

Insulating and sheathing materials of electric and optical cables — Common test methods —

Part 4-1: Methods specific to polyethylene and polypropylene compounds — Resistance to environmental stress cracking — Measurement of the melt flow index — Carbon black and/or mineral filler content measurement in polyethylene by direct combustion — Measurement of carbon black content by termogravimetric analysis (TGA) — Assessment of carbon black dispersion in polyethylene using a microscope

The European Standard EN 60811-4-1:2004 has the status of a British Standard

ICS 29.035.20; 29.060.20

National foreword

This British Standard is the official English language version of EN 60811-4-1:2004. It is identical with IEC 60811-4-1:2004. It supersedes BS EN 60811-4-1:1995 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee GEL/20, Electric cables, to Subcommittee GEL/20/17, Low voltage cables, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 25 and a back cover.

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Amendments issued since publication

Amd. No.	Date	Comments

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 2 September 2004

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ISBN 0 580 44386 8

English version

**Insulating and sheathing materials of electric and optical cables –
Common test methods**

Part 4-1: Methods specific to polyethylene and polypropylene compounds - Resistance to environmental stress cracking - Measurement of the melt flow index - Carbon black and/or mineral filler content measurement in polyethylene by direct combustion - Measurement of carbon black content by thermogravimetric analysis (TGA) - Assessment of carbon black dispersion in polyethylene using a microscope (IEC 60811-4-1:2004)

Matériaux d'isolation et de gainage des câbles électriques et optiques - Méthodes d'essais communes
Partie 4-1: Méthodes spécifiques pour les mélanges polyéthylène et polypropylène - Résistance aux craquelures sous contraintes dues à l'environnement - Mesure de l'indice de fluidité à chaud - Mesure dans le polyéthylène du taux de noir de carbone et/ou des charges minérales par méthode de combustion directe - Mesure du taux de noir de carbone par analyse thermogravimétrique - Evaluation de la dispersion du noir de carbone dans le polyéthylène au moyen d'un microscope
(CEI 60811-4-1:2004)

Isolier- und Mantelwerkstoffe für Kabel und isolierte Leitungen - Allgemeine Prüfverfahren
Teil 4-1: Besondere Verfahren für Polyethylen- und Polypropylen-Verbindungen - Spannungsrissbeständigkeit - Messung des Schmelzindex - Bestimmung des Ruß- und/oder Füllstoffgehaltes in Polyethylen durch direkte Verbrennung - Bestimmung des Rußgehaltes durch thermogravimetrische Analyse (TGA) - Bewertung der Rußverteilung in Polyethylen unter Verwendung eines Mikroskops
(IEC 60811-4-1:2004)

This European Standard was approved by CENELEC on 2004-07-01. 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.

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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 document 20/687/FDIS, future edition 2 of IEC 60811-4-1, prepared by IEC TC 20, Electric cables, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60811-4-1 on 2004-07-01.

This European Standard supersedes EN 60811-4-1:1995.

The principal changes with respect to EN 60811-4-1:1995 are:

- a) the wrapping test after thermal ageing in air is deleted from this part of EN 60811. It is now given only in EN 60811-4-2;
- b) a thermogravimetric method is added for determination of carbon black content;
- c) a method is introduced for assessment of carbon black dispersion.

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) 2005-04-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2007-07-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60811-4-1:2004 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60811-4-2	NOTE	Harmonized as EN 60811-4-2:2004 (not modified).
ISO 1133	NOTE	Harmonized as EN ISO 1133:1997 (not modified).

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INSULATING AND SHEATHING MATERIALS OF ELECTRIC AND OPTICAL CABLES – COMMON TEST METHODS –

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1 General

1.1 Scope

This part of IEC 60811 specifies the test methods to be used for testing polymeric insulating and sheathing materials of electric and optical fibre cables for power distribution and telecommunications, including cables used on ships and in offshore applications. These test methods apply specifically to PE and PP compounds, including cellular compounds and foam skin for insulation.

1.2 Normative references

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

IEC 60811-1-3:1993, *Insulating and sheathing materials of electric cables – Common test methods – Part 1: General application – Section 3: Methods for determining the density – Water absorption tests – Shrinkage test*

ISO 18553:2002, *Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds*

2 Terms and definitions

For the purposes of this document, a distinction is made between low-density, medium-density and high-density PE as shown below:

Type of polyethylene	Density at 23 °C ^a g/cm ³
Low-density polyethylene	≤0,925
Medium-density polyethylene	>0,925 ≤0,940
High-density polyethylene	>0,940

^a These densities refer to unfilled resins as determined by the method specified in Clause 8 of IEC 60811-1-3.

3 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 standard may be modified by the relevant cable standard to suit the needs of a particular type of cable.

4 Applicability

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

5 Type tests and other tests

The test methods described in this standard are primarily intended 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.

6 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.

7 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 the mean of the two middle values if the number is even.

8 Resistance to environmental stress cracking

8.1 General

These test procedures apply only to the original granules used as sheathing materials.

Procedure A

Applies to materials which will encounter less severe cable system conditions and environments.

Procedure B

Applies to materials which will encounter more severe cable system conditions and environments.

8.2 Apparatus

The apparatus shall comprise the following elements:

8.2.1 Heatable press for producing moulded test sheets, with platens which are larger than the backing plates.

8.2.2 Two rigid metal backing plates ($6 \pm 0,5$) mm thick and about 200 mm $\times$ 230 mm in area, each drilled with a hole from one edge so that a temperature sensor can be located within 5 mm of the centre of the plate.

8.2.3 Two separator sheets, about 200 mm $\times$ 230 mm, for instance aluminium foil 0,1 mm to 0,2 mm thick.

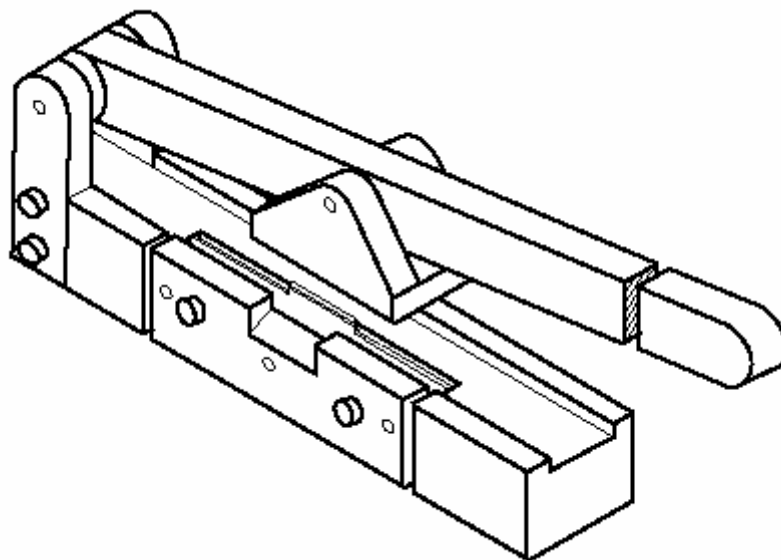
8.2.4 Suitable moulding chases for producing test sheets, 150 mm $\times$ 180 mm $\times$ ($3,3 \pm 0,1$) mm with internal corners rounded to a radius of 3 mm.

8.2.5 Electrically heated air oven with forced air circulation and programming device which lowers temperature at a rate of ($5 \pm 0,5$) K/h.

8.2.6 Clean, sharp, undamaged blanking die with blanking press suitable for cutting test pieces ($38,0 \pm 2,5$) mm $\times$ ($13,0 \pm 0,8$) mm or other suitable devices.

8.2.7 Dial gauge, with plane gauging faces 4 mm to 8 mm in diameter and a gauging pressure of 5 N/cm² to 8 N/cm².

8.2.8 Notching devices as in Figure 1 with blades as in Figure 2.



IEC 621/04

NOTE The blade is made of "Gem" blades as in Figure 2 – see also Annex A.

Figure 1 – Notching device