

Insulating and sheathing materials of electric cables

**Part 4. Methods of test specific to polyethylene and
polypropylene compounds**

**Section 4.2 Elongation at break after
pre-conditioning — Wrapping test after
pre-conditioning — Wrapping test after
thermal ageing in air — Measurement of
mass increase — Long-term stability test
— Test method for copper-catalysed
oxidative degradation**

(Implementation of HD 505.4.2 S1)

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Cables and Insulation Standards Policy Committee (CIL/-) to Technical Committee CIL/20, upon which the following bodies were represented:

- Aluminium Federation
- Association of Consulting Engineers
- Association of Manufacturers of Domestic Electrical Appliances
- British Approvals Service for Cables
- British Cable Makers' Confederation
- British Plastics Federation
- British Steel Industry
- British Telecommunications plc
- Department of the Environment (Property Services Agency)
- Department of Trade and Industry (Consumer Safety Unit, CA Division)
- Electricity Association
- Engineering Equipment and Materials Users' Association
- Institution of Electrical Engineers
- London Regional Transport

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- British Railways Board
- British Rubber Manufacturers' Association Ltd.
- ERA Technology Ltd.
- GAMBICA (BEAMA Ltd.)
- Institution of Incorporated Executive Engineers
- London Underground Ltd.
- Queen Mary and Westfield College
- Telecommunications Cables Group of BCMC

This British Standard, having been prepared under the direction of the Cables and Insulation Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 August 1992

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National foreword

This Section of BS 6469 has been prepared under the direction of the Cables and Insulation Standards Policy Committee. BS 6469 : Parts 1 to 5 and Part 99 supersede BS 6469 : 1990 which is withdrawn.

Parts 1 to 5 implement CENELEC HD 505 : Parts 1 to 5. Part 99 describes test methods having national applicability only.

The International Electrotechnical Commission has completed its comprehensive update of the test methods previously given in IEC 538, IEC 538A and IEC 540, which are now largely brought together in IEC 811. Electrical tests from IEC 540 have been incorporated into IEC 885. The technical changes introduced during this update, and endorsed by CENELEC in HD 505, are now included in BS 6469.

BS 6469 : Section 4.2 includes a number of test methods described in BS 6234. Other test methods from BS 6234, from BS 6746 and from BS 6899 have been incorporated in BS 6469 : Part 99. The status of these test methods in BS 6234, BS 6746 and BS 6899 will be reviewed separately.

BS 6469 describes methods of test, but does not specify requirements for products or materials. These will be specified in the relevant cable standards or cable material standards.

This Section of BS 6469 implements CENELEC Harmonization Document HD 505.4.2 S1 : 1992, which is identical with IEC 811-4-2 : 1990.

Definitions of terms relating to electric cables are given in BS 4727 : Part 2 : Group 08.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

WARNING. The methods of test described in this British Standard do not necessarily detail all precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974. Attention should be paid to any appropriate safety precautions and the tests should be carried out only by trained personnel.

Cross-references between the relevant clauses in BS 6469 : 1990 and those in BS 6469 : Parts 1 to 5 and Part 99 are given in table NB.1. Tests included in BS 6469 : Sections 1.3 and 5.1 which were not given in BS 6469 : 1990 are listed in table NC.1.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

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Descriptors: Electric cable, insulated cable, electrical insulation, outer sheath, polyethylene, polypropylene, test method, elongation at break, stability test, oxidation resistance, copper

English version

Common test methods for insulating and sheathing materials of electric cables

Part 4. Methods specific to polyethylene and polypropylene compounds

Section 2 — Elongation at break after pre-conditioning — Wrapping test after pre-conditioning — Wrapping test after thermal ageing in air — Measurement of mass increase — Long-term stability test (Appendix A) — Test method for copper-catalysed oxidative degradation (Appendix B)

(IEC 811-4-2 : 1990)

Méthodes d'essais communes pour les matériaux d'isolation et de gainage des câbles électriques
Quatrième partie: Méthodes spécifiques pour les mélanges polyéthylène et polypropylène
Section deux — Allongement à la rupture après préconditionnement — Essai d'enroulement après préconditionnement — Essai d'enroulement après vieillissement thermique dans l'air — Mesure de l'augmentation de masse — Essai de stabilité à long terme (annexe A) — Méthode d'essai pour l'oxydation catalytique par le cuivre (annexe B)
(CEI 811-4-2 : 1990)

Allgemeine Prüfungen für Isolier- und Mantelwerkstoffe für Kabel und isolierte Leitungen
Teil 4: Besondere Methoden für Polyäthylen und Polypropylen Compounds
Hauptabschnitt Zwei: Reißdehnung nach Konditionierung — Wickelprüfung nach Konditionierung —
Wickelprüfung nach Alterung in Luft — Messung der Masseaufnahme — Langzeit-Stabilitätsprüfung (Anhang A)— Prüfungen für kathalytsiche Oxydation durch Kupfer (Anhang B)
(IEC 811-4-2 : 1990)

This Harmonization Document was approved by CENELEC on 1991-12-10. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document on a national level.

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

This Harmonization Document exists in three official versions (English, French, German).

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

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Foreword

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 811-4-2 : 1990 could be accepted without textual changes, has shown that no CENELEC common modifications were necessary for the acceptance as Harmonization Document.

The reference document was submitted to the CENELEC members for formal vote and was approved by CENELEC as HD 505.5.1 S1 on 10 December 1991.

The following dates were fixed:

- latest date of
announcement of the
HD at national level (doa) 1992-06-01
- latest date of
publication of a
harmonized national
standard (dop) 1992-12-01
- latest date of
withdrawal of
conflicting national
standards (dow) 1992-12-01

For products which have complied with the relevant national standard before 1992-12-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1997-12-01.

Annexes designated ‘‘normative’’ are part of the body of the standard. In this standard, annex ZA is normative.

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COMMON TEST METHODS FOR INSULATING AND SHEATHING MATERIALS OF ELECTRIC CABLES

Part 4: Methods specific to polyethylene and polypropylene compounds

Section Two - Elongation at break after pre-conditioning -

Wrapping test after pre-conditioning -

Wrapping test after thermal ageing in air -

Measurement of mass increase - Long-term stability test (Appendix A) -

Test method for copper-catalysed oxidative degradation (Appendix B)

1. Scope

This standard specifies the test methods for testing polymeric insulating and sheathing materials of electric cables for power distribution and telecommunications including cables used on ships.

This Section Two of Part 4 gives the methods for measurement of elongation at break after pre-conditioning, for wrapping test after pre-conditioning, for wrapping test after thermal ageing in air, for measurement of mass increase, for long-term stability test and for measurement of copper-catalysed oxidative degradation, which apply to polyolefin insulations.

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 standard 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. Definitions

For the purpose of these tests, a distinction shall be made between low-density, medium-density and high-density PE:

Low-density polyethylene	$\leq 0,925 \text{ g/cm}^3$	} at 23 °C
Medium-density polyethylene	$> 0,925 \leq 0,940 \text{ g/cm}^3$	
High-density polyethylene	$> 0,940 \text{ g/cm}^3$	

Note. - These densities refer to unfilled resins as determined by the method specified in Clause 8 of Publication 811-1-3.

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.

Note. – For multicore cables and cords, not more than three cores (of different colours, if any) shall be tested unless otherwise specified in the relevant cable standard.

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. Elongation at break after pre-conditioning

8.1 General

This test is intended for polyolefin insulations with a wall thickness of less than 0.8 mm of filled cables.

8.2 Pre-conditioning procedure

A sample of complete cable of sufficient length shall be pre-conditioned in air (i.e. suspended in an oven). The temperature of the air shall be maintained continuously at a temperature and duration as follows:

- 7 x 24 h at 60 °C for filling compound having a nominal drop-point above 50 °C and up to and including 70 °C.
- 7 x 24 h at 70 °C for filling compound having a nominal drop-point above 70 °C.

After pre-conditioning, the cable sample shall be left at ambient temperature for at least 16 h without being exposed to direct sunlight. Then the sheath shall be removed and the cores shall be cleaned by suitable means.

8.3 Apparatus

A tensile strength testing machine with grips either of a self-tightening type or of a non self-tightening type for tubular test pieces.