SLOVENSKI STANDARD

SIST EN 50396:2005

december 2005

Metode za preskušanje neelektričnih lastnosti nizkonapetostnih energetskih kablov

Non electrical test methods for low voltage energy cables

ICS 29.060.20

Referenčna številka
SIST EN 50396:2005(en)

EUROPEAN STANDARD **EN 50396**

NORME EUROPÉENNE

EUROPÄISCHE NORM August 2005

ICS 29.060.20

Partially supersedes HD 21.2 S3:1997 + A1:2002 &
HD 22.2 S3:1997 + A1:2002

English version

Non electrical test methods for low voltage energy cables

Méthodes d'essais non électriques
pour les câbles d'énergie basse tension

Nicht-elektrische Prüfverfahren
für Niederspannungskabel und -leitungen

This European Standard was approved by CENELEC on 2005-07-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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

Ref. No. EN 50396:2005 E

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 20, Electric cables. In accordance with the decision of TC 20 at its Setubal meeting (June 2004), the text of the draft was submitted to the formal vote. It was approved by CENELEC as EN 50396 on 2005-07-01.

This European Standard, together with EN 50395:2005, supersedes HD 21.2 S3:1997 + A1:2002 and HD 22.2 S3:1997 + A1:2002.

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)	2006-07-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2008-07-01

Contents

Introduction

EN 50396 contains the non-electrical test methods that are used for harmonized low voltage energy cables. These non-electrical test methods include all those previously contained in HD 21 and HD 22. Annex A gives a comparison between the original location of each test method and its place in this new EN.

The content of EN 50396 is not, and will not be, restricted only to test methods for cables to HD 21 and HD 22. Other test methods for harmonized LV cables may be included. Furthermore, the use of test methods in EN 50396 for cables outside HD 21 and HD 22 is not prohibited, but it is strongly recommended that expert advice be taken before such use, or before any proposal for incorporation into another standard.

1 Scope

EN 50396 contains non-electrical test methods required for the testing of harmonized low voltage energy cables, especially those rated at up to and including 450/750 V.

NOTE 1 A description of the origin of these test methods and of the background to the EN are given in the Introduction and Annex A.

The particular cable standard dictates the tests which need to be performed on the relevant cable type. It also specifies whether the specific test is a type test (T), a sample test (S) or a routine test (R) for the particular cable type.

NOTE 2 T, S and R are defined in the relevant cable standard.

The requirements to be met during or after the test are specified for the particular cable type in the relevant cable standard. However, some test requirements are obvious and universal, such as the fact that no cracks shall occur during ozone test, and these are stated in the particular test method.

Test methods for use specifically in utility power cables are not covered by this EN. They can be found in HD 605.

Test methods for use specifically in communications cables are the responsibility of CENELEC TC 46X. At present such test methods are given in EN 50289 (series).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Publication	Year	Title
EN 60332-1-2	2004	Tests on electric and optical fibre cables under fire conditions - Par1-2: Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame
EN 50395	2005	Electrical test methods for low voltage energy cables
EN 60695-11-5	2005	Fire hazard testing - Part 11-5: Test flames - Needle-flame test method - Apparatus, confirmatory test arrangement and guidance

EN 60811-1-1 A1	1995 2001	Insulating and sheathing materials of electric and optical cables - Common test methods - Part 1-1: General application - Measurement of thickness and overall dimensions - Tests for determining the mechanical properties
EN 60811-1-2 A2	1995 2000	Insulating and sheathing materials of electric and optical cables - Common test methods - Part 1-2: General application - Thermal ageing methods
EN 60811-2-1 A1	1998 2001	Insulating and sheathing materials of electric and optical cables - Common test methods - Part 2-1: Methods specific to elastomeric compounds - Ozone resistance test, hot set and mineral oil immersion test

3 General test requirements

3.1 Sampling

If a marking is indented in the insulation or sheath, the samples used for the tests shall be taken so as to include such marking.

For multicore cables, except for the test in 5.1, not more than three cores (of different colours, if available) shall be tested unless otherwise specified.

3.2 Pre-conditioning

All the tests shall be carried out not less than 16 h after the extrusion or cross-linking, if any, of the insulating or sheathing compounds.

3.3 Test temperature

Unless otherwise specified in the details for the particular test, tests shall be made at an ambient temperature of (20 ± 15) °C.

3.4 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.

4 General test methods for dimensions

4.1 Measurement of insulation thickness

4.1.1 Procedure

The thickness of insulation shall be measured in accordance with 8.1 of EN 60811-1-1.

Three samples shall be taken from the cable; each sample shall be separated from the next by a distance of at least 1 m.

Conformity shall be checked on each core.

If withdrawal of the conductor is difficult, it shall be stretched in a tensile testing machine or the piece of core shall be loosened by stretching or some other suitable means that does not damage the insulation.

The cores of flat non-sheathed cords shall not be separated.

4.1.2 Evaluation of results

The mean of the 18 values (expressed in millimetres) obtained from the three pieces of insulation from each core shall be calculated to two decimal places and rounded off as given in Annex B, and this shall be taken as the mean value of the thickness of insulation.

The lowest of all values obtained shall be taken as the minimum thickness of insulation at any place.

4.2 Measurement of sheath thickness for circular cables

4.2.1 Procedure

The thickness of the sheath for circular cables shall be measured in accordance with 8.2 of EN 60811-1-1.

One sample of cable shall be taken from each of three places, separated by at least 1 m.

For flat cords the measurements shall be carried out in accordance with 4.3.

4.2.2 Evaluation of results

The mean of all the values (expressed in millimetres) obtained from the three pieces of sheath shall be calculated to two decimal places and rounded off as given in Annex B, and this shall be taken as the mean value of the thickness of sheath.

The lowest of all values obtained shall be taken as the minimum thickness of sheath at any place.

4.3 Measurement of sheath thickness for flat cables

4.3.1 Measuring equipment

A measuring microscope or a profile projector shall be used, each instrument being capable of at least 10 x magnification. The equipment shall have an accuracy of 0,01 mm. In cases of dispute a microscope allowing a reading with an accuracy of 0,01 mm or a profile projector of at least 20 x magnification shall be used.

4.3.2 Preparation of test pieces

One sample of cable shall be taken from each of three places, separated by at least 1 m.

After all materials inside the sheath have been removed, a test piece shall be prepared from each sample by cutting with a suitable device (sharp knife, razor blade, etc.) a slice of sheath along a plane perpendicular to the longitudinal axis of the cable. If the sheath carries an indented marking, the test piece shall be taken so as to include such marking.

4.3.3 Measuring procedure

The test piece shall be placed under the measuring equipment with the plane of the cut perpendicular to the optical axis.

Measurements shall be taken on lines approximately parallel to the minor axis and on the major axis of the cross section, at the position of each core, as shown in Figure 1.

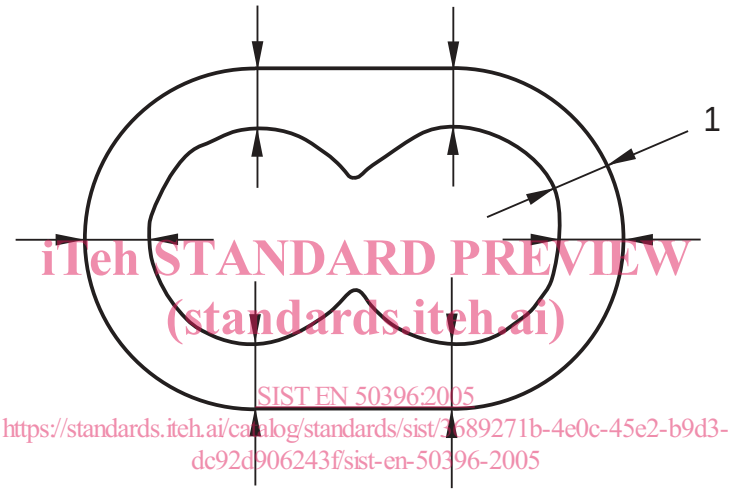
The thinnest place on the sheath shall be measured. Where this does not coincide with one of the designated measurement points shown in Figure 1, it shall be substituted for the closest such point, to give a total of six measurements.

The measurements shall be made in millimetres to two decimal places.

4.3.4 Evaluation of results

The mean of all the values (expressed in millimetres) obtained from the three pieces of sheath shall be calculated to two decimal places and rounded off as given in Annex B, and this shall be taken as the mean value of the thickness of sheath.

The lowest of all values obtained shall be taken as the minimum thickness of sheath at any place.



Key

1 minimum thickness

Figure 1 - Measurement of sheath thickness (flat cable)

4.4 Measurement of overall dimensions and ovality

4.4.1 Overall dimensions

4.4.1.1 Procedure

The measurement of the overall diameter of any circular cable and of the overall dimensions of flat cables with a major dimension not exceeding 15 mm shall be carried out in accordance with 8.3 of EN 60811-1-1.

The three samples taken in accordance with 4.1.1, 4.2.1 or 4.3.2 shall be used.

For the measurement of flat cables with a major dimension exceeding 15 mm, a micrometer, a profile projector or similar equipment shall be used.

4.4.1.2 Evaluation of results

The mean of the values obtained shall be taken as the mean overall dimensions.

4.4.2 Procedure for ovality measurement

For checking the ovality of circular sheathed cables, two measurements shall be made at the same cross-section of the cable, covering the maximum and minimum values.

5 Tests relating to marking and colouring

5.1 Durability

The durability of printed marking or of colour shall be checked by trying to remove the marking or colour by rubbing lightly 10 times with a piece of cotton wool or cloth soaked in water.

5.2 Green-and-yellow measurement

5.2.1 General

This method is not appropriate where the colour marking forms a spiral on the insulation.

5.2.2 Procedure

Two samples of the green-and-yellow core each approximately 100 mm in length, shall be taken at least 2 m one from the other.

Measure a 15 mm length from each of the samples and cut three sections of insulation from each 15 mm test piece length, one from each end and one from the centre.

Project a 10 X minimum magnified image of each cross section on to a ground glass screen and make a visual estimation of the colour boundaries at the outer surface of the core.

Continue the measurement using either of the following methods.

Method 1

Measure the distance $d1$ and the core diameter D (Figure 2a).

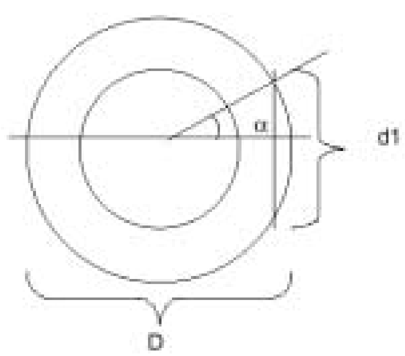


Figure 2a - Measurement of the green-and-yellow proportion

Calculate the value for sine α using the formula:

$$\sin \alpha = \frac{d1}{D}$$

$d1$ = the chord of the green segment.
D = the mean value of the diameter calculated from three measurements at different angles

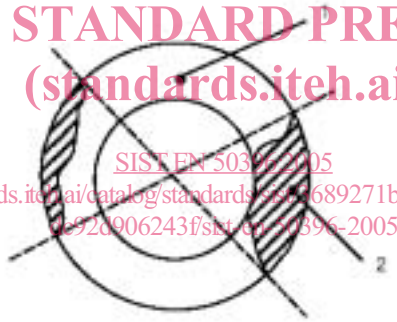
Calculate the percentage (G_p) of green (or yellow) using the following formula:

$$G_p = \frac{2 \times \alpha}{360} \times 100$$

In order to facilitate the calculation, the table in Annex C can be used.

Method 2

Measure to the nearest degree, using a protractor placed on the magnified image, the angle subtended at the centre of the cross section by each portion of green (or yellow if appropriate). See Figure 2b.



Key

1 base colour 2 other colour

Figure 2b - Measurement of the green-and-yellow proportion

Calculate the percentage (G_p) of green (or yellow) for each cross section using the following equation:

$$G_p = \frac{A_T}{360} \times 100$$

A_T is the total sum of each of the angles of rotation through each of the portions of green (or yellow if appropriate).

5.2.3 Evaluation of results

Calculate the mean of the six measurements and round to the nearest integer.

Compare the results with the requirement specified in the relevant cable standard.

6 Tests for mechanical strength of cables

6.1 Static flexibility test

6.1.1 Apparatus

A sample with a length of (3 ± 0,05) m shall be tested using test apparatus similar to that shown in Figure 3. Two clamps, A and B, shall be located at a height of at least 1,5 m above ground level.

Clamp A shall be fixed and clamp B shall move horizontally at the level of clamp A.

6.1.2 Procedure

Clamp the ends of the sample vertically so that they remain vertical during the test, one end in clamp A, the other in the movable clamp B which shall be at a distance L = 0,20 m from clamp A.

NOTE The cable should take approximately the shape indicated by Figure 3 (dotted lines).

Move the movable clamp B away from the fixed clamp A until the loop formed by the cable takes the shape, indicated in Figure 3 by the heavy outline, of the U enclosed wholly between two plumb lines through the clamps and set up tangentially to the external generatrix of the cable. Measure the new distance, L'. The cable shall then be turned in the clamps by 180°, and the test repeated.

Calculate the mean value of L'.

6.1.3 Pre-conditioning of non-conforming samples

Where the cable does not satisfy the requirement for L', or in the case of dispute, the test shall be repeated after the following pre-conditioning.

Wind the sample four times on and off a reel with a diameter approximately 20 times the outer diameter of the cable. Each time the sample shall be turned through 90°, for round cables or, in the case of flat cables, through 180°.

After this pre-conditioning, the sample shall be subjected to the test described in 6.1.2.