IEC 60811-509

Edition 1.1 2017-07
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Electric and optical fibre cables – Test methods for non-metallic materials – Part 509: Mechanical tests – Test for resistance of insulations and sheaths to cracking (heat shock test)

Câbles électriques et à fibres optiques – Méthodes d'essai pour les matériaux non-métalliques –
Partie 509: Essais mécaniques – Essai de résistance à la fissuration des enveloppes isolantes et des gaines (essai de choc thermique)

IEC 60811-509:2012-03+AMD1:2017-07 CSV(en-fr)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.035.01; 29.060.20

ISBN 978-2-8322-4655-9

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IEC 60811-509

Edition 1.1 2017-07
CONSOLIDATED VERSION

REDLINE VERSION

VERSION REDLINE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 60811-509 edition 1.1 contains the first edition (2012-03) [documents 20/1305/FDIS and 20/1354/RVD] and its amendment 1 (2017-07) [documents 20/1737/FDIS and 20/1744/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60811-509 has been prepared by IEC technical committee 20: Electric cables.

There are no specific 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 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 the base publication and its amendment 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.

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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.

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

Part 509: Mechanical tests – Test for resistance of insulations and sheaths to cracking (heat shock test)

1 Scope

This Part 509 of IEC 60811 gives the procedure for the test for resistance of insulations and sheaths to cracking at an elevated temperature.

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.

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

Unless otherwise specified, tests shall be carried out at room temperature. The heat shock test was specifically developed for PVC compounds. The use of this test for other types of compounds needs careful consideration.

NOTE In the absence of any requirement in the relevant cable standard, Annex A in this standard gives a recommendation for the test conditions and test requirements.

4.2 Apparatus

The apparatus consists of the following parts:

a) an air oven capable of maintaining the temperature and tolerance specified;

b) mandrels of sufficient length made of metal or other suitable material.

4.3 Sample and test piece preparation for insulations

4.3.1 General

Each core to be tested shall be represented by two samples of suitable length taken from two places separated by at least 1 m. External coverings, if any, shall be removed from the insulation.

The test pieces shall be prepared in one of the three following ways:

a) For cores with an overall diameter not exceeding 12,5 mm, each test piece shall consist of a piece of core.

b) For cores with an overall diameter exceeding 12,5 mm and having an insulation thickness not exceeding 5 mm, and for all sector-shaped cores, each test piece shall consist of a strip taken from the insulation whose width shall be at least 1,5 times its thickness, but not less than 4 mm. The strip shall be cut in the direction of the axis of the conductor. In the case of sector-shaped cores, it shall be cut out of the “back” of the core.

c) For cores with an overall diameter exceeding 12,5 mm and a wall thickness exceeding 5,0 mm, each test piece shall consist of a strip cut in accordance with item b) and then ground or cut (avoiding heating) on the outer surface, to a thickness between 4,0 mm and 5,0 mm. This thickness shall be measured on the thicker part of the strip, whose width shall be at least 1,5 times the thickness.

4.3.2 Procedure

Each test piece shall be tautly wound and fixed, at ambient temperature, on a mandrel to form a close helix, as given below:

a) For test pieces prepared in accordance with 4.3.1 a), and ~~for~~ flat cables with major axis not exceeding 12,5 mm, the diameter of the mandrel and the number of turns shall be as given below in Table 1. The mandrel diameter shall be based on the minor dimension of the core which is wound on with its minor axis perpendicular to the mandrel.

Table 1 – Diameter of mandrel and number of turns for cores with overall diameter not exceeding 12,5 mm

External diameter of test piece mm	Mandrel diameter (maximum) mm	Number of turns
Up to and including 2,5	5	6
Over 2,5 up to and including 4,5	9	6
Over 4,5 up to and including 6,5	13	6
Over 6,5 up to and including 9,5	19	4
Over 9,5 up to and including 12,5	40	2

b) For test pieces prepared in accordance with 4.3.1 b) and c), the diameter of the mandrel and the number of turns shall be as given below in Table 2. In this case, the inner surface of the test piece shall be in contact with the mandrel.

Table 2 – Diameter of mandrel and number of turns for cores with overall diameter exceeding 12,5 mm

Thickness of test piece mm	Mandrel diameter (maximum) mm	Number of turns
Up to and including 1	2	6
Over 1 up to and including 2	4	6
Over 2 up to and including 3	6	6
Over 3 up to and including 4	8	4
Over 4 up to and including 5	10	2

For the application of Tables 1 and 2, the diameter or thickness of each test piece shall be measured by means of callipers or any other suitable measuring instrument.

Each test piece, on its mandrel, shall be placed in the oven, pre-heated to the temperature specified in the relevant cable standard or, if no other is specified in the cable standard, to that given in Annex A of this standard.

The test pieces shall be removed from the oven and allowed to attain approximately ambient temperature. They shall then be examined while still on the mandrel.

4.3.3 Expression of results

The test pieces shall show no cracks when examined with normal or corrected vision without magnification. Cracks at the fixing points shall not be recorded as a fault.

A crack is ~~considered to be a crack if it goes~~ a sharp fissure which has propagated through the whole insulation and/or sample thickness.

A more rounded opening due to polymer melt deformation shall not be interpreted as a crack.

4.4 Sample and test piece preparation for sheaths

4.4.1 General

Each sheath to be tested shall be represented by two samples of cable of suitable length taken from two places, separated by at least 1 m. Any external coverings shall be removed.

a) For ~~sheaths~~ cables with an overall diameter not exceeding 12,5 mm, each test piece shall consist of a piece of cable, except for polyethylene-insulated ~~PVC sheathed~~ cables, where a strip of the sheath shall be prepared according to item b), c) or d).

b) For ~~sheaths~~ cables with an overall diameter exceeding 12,5 mm and with a sheath wall thickness not exceeding 5,0 mm, and for sheaths of polyethylene-insulated cables, each test piece shall consist of a strip taken from the sheath, whose width shall be at least 1,5 times its thickness but not less than 4 mm; the strip shall be cut in the direction of the axis of the cable.

c) For ~~sheaths~~ cables with an overall diameter exceeding 12,5 mm and a sheath wall thickness exceeding 5,0 mm, each test piece shall consist of a strip cut in accordance with item b) and then ground or cut (avoiding heating) on the outer surface, to a thickness between 4,0 mm and 5,0 mm. This thickness shall be measured on the thicker part of the strip, whose width shall be at least 1,5 times the thickness.

d) For flat cables, if the major axis (width) of the cable does not exceed 12,5 mm, each test piece shall ~~be~~ consist of a piece of ~~complete~~ cable, except for polyethylene-insulated cables, where a strip of the sheath shall be prepared according to item b). If the major axis (width) of the cable exceeds 12,5 mm, each test piece shall consist of a strip taken from the sheath as specified in item b).

4.4.2 Procedure

Each test piece shall be tautly wound and fixed, at ambient temperature, on a mandrel to form a close helix, as given below:

a) For test pieces prepared in accordance with ~~4.3.1~~ 4.4.1 a), and flat cables of width not exceeding 12,5 mm in accordance with 4.4.1 d), the diameter of the mandrel and the number of turns shall be as given in ~~4.4.1 a)~~ Table 1. The mandrel diameter shall be based on the minor dimensions of the cable which is wound on with its minor axis perpendicular to the mandrel.

b) For test pieces prepared in accordance with ~~4.3.1~~ 4.4.1 b) and c), and flat cables wider than 12,5 mm in accordance with 4.4.1 d), the diameter of the mandrel and the number of turns shall be as given in ~~4.4.1 b)~~ Table 2. In this case, the inner surface of the test piece shall be in contact with the mandrel.

   The diameter or thickness of each test piece shall be measured by means of calipers or any other suitable measuring instrument.

4.4.3 Measurements

In accordance with 4.3.2 of this standard.

~~A crack is considered to be a crack if it goes through the whole sheath and/or sample thickness.~~

4.4.4 Expression of the results

In accordance with 4.3.3 of this standard.

A crack is a sharp fissure which has propagated through the whole sheath and/or sample thickness.

A more rounded opening due to polymer melt deformation shall not be interpreted as a crack.

5 Test report

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

Annex A
(informative)

Recommended performance requirement

The performance requirements for a particular type or class of insulated conductor or cable should preferably be given in the individual cable standard.

In the absence of any given requirement, it is recommended that the following values are adopted for any cable tested against this standard:

– test temperature: (150 ± 3) °C
– test time: 1 h
– requirement: no cracks going through the sample of the insulation or sheath.