BRITISH STANDARD

BS 6469 :
Section 1.2 :
1992

Insulating and sheathing materials of electric cables

Part 1. Methods of test for general application

Section 1.2 Thermal ageing methods

(Implementation of HD 505.1.2 S2)

BSI
STANDARDS

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

Amendments issued since publication

Amd. No.	Date	Text affected

The following BSI references relate to the work on this standard:
Committee reference CIL/20
Draft announced in *BSI News* December 1991

ISBN 0 580 20839 7

Contents

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 BS 6469 : Parts 1 to 5 and Part 99 supersede BS 6469 : 1990 which is withdrawn.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 the 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 505.1.2 S2 : 1991, which is identical with IEC 811-1-2 : 1985 plus Amentment No. 1 (1989) 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 A.

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.

References to page numbers in the text relate to the IEC page numbers and should be ignored.

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

HARMONIZATION DOCUMENT
DOCUMENT D'HARMONISATION
HARMONISIERUNGSDOKUMENT

HD 505.1.2 S2

February 1991

UDC 621.315.6 : 621.315.2 : 620.199.94

Descriptors: Electric cable, insulated cable, electrical insulation, sheath, ageing treatment, ageing

English version

Common test methods for insulating and sheathing materials of electric cables

Part 1. Methods for general application
Section two — Thermal ageing methods

(IEC 811-1-2 : 1985 + Amendment 1 : 1989)

Méthodes d'essais communes pour les matériaux d'isolation et de gainage des câbles électriques
Première partie: Méthodes d'application générale
Section deux — Méthodes de vieillissement thermique
(CEI 811-1-2 : 1985 + Modification 1 : 1989)

Allgemeine Prüfungen für Isolier- und Mantelwerkstoffe für Kabel und isolierte Leitungen
Teil 1: Allgemeine Prüfverfahren
Hauptabschnitt 2: Thermische Alterungsarten
(IEC 811-1-2 : 1985 + Änderung 1 : 1989)

This Harmonization Document was approved by CENELEC on 1990-12-10. 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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 811-1-2 : 1985 and its amendment 1 : 1989 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 505.1.2 S2 on 10 December 1990.

The following dates were fixed:

- latest date of announcement of the HD at national level (doa) 1991-06-01
- latest date of publication of a harmonized national standard (dop) 1991-12-01
- latest date of withdrawal of conflicting national standards (dow) 1991-12-01

CONTENTS

COMMON TEST METHODS FOR INSULATING AND SHEATHING MATERIALS OF ELECTRIC CABLES

Part 1: Methods for general application

SECTION TWO — THERMAL AGEING METHODS

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 Two of Part 1 gives the thermal ageing methods which apply to the most common types of insulating and sheathing compounds (elastomeric, PVC, PE, PP, etc.).

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. Type tests and other tests

The test methods described in this standard are intended, in the first instance, 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) need be tested unless otherwise specified in the relevant cable standard.

5. 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.

6. Test temperature

Unless otherwise specified, tests shall be carried out at room temperature.

Note. – In the UK room temperature is defined as 20 ± 5 °C.

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. **Thermal ageing methods**

8.1 *Ageing in an air oven*

8.1.1 *General*

An ageing treatment in an air oven may be required by the relevant cable standard:

a) for prepared test pieces of insulating or sheathing material only (see Sub-clause 8.1.3.1);

b) for prepared test pieces of cores (conductor and insulation) (see Sub-clause 8.1.3.2 and subsequent Sub-clauses if necessary);

c) for test pieces of completed cable (see Sub-clause 8.1.4);

d) for the loss of mass test (see IEC Publication 811-3-2, Clause 8).

The ageing test *a)* and the loss of mass test *d)* may be combined and carried out on the same test pieces.

8.1.2 *Equipment*

An oven with natural air flow or air flow by pressure. The air shall enter the oven in such a way that it flows over the surface of the test pieces and leaves near the top of the oven. The oven shall have not less than 8 and not more than 20 complete air changes per hour at the specified ageing temperature.

Two methods of measuring the rate of air flow through an oven are given in Sub-clause 8.4.

A fan shall not be used inside the oven.

Note. – For routine testing a fan may be used inside the oven when testing rubber.

8.1.3 *Procedure for prepared test pieces*

8.1.3.1 *Ageing of prepared test pieces of insulating material without conductor and of sheathing material*

The ageing shall be carried out in an atmosphere having the composition and pressure of the ambient air.

The test pieces, as specified in Clause 9 of IEC Publication 811-1-1 shall be suspended vertically and substantially in the middle of the oven so that each piece is at least 20 mm from any other piece.

If any of the test pieces are to be used for the loss of mass test, the test piece shall not occupy more than 0,5 % of the volume of the oven.

The test pieces shall be kept in the oven at the temperature and for the time specified for the material in the relevant standard for the type of cable.

Compounds of substantially different compositions shall not be tested at the same time.

As soon as the ageing period is completed, the test pieces shall be removed from the oven and left at ambient temperature, avoiding direct sunlight, for at least 16 h. The tensile test shall then be carried out in accordance with Sub-clauses 9.1.6 and 9.1.7 of IEC Publication 811-1-1 for both insulation and sheath.

8.1.3.2 *Ageing of prepared test pieces of cores with the original conductor*

a) If after ageing, the conductor and the separator, if any, can be removed without damaging the insulation, the procedure shall be as follows. Samples of core, cut into pieces which are sufficiently long, shall be taken, preferably from positions close to that from which the samples for the tensile tests without ageing are taken (see IEC Publication 811-1-1). They shall then be aged as described in Sub-clause 8.1.3.1, after which five test pieces shall be prepared in accordance with Sub-clause 9.1.3 of IEC Publication 811-1-1 and the cross-sectional area shall be determined in accordance with Sub-clause 9.1.4 of IEC Publication 811-1-1. The tensile test shall then be carried out in accordance with Sub-clauses 9.1.6 and 9.1.7 of IEC Publication 811-1-1.

b) If it is not possible to remove the conductor or the separator, if any, after the ageing procedure without damaging the insulation, the appropriate preparation and test method shall be applied as given in the following table.

Note. – At this stage these methods are only applicable for conductors insulated with 90 °C EPR or 90 °C XLPE of low voltage cables (i.e. cables which do not employ conductor screening).

TABLE 1

Class of copper conductor and conductor form	Summary of guidelines for ageing tests for conductors insulated with 90 °C EPR or 90 °C XLPE of low voltage cables in case of difficulties in preparing test pieces due to conductor insulation or separator adhesion during ageing
Class 1: plain copper	See Sub-clause 8.1.3.3 or if this method also gives rise to adhesion problems see Sub-clause 8.1.3.4. Ageing followed by the bending test is considered the acceptance procedure in case of dispute
Class 1: metal coated	See Sub-clause 8.1.3.4
Class 1: with a separator around the conductor	See Sub-clause 8.1.3.4
Class 2: circular conductors up to and including 16 mm^2 and having plain or metal coated wires and also where a separator around the conductor is included.	See Sub-clause 8.1.3.4
Class 2: conductors above 16 mm^2, circular or shaped, and having plain or metal coated wires	See Sub-clause 8.1.3.5
Note. – In the case of the bending test (Sub-clause 8.1.3.4), ageing conditions may be different from those requiring the determination of tensile properties (Sub-clauses 8.1.3.2, 8.1.3.3, 8.1.3.5); see the relevant cable standard.	

8.1.3.3 *Ageing of tubular test pieces with a solid plain conductor having a reduced diameter*

After preparation of five test pieces in accordance with item *b* of Sub-clause 9.1.3 of IEC Publication 811-1-1 a piece of solid plain conductor, having a diameter reduced by up to 10 % shall be reinserted. This shall be achieved by stretching the original conductor or by using a conductor having the required smaller diameter.

These test pieces shall then be aged as described in Sub-clause 8.1.3.1 after which the conductor shall be removed and the cross-sectional area of the tubular test pieces shall be determined according to Sub-clause 9.1.4 of IEC Publication 811-1-1, followed by the determination of the tensile properties according to Sub-clauses 9.1.6 and 9.1.7 of the same publication.

8.1.3.4 *Ageing and bending test on test pieces of cores*

a) Sampling and preparation of test pieces

Two pieces of suitable length shall be taken from each core to be tested preferably from positions close to that from which the samples for the tensile tests without ageing are taken (see IEC Publication 811-1-1).

b) Ageing procedure

The test pieces shall be placed substantially in the middle of the oven so that each piece is at least 20 mm from any other piece. They shall be supported at both ends and the insulation shall not contact any other object. The test pieces shall not occupy more than 2 % of the volume of the oven, and they shall be kept in the oven at the temperature and for the time specified in the relevant standard for the type of cable.

c) Bending procedure

As soon as the ageing period is completed the test pieces shall be removed from the oven and left at ambient temperature, avoiding direct sunlight, for at least 16 h.

Each test piece shall then be bent at ambient temperature around a mandrel so as to form a close helix.

The bending procedure shall be carried out uniformly at a rate of one turn in about 5 s.

The bending tests may be carried out with the apparatus described in Sub-clause 8.1.3 of IEC Publication 811-1-4.

The diameter of the mandrel shall be f times the diameter of the core. The values of f and also the number of turns are specified as follows.

TABLE 2

Cross-sectional area of conductor (mm^2)	Factor f	Number of turns
Up to and including 2,5	1 ± 0,1	7
4 and 6	2 ± 0,1	6
10 and 16	4 ± 0,1	5

d) Requirement

At the end of the bending procedure the test pieces shall be examined while still on the mandrel. The insulation of both test pieces shall not show any crack when examined with normal or corrected vision without magnification. Any cracks in the first or the last turn on the mandrel shall be disregarded.

8.1.3.5 *Ageing of specially prepared test pieces of cores*

a) Sampling and preparation of test pieces

Three samples each about 200 mm long shall be taken from each core to be tested, preferably from positions close to that from which the samples for the tensile tests without ageing are taken (see IEC Publication 811-1-1).

In the case of sector-shaped cores a strip of not less than 10 mm width shall be cut out of the insulation at the sector back along the conductor axis and separated from the conductor. Subsequently this strip shall be applied again in the same place and fastened with suitable wire in the middle of the test piece and at about 20 mm from each end in such a way that the strip is again well in contact with the conductor; see figure below.

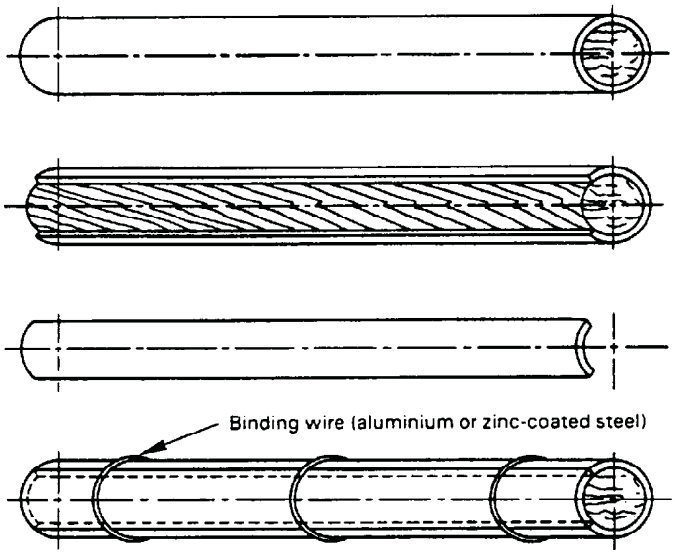

FIGURE 1

For cores with circular conductors a similar procedure shall be applied, where, for smaller sizes (for example, 25 mm^2) up to half the insulation can be separated.

b) Ageing procedure

The specially prepared test pieces shall be placed substantially in the middle of the oven so that each piece is at least 20 mm from any other piece. They shall be supported at both ends and the insulation shall not contact any object other than the binding wire. The test pieces shall not occupy more than 2 % of the volume of the oven, and they shall be kept in the oven at the temperature and for the time specified in the relevant standard for the type of cable.

As soon as the ageing period is completed, the test pieces shall be removed from the oven, left at ambient temperature avoiding direct sunlight, for at least 16 h and then dismantled. Dumb-bell test pieces, two from each sample, shall then be prepared in accordance with Sub-clause 9.1.3 of IEC Publication 811-1-1, the cross-sectional area being determined in accordance with Sub-clause 9.1.4 of IEC Publication 811-1-1, as shown in the figure below.

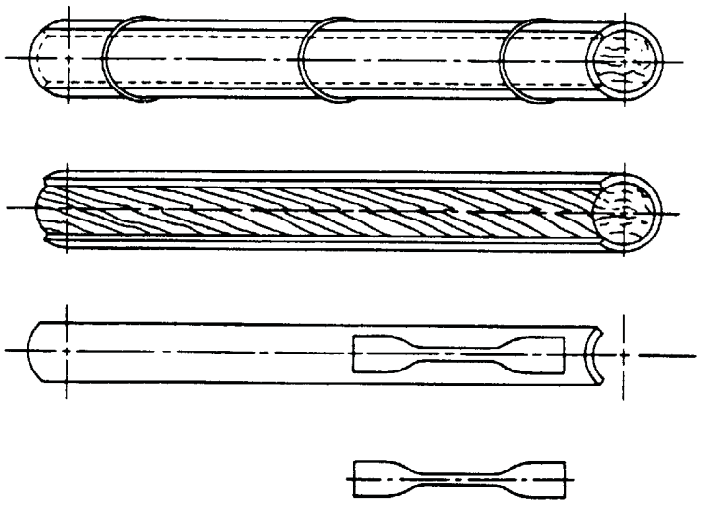

FIGURE 2

The tensile test shall then be carried out in accordance with Sub-clauses 9.1.6 and 9.1.7 of IEC Publication 811-1-1.

8.1.4 *Procedure for pieces of complete cable*

Three pieces of complete cable about 200 mm long shall be taken, preferably from positions close to that from which the samples for the tensile tests without ageing (see IEC Publication 811-1-1) are taken.

The pieces of cable shall be suspended vertically and substantially in the middle of the oven at least 20 mm away from any other piece and shall not occupy more than 2% of the volume of the oven.

The pieces of cable shall be kept in the oven at the temperature and for the time specified in the relevant standard for the type of cable.

As soon as the specified heating period is completed, the pieces of cable shall be removed from the oven and left at ambient temperature, avoiding direct sunlight, for at least 16 h.

The three pieces of cable shall then be dismantled. Two test pieces shall be prepared from the insulation of each core (up to a maximum of three cores) and from the sheath of each piece of cable, as specified in Clause 9 of IEC Publication 811-1-1 so that there are six test pieces from each core and from the sheath.

If the test pieces need to be cut or ground to reduce their thickness to not more than 2 mm, this operation shall be effected, so far as possible, on the side which was not facing a material of different type in the complete cable. If ridges must be cut or ground on the side which was facing the different type of material, the material removed on that side shall be the minimum compatible with adequate smoothing.

After measurement of their cross-sectional areas and conditioning has been carried out, the test pieces shall be subjected to the tensile test, in accordance with Clause 9 of IEC Publication 811-1-1.

8.2 *Ageing in an air bomb*

Test pieces, as specified in Clause 9 of IEC Publication 811-1-1 shall be placed in an air bomb at room temperature without touching each other. The test pieces shall not occupy more than one-tenth of the effective capacity of the bomb.

Compounds of substantially different compositions shall not be tested at the same time.

The bomb shall be filled with air, which shall be free from oil and moisture, to a pressure of 0.55 ± 0.02 MPa.

The test pieces shall be kept in the bomb at the temperature and for the time specified for the material in the standard for the type of cable.

As soon as the ageing period is completed, the pressure shall be released gradually so as to reach atmospheric pressure in not less than 5 min, in order to avoid formation of porosity in the test pieces.

The test pieces shall then be removed from the bomb and left at ambient temperature, avoiding direct sunlight, for at least 16 h.

The tensile test shall then be carried out in accordance with Sub-clauses 9.1.6 and 9.1.7 of IEC Publication 811-1-1.

8.3 *Ageing in an oxygen bomb*

Test pieces as specified in Clause 9 of IEC Publication 811-1-1 shall be placed in the bomb at room temperature without touching each other. They shall not occupy more than one-tenth of the effective capacity of the bomb.

Compounds of substantially different compositions shall not be tested at the same time.

The bomb shall be filled with commercial oxygen of not less than 97% purity to a pressure of 2.1 ± 0.07 MPa.

The test pieces shall be kept in the bomb at the temperature and for the time specified for the material in the standard for the type of cable.

As soon as the ageing period is completed, the pressure shall be released gradually so as to reach atmospheric pressure in not less than 5 min, in order to avoid formation of porosity in the test pieces.

The test pieces shall then be removed from the bomb and left at ambient temperature, avoiding direct sunlight, for at least 16 h.

The tensile test shall then be carried out in accordance with Sub-clauses 9.1.6 and 9.1.7 of IEC Publication 811-1-1.

8.4 *Methods of measuring air flow in ovens*

8.4.1 *Method 1 — Indirect or power consumption method*

a) In this method, the additional power required to maintain the oven at a given temperature with its ports open, over that required to maintain the oven at the same temperature with its ports closed, is used as a measure of the quantity of air passing through the oven when the ports are open. The average power ($P1$ watts) required to maintain the oven temperature at the specified ageing temperature when the ports are open is determined over a period of 30 min or longer. The

ventilation ports (and, if necessary, the thermometer aperture) are then closed and the average power ($P2$ watts) to maintain the same temperature over a similar period is determined. It is essential that the difference between the oven temperature and the room temperature should be the same for the two tests to within 0.2 °C. The room temperature should be measured at a point about 2 m from the oven, approximately level with its base, and at least 0.6 m from any solid objects.

b) The amount of air passing through the oven when the ports are open is given by the formulae:

$$m = \frac{P1 - P2}{C_p (t_2 - t_1)} \quad (1)$$

$$V = \frac{3\,600\,\mathrm{m}}{d} \quad (2)$$

where:

C_p is the specific heat of air constant pressure (1.003 J/g)

t_1 is the room temperature, in degrees Celsius

t_2 is the oven temperature, in degrees Celsius

$P1 - P2$ is the difference in power consumption, as defined in the first paragraph

m is the mass of air, in grams per second

V is the volume of air, in litres per hour

d is the density of air in the laboratory at the time of test, in grams per litre

Note. — The density of air at 760 mm Hg and 20 °C is 1.205 g/l.

Hence: $V = \frac{3\,600\,(P1 - P2)}{1.003\,d\,(t_2 - t_1)}$ or $V = \frac{3\,590\,(P1 - P2)}{d\,(t_2 - t_1)}$

This formula assumes that, when the ports are closed, no air passes through the oven. Therefore, there shall be no leakages; the air-tight door joint should be sealed with adhesive tape and all apertures, including the inlet port, should be effectively closed.

c) If the power consumption is measured with a wattmeter, the total length of time, in seconds, for which the oven heaters are "on" shall be measured with a stop-watch and the reading of the wattmeter shall be taken once during each "on" period.

The average of the wattage readings multiplied by the total time registered by the stop-watch and divided by the duration of the test, in seconds, is taken as the power, in watts, required to maintain a constant temperature.

d) If a watt-hour or kilowatt-hour meter is used, the reading of the total energy consumption registered by the meter shall be divided by the duration of the test, measured as a fraction of an hour. If a household kilowatt-hour meter is used, the dial units are too large to enable a sufficient accuracy to be obtained over a reasonably short test, and the rotating disc with which these meters are provided shall be used therefore as the power consumption indicator. The meter shall be put into operation until the index mark on the disc is opposite the centre of the window; it shall then be disconnected until the start of the test.

To reduce the possible error, the period of test shall be long enough to permit 100 revolutions of the disc and the test shall preferably be ended when the mark on the disc is visible. If, however, the mark is out of sight at the end of the test, an estimated fraction of a revolution shall be added. The test shall be started and stopped at corresponding points on the "on-off" heating cycle (e.g., at the moment when the heaters are switched on by the thermostat).

8.4.2 *Method 2 — Direct and continuous method*

Description of the equipment

Starting from the high-pressure air source, i.e. from a pipe system or air cylinders:

a) Air pressure regulator

A device to reduce the air pressure from the many atmospheres of the supply mains to the quite low-pressure values needed for supplying the oven.

It is equipped with an adjustable valve which permits a constant pressure downstream.

b) Flowmeter

An instrument with which the rate of air flow can be measured. It is illustrated by Figure 1, page 16, and operates on a manometric principle, with:

1) A calibrated capillary tube, with an internal calibrated diameter of about 2 mm and a calibrated length of about 70 mm. Figure 2, page 17, shows a typical calibration diagram, which permits the control of air flow up to 500 litres/h or 600 litres/h.

2) A manometric tube with a double graduation of pressure difference ranging between 0 and ± 300 mm of water. Distilled water is the manometric liquid.

c) Air oven

An air oven to be operated when carefully sealed, including sealing round the inlet tube, which should preferably enter the oven through the bottom. The outflow hole, which should be at the top of the oven, is the only port to be open.

Note. — The following two features facilitate the reliability of the method and the equipment.

a) The flowmeter described above can be considered as fully reliable, easy to manufacture and to calibrate, as well as suitable for the range of air rates involved here.

b) As shown by tests the adoption of a slightly "forced" ventilation does not alter, in practice, the uniformity of the temperature at the various points in the ovens.

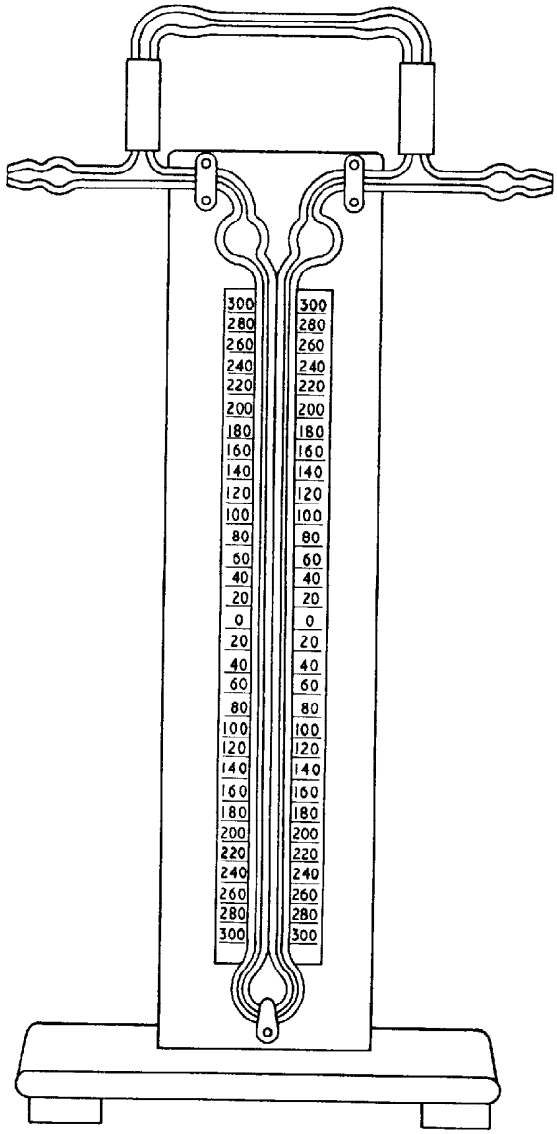

FIG. 1.— Débitmètre pour le contrôle du débit d'air dans les étuves par la méthode 2.
Flowmeter for air-flow control in air ovens for method 2.

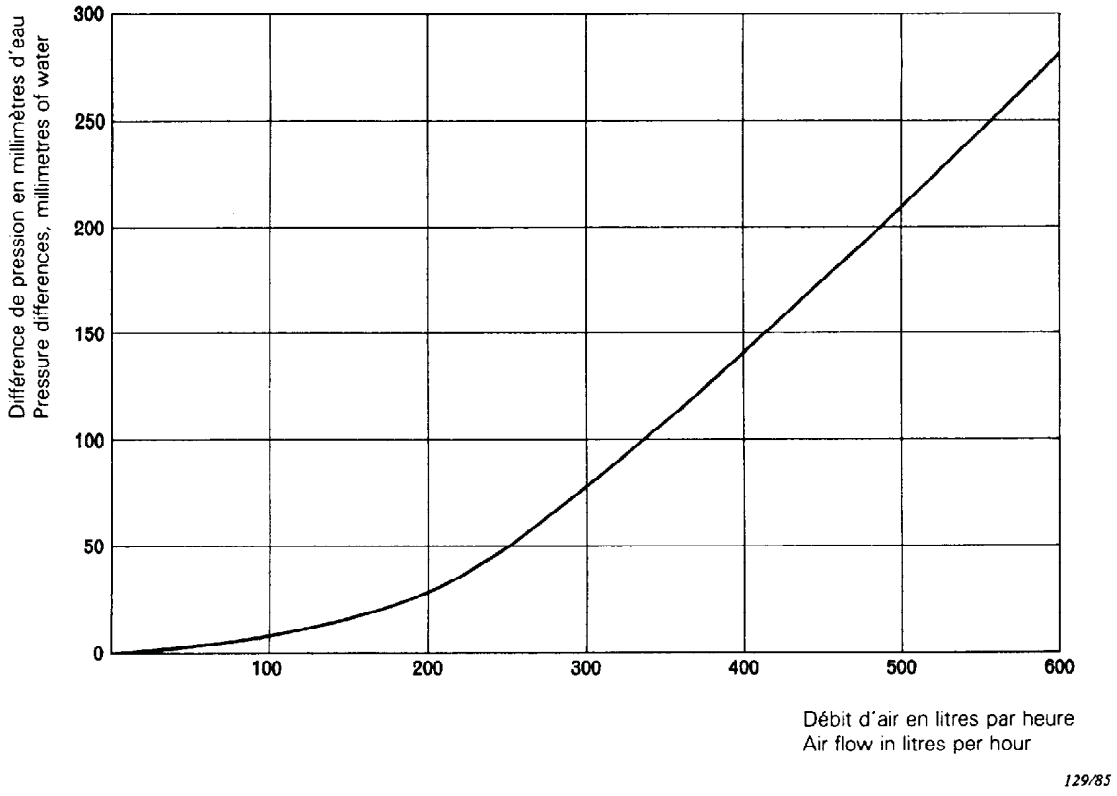

FIG. 2.— Diagramme d'étalonnage du tube capillaire (diamètre: d = 2 mm; longueur: l = 70 mm) du débitmètre pour le contrôle du débit d'air dans les étuves par la méthode 2.
Calibration diagram of the capillary tube (diameter: d = 2 mm; length: l = 70 mm) of the flowmeter for air-flow control in air ovens for method 2.

APPENDIX A

CORRESPONDING CLAUSES AND SUB-CLAUSES IN IEC PUBLICATIONS 538 AND 540 AND IEC PUBLICATION 811

A1. Corresponding clauses or sub-clauses in IEC Publications 538 and 811

Heading of clause in Publication 538*	538	811		
	Clause or sub-clause	Part	Section	Clause or sub-clause
General	1	All	All	1 to 7
Mechanical properties of insulation	2	1	1	9.1
Mechanical properties of sheath	3	1	1	9.2
Melt flow index (MFI)	4	4	1	10
Density	5	1	3	8
Ageing test for insulation and sheath	6.1	1	2	8
Shrinkage test for insulation	6.2	1	3	10
Bending test at low temperature				
insulation	6.3.1	1	4	8.1
sheath	6.3.2	1	4	8.2
Carbon black and/or mineral filler content	7	4	1	11
Measurement of thicknesses and diameters	Appendix A	1	1	8
Melt flow index	Appendix B	4	1	10
Heading of clause in Publication 538A**	**538A**	**811**		
	Clause	Part	Section	Clause
Wrapping test after thermal ageing in air	1	4	1	9
Resistance to environmental stress cracking	2	4	1	8

* Publication 538: Electric Cables, Wires and Cords: Methods of Test for Polyethylene Insulation and Sheath.

** Publication 538A: First Supplement to Publication 538 (1976): Additional Methods of Test for Polyethylene Insulation and Sheath of Electric Cables, Wires and Cords Used in Telecommunication Equipment and in Devices Employing Similar Techniques.

A2. Corresponding clauses in IEC Publications 540, 811 and 885*

Heading of clause in Publication 540 *	540	811			885
	Clause	Part	Section	Clause	Part
Partial discharge tests	3	–	–	–	2
Measurement of thicknesses and diameters **	4	1	1	8	–
Tests for determining the mechanical properties of insulating and sheathing compounds	5	1	1	9	–
Thermal ageing methods	6	1	2	8	–
Loss of mass test for PVC insulations and sheaths	7	3	2	8	–
Pressure test at high temperature for PVC insulations and sheaths	8	3	1	8	–
Tests at low temperature for PVC insulations and sheaths	9	1	4	8	–
Tests for resistance of PVC insulations and sheaths to cracking	10	3	1	9	–
Method for determining the density of elastomeric and thermoplastic compounds	11	1	3	8	–
Measurement of the melt flow index of thermoplastic polyethylene	12	4	1	10	–
Ozone resistance test	13	2	1	8	–
Hot set test	14	2	1	9	–
Mineral oil immersion test for elastomeric sheaths	15	2	1	10	–
Electrical tests for cables, cords and wires for voltages up to and including 450/750 V	16	–	–	–	1
Thermal stability of PVC insulations and sheaths	17	3	2	9	–
Carbon black and/or mineral filler content in PE	18	4	1	11	–
Water absorption tests	19	1	3	9	–
Shrinkage test	20	1	3	10	–

* Publication 540: Test Methods for Insulations and Sheaths of Electric Cables and Cords (Elastomeric and Thermoplastic Compounds).
Publication 885: Electrical Test Methods for Electric Cables.

** Technically not identical.

National annex NA (informative)

Cross-references

Publication referred to	Corresponding British Standard
	BS 6469 Insulating and sheathing materials of electric cables
IEC 811-1-1 : 1985	Section 1.1 : 1992 Measurement of thickness and overall dimensions — Tests for determining the mechanical properties
IEC 811-1-4 : 1985	Section 1.4 : 1992 Tests at low temperature
IEC 811-3-2 : 1985	Section 3.2 : 1992 Loss of mass test — Thermal stability test

National annex NB (informative)

Table NB.1. Corresponding clauses or sub-clauses in BS 6469 : 1990 and BS 6469 : 1992

Clause in BS 6469 : 1990	BS 6469 : 1990	BS 6469 : 1992		
	Clause or sub-clause	Part	Section	Clause or sub-clause
General	1.1 to 1.3	1 to 4 and 99 5	All 5.1	1 to 7 1 to 3
Measurement of thickness and diameters	2.1	1	1.1	8
Determination of tensile strength and elongation at break	2.2	1	1.1	9
Thermal ageing methods	2.3	1	1.2	8
Methods for determining density	2.4	1	1.3	8
Shrinkage test	2.5	1	1.3	10
Gravimetric water absorption test	2.6	1	1.3	9.2
Green/yellow proportions	2.7	99	99.1	8
Mineral oil immersion test	3.1	2	2.1	10
Ozone resistance test	3.2	2	2.1	8
Hot set test	3.3	2	2.1	9
Tear resistance	3.4	99	99.1	9
Loss of mass tests	4.1	3	3.2	8
Pressure tests at high temperature	4.2	3	3.1	8
Tests at low temperature	4.3	1	1.4	8
Tests for resistance to cracking	4.4	3	3.1	9
Hot deformation test	4.5	99	99.1	10
Thermal stability test for insulations and sheaths	4.6	3	3.2	9
Determination of melt flow index (MFI)	5.1	4	4.1	10
Test for resistance to environmental stress cracking: Original granules	5.2.2	4	4.1	8
Test for resistance to environmental stress cracking: Complete cable	5.2.3	99	99.1	11
Carbon black content	5.3.2	4	4.1	11
Carbon black dispersion[1)]	5.3.3	-	-	-
Wrapping test after thermal ageing[2)]	5.4	4 4	4.1 4.2	9 10

[1)] Methods given in BS 2782 : Methods 823A or 823B.

[2)] It is intended that a formal proposal to IEC will result in the test in clause 9 of Section 4.1 being withdrawn.

National annex NC (informative)

Table NC.1. Tests included in BS 6469 : 1992 not previously covered

Test	Part	Section	Clause
Water absorption test: electrical	1	1.3	9.1
Tests specific to filling compounds:			
Drop-point	5	5.1	4
Separation of oil	5	5.1	5
Low temperature brittleness	5	5.1	6
Total acid number	5	5.1	7
Absence of corrosive components	5	5.1	8
Permittivity at 23 °C	5	5.1	9
D.C. resistivity at 23 °C and 100 °C	5	5.1	10
Determination of linear swell after ageing in oil	99	99.1	12
Alternative ozone resistance test method (low concentration)	99	99.1	13
Method of test for insulation resistance constant (K value)	99	99.2	8
Method of test for power factor and permittivity	99	99.2	9
Water absorption determined by the capacitance method	99	99.2	10

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