

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Electric and optical fibre cables – Test methods for non-metallic materials –
Part 408: Miscellaneous tests – Long-term stability test of polyethylene and
polypropylene compounds**

**Câbles électriques et à fibres optiques – Méthodes d'essai pour les matériaux
non-métalliques –
Partie 408: Essais divers – Essai de stabilité à long terme pour les mélanges
polyéthylène et polypropylène**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRIC AND OPTICAL FIBRE CABLES –
TEST METHODS FOR NON-METALLIC MATERIALS –****Part 408: Miscellaneous tests –
Long-term stability test of polyethylene and polypropylene compounds**

FOREWORD

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International Standard IEC 60811-408 has been prepared by IEC technical committee 20: Electric cables.

This Part 408 of IEC 60811 cancels and replaces Annex A of IEC 60811-4-2:2004, which is withdrawn.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 |
|--------------|------------------|
| 20/1292/FDIS | 20/1341/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- withdrawn,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.

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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 408: Miscellaneous tests – Long-term stability test of polyethylene and polypropylene compounds

1 Scope

This Part 408 of IEC 60811 gives the procedure to establish as to whether or not the quality of a cable's components will be satisfactory over the proposed life of a communication cable.

This test is considered only as a material selection test to ensure that the chosen materials are satisfactory for the intended life of the cable. The test duration makes the test unsuitable for routine quality control testing; one method found suitable for monitoring raw materials is given in IEC 60811-410.

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, Geneva, 2012, <https://standards.iteh.ai/catalog/standards/sist/814e9f28-0d03-4e62-9ffc-1a7f92302649/iec-60811-408-2012>

IEC 60811-410, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 410: Miscellaneous tests – Test method for copper-catalyzed oxidative degradation of polyolefin insulated conductors*

ISO 188, *Rubber, vulcanized or thermoplastic – Accelerated ageing and heat resistance tests*

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 Test method for unfilled cables

4.1.1 General

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

NOTE This test method is only applicable to communication cables containing copper pairs. A similar test method applicable to electric cables for power distribution is under consideration.

The need to establish whether or not the quality of a cable's components will be satisfactory over the proposed life of the cable is well recognized. In particular, polyolefin insulation shall have sufficient resistance to ageing in service.

The definition of test duration, temperature, atmosphere and failure criteria shall be carefully chosen.

One of the two test conditions, differing in test temperatures and duration, shall be used according to the severity of cable system conditions, as specified in the cable standard.

Condition A: Applies to insulations in cables or installations under moderate conditions generally below 50 °C such as directly buried cables, cables in ducts or troughs, or cables exposed above ground in temperate climates:

- 100 °C for 42 days.

Condition B: Applies to insulation in cables or installations in above-ground situations under hot conditions, for instance cabinets or terminal boxes:

- 105 °C for 42 days.

4.1.2 Apparatus

For the purpose of this test, the different equipment used is as follows:

- a) An air oven generally in accordance with ISO 188 and complying especially with the following criteria:
 - the mean temperature throughout the test shall be controlled to within $\pm 0,5$ °C of the specified temperature;
 - the maximum variation of temperature throughout the test shall not exceed $\pm 1,0$ °C of the specified temperatures;
 - exchange of clean dry air at least 6 changes of air per hour; in case of dispute, the maximum rate of change shall be 10 changes per hour.

NOTE Alternatively, a test apparatus consisting of one or more cells having the following dimensions may be used, provided that the above criteria are followed.

| | |
|---------------------------|---------------------|
| Cell height: | at least 250 mm; |
| Cell diameter: | at least 75 mm; |
| Height to diameter ratio: | between 3:1 and 4:1 |

- b) An air flow meter with a measuring range dependent on the size of the air oven according to a).
- c) A thermocouple or thermometer allowing a resolution of not greater than 0,1 °C and total measurement uncertainty not greater than 0,2 °C.
- d) An analytical balance accurate to 0,5 mg and readable and repeatable to 0,1 mg.

4.1.3 Sample and test piece preparation

Three samples of each colour and 2 m in length shall be taken from a sample of unfilled finished cable. They shall be subjected to the test described in Annex A, and shall satisfy the requirement in Clause A.4.

At least three test pieces of 200 mm length shall then be cut from each sample that has been tested as specified above. These test pieces shall be cut at equidistant intervals, the first being taken at 200 mm from one end of the sample.

One end of each 200 mm length shall be wound manually around the other end to give at least 10 contiguous turns. They shall be visually examined for cracks and splits.

4.1.4 Ageing procedure

The test pieces so formed shall be suspended in an air-circulating oven at (60 ± 2) °C for seven days.

4.1.5 Evaluation of the result

At the end of the treatment period the test pieces, when visually examined, shall be free from cracks and splits.

4.2 Test method for fully filled cables

4.2.1 General

See 4.1.1.

For filled polyolefin insulated cables, compatibility of the combination of the insulation and filling compound shall be assessed.

4.2.2 Apparatus

See 4.1.2.

4.2.3 Sample and test piece preparation

Three samples of each colour and 2,5 m in length shall be conditioned during seven days in the associated filling compound at the following temperatures:

- $(60 \pm 2) ^\circ\text{C}$ for filling compounds having a drop-point above $50 ^\circ\text{C}$ and up to and including $70 ^\circ\text{C}$;
- $(70 \pm 2) ^\circ\text{C}$ for filling compounds having a drop-point above $70 ^\circ\text{C}$.

NOTE For an explanation of the drop-point, see IEC 60811-601.

Conditioning may be performed either on insulated cores by immersion in about 200 g of filling compound (except for the ends) contained in a glass vessel, or on a cable. If a cable is used, care shall be taken in removing the test pieces after conditioning.

After pre-conditioning, the samples shall be carefully wiped free of excess filling compound using an absorbent lint-free tissue. The ends which were not immersed in the filling compound shall be discarded, to obtain three samples of each colour and 2 m in length. These samples shall be subjected to the test described in Annex A, and shall satisfy the requirement in Clause A.4.

Then, at least three test pieces of 200 mm length shall be cut from the each sample that has been tested as specified above. These test pieces shall be cut at equidistant intervals, the first being taken at 200 mm from one end of the sample.

One end of each 200 mm length shall be wound manually around the other end to give at least 10 contiguous turns. They shall be visually examined for cracks and splits.

4.2.4 Ageing procedure

See 4.1.4.

4.2.5 Evaluation of the result

See 4.1.5.

5 Test report

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

Annex A (normative)

Sample conditioning

A.1 Sample preparation

Each of the three samples shall be wound individually into a loose coil of about 60 mm diameter. There shall be no twists or kinks in the test piece. If necessary, the coil may be secured with two loose ties of aluminium wire.

Each sample shall be weighed to the nearest 0,1 mg.

A.2 Ageing procedure

Each of the three samples shall be suspended in the lower part of the air oven by means of an aluminium wire hook attached to the lid. A thermocouple or a suitable thermometer shall be used to check that the air temperature at the centre of the coil is maintained at the specified temperature according to Condition A or Condition B (see 4.1.1).

If a testing apparatus consisting of ageing cells is used, it is preferable to age each sample in a separate cell. However, if necessary, up to three samples may be aged together in one cell, provided they are suspended 3 mm to 5 mm apart so as not to touch each other or the cell wall.

NOTE The use of a data logger to monitor temperature throughout the test is recommended.

At the end of the specified test period, the samples shall be removed from the air oven, and cooled to ambient temperature.

A.3 Measurements

After ageing, each sample shall be weighed to the nearest 0,1 mg.

A.4 Evaluation of the result

The insulation shall be visually examined and shall be free from cracks and splits and any other signs of polymer degradation; the colours shall remain identifiable.

Calculate the mass increase, which shall not be greater than 1 mg.

Alternatively, an induction time of at least 2 min shall be observed in the OIT test in IEC 60811-410.