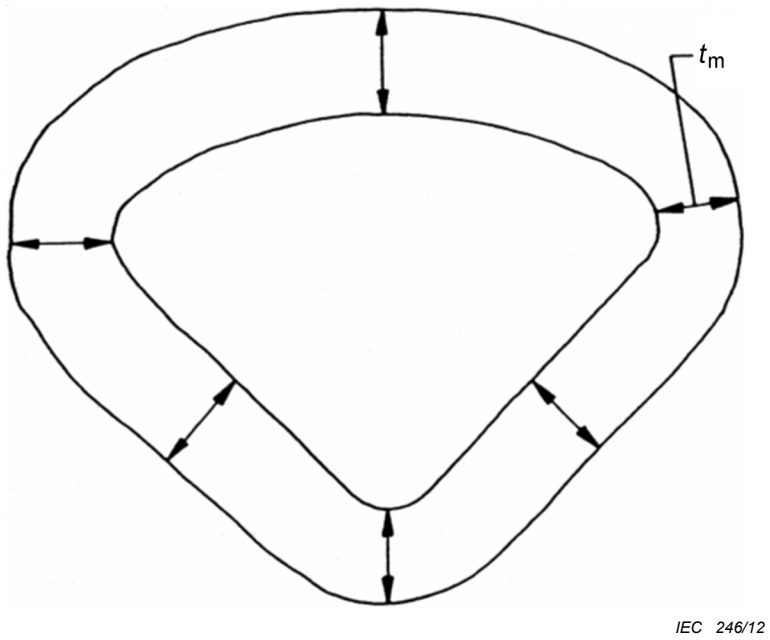



**Key**

$t_m$ minimum thickness

**Figure 1 – Measurement of insulation (circular inner profile)**




**Key**

$t_m$ minimum thickness

**Figure 2 – Measurement of insulation thickness (sectoral-shaped conductor)**

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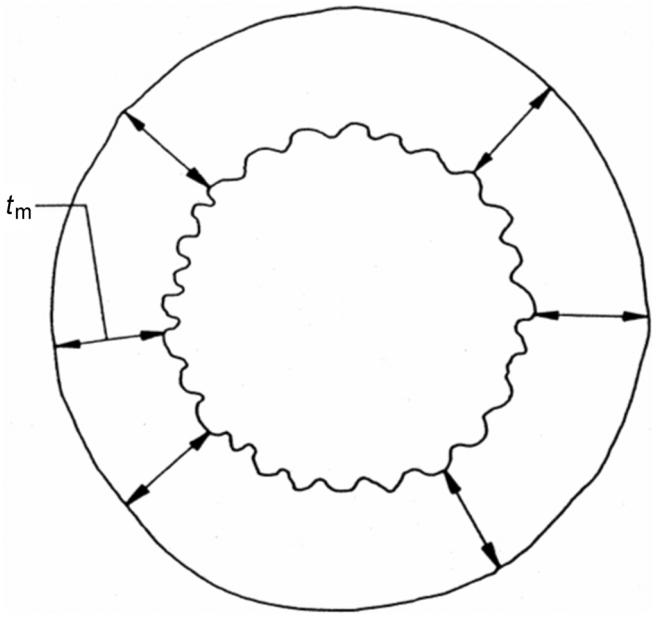
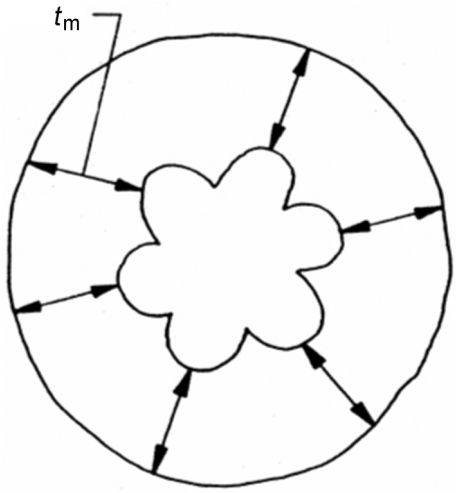



IEC 247/12

**Key**

$t_m$ minimum thickness

**Figure 3 – Measurement of insulation thickness (stranded conductor)**




IEC 248/12

**Key**

$t_m$ minimum thickness

**Figure 4 – Measurement of insulation thickness (stranded conductor)**

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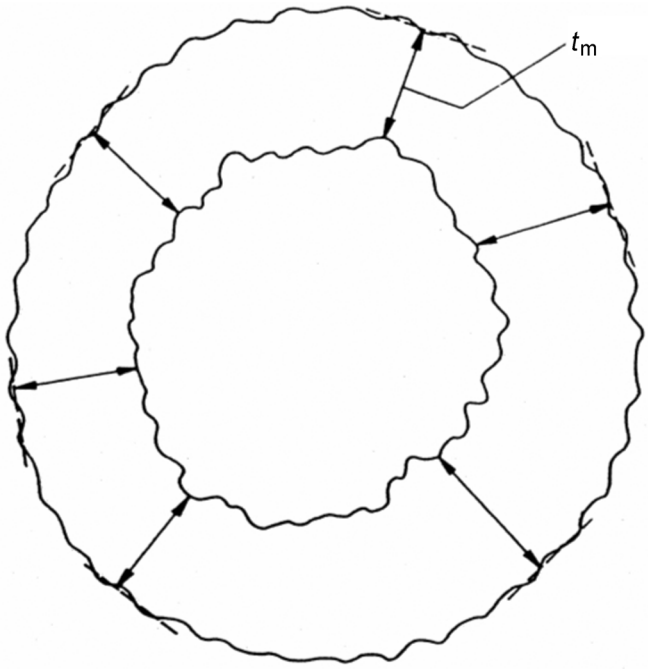
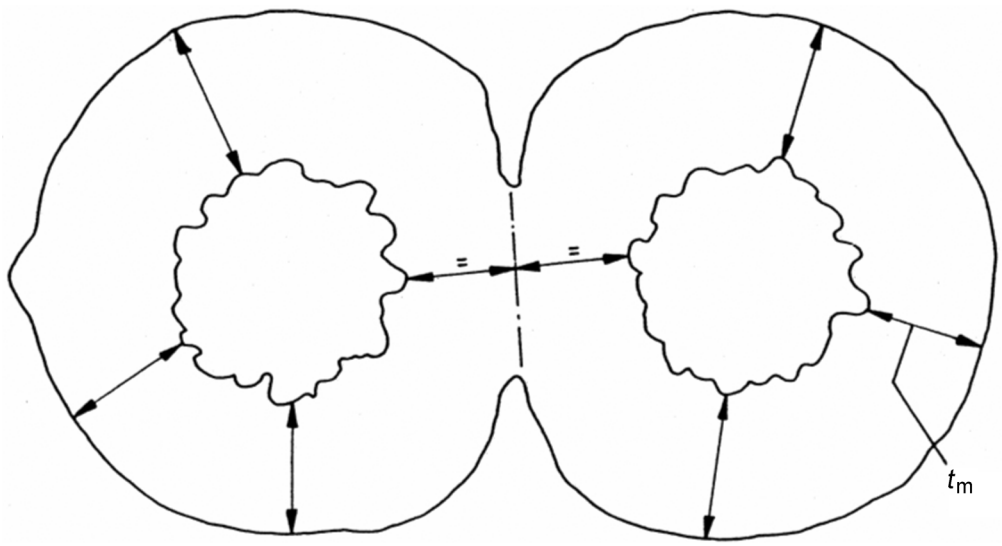



IEC 249/12

**Key**

$t_m$ minimum thickness

**Figure 5 – Measurement of insulation thickness (uneven outer profile)**




IEC 250/12

**Key**

$t_m$ minimum thickness

**Figure 6 – Measurement of insulation thickness (twin flat non-sheathed cable)**

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