

Insulating and sheathing materials of electric cables

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

**Section 4.1 Resistance to environmental
stress cracking — Wrapping test after
thermal ageing in air — Measurement of
the melt flow index — Carbon black
and/or mineral content measurement
in PE**

(Implementation of HD 505.4.1 S2)

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 BS 6469 : Parts 1 to 5 and Part 99 supersede BS 6469 : 1990 which is withdrawn.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 which were derived from IEC 811 : 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 505.4.1 S2 : 1990, which is identical with IEC 811-4-1 : 1985 plus Amendment No. 1 (1988) plus corrigendum (1986).

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.

The complete IEC standard (IEC 811) will eventually replace IEC Publications 538 and 540. To enable users to compare the relevant clauses in all three publications, a table of cross-references is given in appendix B.

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, sheath, resistance to cracking, wrapping test, measurement, melt flow index, carbon black

English version

Common test methods for insulating and sheathing materials of electric cables

Part 4. Methods specific to polyethylene and polypropylene compounds
Section one — Resistance to environmental stress cracking — Wrapping test after thermal ageing in air — Measurement of the melt flow index — Carbon black and/or mineral content measurement in PE

(IEC 811-4-1 : 1985 + Amendment 1 : 1988)

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 un: Résistance aux craquelures sous contraintes dues à l'environnement — Essai d'enroulement après vieillissement thermique dans l'air — Mesure de l'indice de fluidité à chaud — Mesure dans le PE du taux de noir de carbone et/ou des charges minérales
(CEI 811-4-1 : 1985 + Modification 1 : 1988)

Allgemeine Prüfungen für Isolier- und Mantelwerkstoffe für Kabel und isolierte Leitungen
Teil 4: Besondere Methoden für Polyäthylen und Polypropylen Compounds
Hauptabschnitt 1: Widerstand gegen umgebungsbedingte Spannungsrisse — Wickelprüfung nach thermischer Luftalterung — Messung des Schmelzindex — Bestimmung des Ruß- und/oder Mineralstoffgehalts in PE
(IEC 811-4-1 : 1985 + Änderung 1 : 1988)

This Harmonization Document was approved by CENELEC on 1990-01-01. 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 English and French versions of this Harmonization Document are provided by the text of the IEC publication and the German version is the official translation of the IEC text.

According to the CENELEC Internal Regulations the CENELEC member National Committees are bound:

- to announce the existence of this Harmonization Document at national level by or before 1990-06-01

- to publish their new harmonized national standard by or before 1990-12-01

- to withdraw all conflicting national standards by or before 1990-12-01.

Harmonized national standards are listed on the HD information sheet, which is available from the CENELEC National Committees or from the CENELEC Central Secretariat.

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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 ONE — RESISTANCE TO ENVIRONMENTAL STRESS CRACKING — WRAPPING TEST AFTER THERMAL AGEING IN AIR — MEASUREMENT OF THE MELT FLOW INDEX — CARBON BLACK AND/OR MINERAL FILLER CONTENT MEASUREMENT IN PE

1. Scope

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

This Section One of Part Four gives the methods for measurement of the resistance to environmental stress cracking, for wrapping test after thermal ageing in air, for measurement of melt flow index and for measurement of carbon black and/or mineral filler content, which apply to PE and PP compounds, including cellular compounds and foam skin for insulation.

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	$\leq 0.925 \text{ g/cm}^3$	} 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: Common Test Methods for Insulating and Sheathing Materials of Electric Cables, Part 1: Methods for General Application — Section Three: Method for Determining the Density — Water Absorption Tests — Shrinkage Test.

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 is 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

- 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 ± 0.5 mm thick and about 200 mm $\times$ 230 mm 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 ± 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 ± 0.5 °C/h.
- 8.2.6 Clean, sharp, undamaged blanking die with blanking press suitable for cutting test pieces 38.0 ± 2.5 mm $\times$ 13.0 ± 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.