

SLOVENSKI STANDARD
SIST EN 60811-1-2:1999**01-julij-1999**

Materiali za izoliranje in oplaščenje električnih kablov - Splošne preskusne metode - 1-2. del: Področje uporabe - Metode toplotnega staranja (IEC 60811-1-2:1985 + popravek maj 1986 + A1:1989)

Insulating and sheathing materials of electric cables - Common test methods - Part 1-2: General application - Thermal ageing methods

Isolier- und Mantelwerkstoffe für Kabel und isolierte Leitungen - Allgemeine Prüfverfahren - Teil 1-2: Allgemeine Anwendung - Thermische Alterung

Matériaux d'isolation et de gainage des câbles électriques - Méthodes d'essais communes - Partie 1-2: Application générale - Méthodes de vieillissement thermique

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English version

Insulating and sheathing materials of electric cables
Common test methods
Part 1: General application
Section 2: Thermal ageing methods

(IEC 811-1-2 : 1985 + corrigendum May 1986 + A1 : 1989)

Matériaux d'isolation et de gainage des câbles
électriques

Méthodes d'essais communes

Part 1: Application générale

Section 2: Méthodes de vieillissement thermique

(CEI 811-1-2 : 1985 + corrigendum mai 1986 + A1 :
1989)

Isolier- und Mantelwerkstoffe für Kabel und
isolierte Leitungen

Allgemeine Prüfverfahren

Teil 1: Allgemeine Anwendung

Hauptabschnitt 2: Thermische Alterung

(IEC 811-1-2 : 1985 + Corrigendum Mai 1986 + A1 :
1989)

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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

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Foreword

The text of the International Standard IEC 811-1-2 : 1985, with its corrigendum May 1986 and its amendment 1 : 1989, prepared by IEC TC 20, Electric cables, was approved by CENELEC as HD 505.1.2 S2 on 1990-12-10.

This Harmonization Document was submitted to the formal vote for conversion into a European Standard and was approved by CENELEC as EN 60811-1-2 on 1994-12-06.

Where reference is made to HD 505.1.2 S2 : 1991 in another standard, users should refer to this EN 60811-1-2 for the current information.

The following date was 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) 1996-03-01

Annexes designated 'normative' are part of the body of the standard. In this standard, annex ZA is normative. Annex ZA has been added by CENELEC.

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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.

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.

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 I E C 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.

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 I E C 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 I E C 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 I E C 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 I E C Publication 811-1-1 and the cross-sectional area shall be determined in accordance with Sub-clause 9.1.4 of I E C 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 I E C 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

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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
<i>Note.</i> — 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 I E C 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	$1 \pm 0,1$	7
4 and 6	$2 \pm 0,1$	6
10 and 16	$4 \pm 0,1$	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.