
Materiali za izoliranje in oplaščenje električnih in optičnih kablov - Splošne preskusne metode - 3-2. del: Posebne metode za mase iz PVC - Preskus izgubljanja mase - Preskus toplotne stabilnosti

Insulating and sheathing materials of electric and optical cables - Common test methods - Part 3-2: Methods specific to PVC compounds - Loss of mass test - Thermal stability test

Isolier- und Mantelwerkstoffe für Kabel und isolierte Leitungen - Allgemeine Prüfverfahren -- Teil 3-2: Verfahren für PVC-Mischungen - Prüfung des Masseverlustes - Prüfung der thermischen Stabilität

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Matériaux d'isolation et de gainage des câbles électriques et des câbles optiques - Méthodes d'essais communes -- Partie 3-2: Méthodes spécifiques pour les mélanges PVC - Essai de perte de masse - Essai de stabilité thermique

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English version

Insulating and sheathing materials of electric cables
Common test methods
Part 3: Methods specific to PVC compounds
Section 2: Loss of mass test
Thermal stability test

(IEC 811-3-2 : 1985 + corrigendum May 1986 + A1 : 1993)

Matériaux d'isolation et de gainage des câbles électriques	Isolier- und Mantelwerkstoffe für Kabel und isolierte Leitungen
Méthodes d'essais communes	Allgemeine Prüfverfahren
Part 3: Méthodes spécifiques pour les mélanges PVC —	Teil 3: Methoden für PVC-Compounds
Section 2: Essai de perte de masse —	Hauptabschnitt 2: Prüfung des Masseverlustes — Prüfung der thermischen Stabilität
Essai de stabilité thermique (CEI 811-3-2 : 1985 + corrigendum mai 1986 + A1 : 1993)	(IEC 811-3-2 : 1985 + Corrigendum Mai 1986 + A1 : 1993)

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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.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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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 811-3-2 : 1985, with its corrigendum May 1986 and its amendment 1: 1993, prepared by IEC TC 20, Electric cables, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 60811-3-2 on 1995-03-06 without any modification.

This European Standard supersedes HD 505.3.2 S1 : 1988. Where reference is made to HD 505.3.2 S1 : 1988 in another standard, users should refer to this EN 60811-3-2 for the current information.

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) 1996-03-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-12-01

Annexes designated 'normative' are part of the body of the standard. Appendices and annexes designated 'informative' are given for information only. In this standard, annex ZA is normative and appendix A is informative. Annex ZA has been added by CENELEC

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COMMON TEST METHODS FOR INSULATING AND SHEATHING MATERIALS OF ELECTRIC CABLES

Part 3: Methods specific to PVC compounds Section Two — Loss of mass test — Thermal stability test

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 3 gives the methods for loss of mass test and thermal stability test, which apply to PVC compounds.

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 of the insulating or sheathing compounds.

6. Test temperature

Unless otherwise specified, tests shall be made at ambient 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. Loss of mass test for insulations and sheaths

8.1 Loss of mass test for insulation

8.1.1 Test equipment

- a) 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. In case of dispute, an oven with natural air circulation shall be used.

A rotating fan shall not be used inside the oven.

- b) An analytical balance with a sensitivity of 0.1 mg.
- c) Punching dies for dumb-bell test pieces (see test method in Clause 9 of I E C Publication 811-1-1: Common Test Methods for Insulating and Sheathing Materials of Electric Cables, Part 1: Methods for General Application, Section One — Measurement of Thickness and Overall Dimensions, Tests for Determining the Mechanical Properties).
- d) A desiccator with silica gel or similar material.

8.1.2 Sampling

If the loss of mass test is combined (see Item *c*) of Sub-clause 8.1.1 of I E C Publication 811-1-2: Section Two: Thermal Ageing Methods) with the mechanical test (Clause 9 of I E C Publication 811-1-1), the test pieces shall be three of those subjected to the ageing in the air oven specified in Sub-clause 8.1.3 of Publication 811-1-2, one from each sample of core.

Alternatively, three of the other test pieces prepared from each core in accordance with Clause 9 of Publication 811-1-1 may be used, if they are not required for other purposes and if their thickness complies with Item *c*) of Sub-clause 8.1.3 below.

Otherwise, three samples, each about 100 mm long, of each core or the insulation from each core to be tested shall be taken, and a test piece prepared from each one in the same way as specified in Sub-clause 8.1.3 below.

8.1.3 Preparation of test pieces

- a) Any coverings shall be removed. The conductor shall be removed and semiconducting layers on the insulation, if any, shall be removed mechanically, i.e. without using solvent.
- b) The test shall be made on:
- 1) Dumb-bell test pieces illustrated in Figure 1, page 16, whenever practicable.
 - 2) Dumb-bell test pieces illustrated in Figure 2, page 16, if the core dimensions are too small to permit dumb-bells according to Figure 1 to be used.

- 3) Tubular test pieces, as an alternative to dumb-bells, for inner diameters not exceeding 12.5 mm, provided that there is not an adherent semiconducting layer on the inside of the insulation and that any remaining separator shall be removed in a suitable way but without using solvent.

The ends of tubular test pieces shall not be closed.

- c) Dumb-bell test pieces shall be prepared as specified in Item a) of Sub-clause 9.1.3 of I E C Publication 811-1-1, except that the test pieces shall have two parallel surfaces over the whole length, their thickness shall be 1.0 ± 0.2 mm, and marker lines are not required.

Tubular test pieces shall be prepared as specified in Item b) of Sub-clause 9.1.3 of I E C Publication 811-1-1, without applying marker lines. The total surface area of each test piece (see Item a) of Sub-clause 8.1.4) shall be not less than 5 cm².

- d) Flat twin flexible cords provided with a groove on both sides between the cores shall be tested without separation of the cores. For calculation of its surface of evaporation, the twin cord may be considered as being two separated tubular pieces.

8.1.4 Calculation of the evaporation area *A*

The surface area *A*, in square centimetres, of each test piece shall be determined before conducting the loss of mass test using the following formulae:

- a) For tubular specimens

Surface *A* = outer surface + inner surface + cut surface

$$A = \frac{2\pi(D - \delta) \times (l + \delta)}{100} \text{ cm}^2$$

where:

δ = average thickness of the test piece, in millimetres, to two decimal places if $\delta \leq 0.4$ mm, and to one decimal place above this limit

D = mean outer diameter of the test piece, in millimetres, to two decimal places if *D* \leq 2 mm, and to one decimal place above this limit

l = length of the test piece, in millimetres, to one decimal place

both δ and *D* being measured as specified in the test method in Clause 8 of I E C Publication 811-1-1 (Sub-clauses 8.1 and 8.3) on a thin slice cut from the end of each tubular test piece.

The formula may be applied also to a tubular test piece having a cross-section as shown in Figure 3, page 17

- b) For dumb-bell test piece size of Figure 2, page 16

$$A = \frac{624 + (118 \delta)}{100} \text{ cm}^2$$

- c) For dumb-bell test piece size of Figure 1, page 16

$$A = \frac{1256 + (180 \delta)}{100} \text{ cm}^2$$

Wherein δ is the mean thickness of the strips, in millimetres, to two decimal places, determined as specified in Item a) of Sub-clause 9.1.4 of I E C Publication 811-1-1.

8.1.5 Test procedure

- a) The prepared test pieces shall be placed for at least 20 h at ambient temperature in a desiccator. Immediately after removal from the desiccator, each test piece shall be weighed accurately, in milligrams, to one decimal place.

- b) Thereafter, the three test pieces shall be maintained in the oven (see Sub-clause 8.1.1), in air at atmospheric pressure for 7×24 h at 80 ± 2 °C, unless otherwise specified, under the following conditions:
- compounds of obviously different compositions shall not be tested at the same time in the same oven;
 - test pieces shall be suspended vertically in the middle of the oven so that each piece is at least 20 mm from any other piece;
 - not more than 0.5% of the oven volume shall be occupied by the test pieces.
- c) After this heat treatment, the test pieces shall again be placed for 20 h in a desiccator at ambient temperature and each test piece shall then be re-weighed accurately, in milligrams, to one decimal place.

The difference between the weights determined in Items a) and c), for each test piece, shall be calculated and rounded off to the nearest milligram.

8.1.6 Expression of results

The loss of mass of each test piece shall be determined by dividing its "weight difference" (see Item c) of Sub-clause 8.1.5) in milligrams, by its surface area (see Sub-clause 8.1.4) in square centimetres.

The median value of the results for the three test pieces from each core, expressed in milligrams per square centimetre, shall be taken as the loss of mass of the core.

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8.2 Loss of mass test for sheaths

8.2.1 Test equipment

(See Sub-clause 8.1.1.)

8.2.2 Sampling

Three samples of the sheath shall be taken in accordance with Sub-clause 8.1.2.

8.2.3 Preparation of test pieces

All constructional elements arranged under (and, if any, over) the sheath shall be removed, taking care not to damage the sheath, and the test pieces prepared in accordance with Sub-clause 8.1.3.

8.2.4 Calculation of the evaporation area *A*

The surface of evaporation shall be calculated by the formulae given in Sub-clause 8.1.4, with the following modifications:

The formula given for tubular specimens is only applicable in the case of the cross-sections shown in Figures 4 and 5 (page 17). The inner and outer surfaces of evaporation of sheaths of flat cords and cables shall be calculated from the dimensions of the cross-section of the sheath. These dimensions shall be determined in millimetres to two decimal places.

The inner side of flat sheaths, having a wedge-shaped ridge, may be considered as being flat.

8.2.5 Test procedure

In accordance with Sub-clause 8.1.5.