SLOVENSKI STANDARD
SIST HD 605 S2:2009

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SIST HD 605 S1:1998
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SIST HD 605 S1:1998/A4:2005

Elektriļ ni kabli - Dodatne preskusne metode

Electric cables - Additional test methods

Starkstromkabel - Ergänzende Prüfverfahren

Câbles électriques - Méthodes d'essais supplémentaires

Ta slovenski standard je istoveten z: **HD 605 S2:2008**

ICS:

29.060.20 Kabli Cables

SIST HD 605 S2:2009 **en**

HARMONIZATION DOCUMENT

DOCUMENT D'HARMONISATION

HARMONISIERUNGSDOKUMENT

HD 605 S2

July 2008

ICS 29.060.20

Supersedes HD 605 S1:1994 + A1:1996 + A2:2001 + A3:2002 + A4:2004

English version

Electric cables - Additional test methods

Câbles électriques - Méthodes d'essais supplémentaires

Starkstromkabel - Ergänzende Prüfverfahren

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Up-to-date lists and bibliographical references concerning such national implementations 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).

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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

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Foreword

This Harmonization Document was prepared by the Technical Committee CENELEC TC 20, Electric cables.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as HD 605 S2 on 2008-03-01.

This Harmonization Document supersedes HD 605 S1:1994 + A1:1996 + A2:2001 + A3:2002 + A4:2004. It provides a full updating of edition 1, including incorporation of amendments 1, 2, 3 and 4 together with the results from rationalisation of “Harder to harmonise” tests.

In order to maintain the integrity of existing clause numbers, and hence avoid unnecessary amendments to over 100 particular sections of the product HDs, the normative references are given in Annex A.

The numbering of tables and figures in this standard is not conventional. It retains the scheme as used in HD 605 S1. This is to facilitate easier cross referencing in national sections of HD 603, HD 620 and other compendia HDs. It also allows for continuing work to rationalise and harmonise more of these test methods in the future, without the need for further re-numbering.

The following dates were fixed:

- latest date by which the existence of the HD has to be announced at national level (doa) 2008-09-01
- latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement (dop) 2009-03-01
- latest date by which the national standards conflicting with the HD have to be withdrawn (dow) 2009-03-01

Contents

1 General

1.1 Scope

This HD collates and specifies the test methods to be used for testing polymeric insulated and sheathed electric cables, of rated voltage up to and including 20,8/36 kV, intended for public distribution systems, and for use in power generating plants and sub-stations.

Test methods in this HD are additional to those already harmonised, e.g. EN 60332-1 series and EN 60811 series, and are used for testing cable types specified in HD 603, HD 604, HD 620, HD 622, HD 626 and HD 627. In each case, these HDs give complementary information needed for the practical application to each specific type. Therefore the present HD as such is not sufficient for carrying out and evaluating the tests on electric cables.

Full test conditions (e.g. temperatures, durations) and/or test requirements are not specified in this HD. Such data needed to carry out the tests is given in the particular sections.

NOTE The words 'particular section' refer throughout to the section of HD 603 or HD 604, or other HD to which HD 605 applies, in which a particular cable type is specified.

1.2 Applicable tests

Tests applicable to each type of cable are given in the particular section, which may also state the sequence, the frequency of test, and the possibility of repeating failed tests.

1.3 Classification of tests

The classification of tests is given in Parts 1 of HD 603, HD 604, HD 620, HD 622, HD 626 and HD 627.

1.4 Sampling

The size and number of samples are given either in this HD or in the particular HDs.

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

For multicore cables, except for the test specified in 2.1.1, not more than three cores (of different colours, if available) shall be tested unless otherwise specified.

1.5 Test conditions

1.5.1 Ambient temperature

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

1.5.2 Tolerance on temperature values

Unless otherwise specified in the particular specification, the tolerance on temperature values quoted in the test methods are the following:

Table 1.5.2 – Tolerance on temperature values

Specified temperature, *t* °C	Tolerance K
-40 ≤ t ≤ 0	± 2
0 < t ≤ 50	according to relevant clause
50 < t ≤ 150	± 2
t > 150	± 3

1.5.3 Frequency and waveform of power-frequency test voltages

Unless otherwise specified the test voltage shall be in the range 49 Hz to 61 Hz of approximately sine-wave form, the peak ratio value/r.m.s. value being equal to √2 with a tolerance of ± 7 %. The values given are r.m.s..

1.5.4 Pre-conditioning

Unless otherwise stated 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.

2 Non-electrical tests

2.1 Dimensional measurements

2.1.1 Measurement of insulation thickness

2.1.1.1 Procedure

The thickness of insulation shall be measured in accordance with EN 60811-1-1, 8.1. Unless otherwise specified one sample of cable shall be taken and measurement made at three places.

Compliance shall be checked on each core of cables having up to five cores, and on the number of cores stated in the individual specification for cables with more than five cores.

If withdrawal of the conductor is difficult, it shall be stretched in a tensile machine or the piece of core shall be immersed in an appropriate liquid until the insulation becomes loose.

2.1.1.2 Evaluation of results

Unless otherwise specified 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 below, and this shall be taken as the mean value of the thickness of insulation.

If in the calculation the second decimal figure is 5 or more, the first decimal figure shall be raised to the next number thus, for example, 1,74 shall be rounded off to 1,7 and 1,75 to 1,8.

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

2.1.2 Measurement of non-metallic sheath thickness

2.1.2.1 Procedure

The thickness of sheath shall be measured in accordance with EN 60811-1-1, 8.2. Unless otherwise specified, one sample of cable shall be taken and measurement made at three places.

2.1.2.2 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 below, and this shall be taken as the mean value of the thickness of the sheath.

If in the calculation the second decimal figure is 5 or more, the first decimal figure shall be raised to the next number, thus, for example, 1,74 shall be rounded off to 1,7 and 1,75 to 1,8.

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

2.1.3 Measurement of cable dimensions

2.1.3.1 Measurement of overall dimensions

Unless otherwise specified the three samples taken in accordance with this HD, 2.1.1 or 2.1.2 shall be used.

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 EN 60811-1-1, 8.3.

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

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

2.1.3.2 Measurement of ovality

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.

2.1.4 Measurement of wires, strips and tapes

2.1.4.1 Conductor wires

Measurement of the diameter of conductor wires (class 5 conductors).

(a) Sampling

Take at random either 10 % of the total number of wires, rounded upwards, or 10 wires, whichever is the lowest, from one core of each length of cable selected for the test.

(b) Method

Determine the diameter of each wire with a micrometer by taking a measurement in three positions, approx. 300 mm far away from each other. The readings shall be made to two decimal places. Take the average of the three measurements to be the wire diameter.

2.1.4.2 Wires and tapes for concentric conductor or screen

(a) Sampling

A sample of about 500 mm length is taken from the test piece and straightened by means of a non-damaging tool. After that it is cleaned.

(b) Procedure

For wires and tapes the diameter or the thickness is measured with an screw type micrometer or a dial gauge with a measuring element with flat measurement planes with a diameter 4 mm to 8 mm. Measurements shall be made at three points which are uniformly spread along the sample.

(c) Expression of results

The diameter or the thickness is the mean value obtained from the three measurements. The test is considered to be fulfilled if the mean value does not fall below the minimum value prescribed in the particular specification.

2.1.4.3 Wires, strips and tapes for armour

(a) Round wires

Take at random 10 wires or 10 % of the total number of wires, whichever is the smaller, from a sample of the completed cable.

Determine the diameter of each wire of this sampling by taking two measurements at right angles to each other using a micrometer with flat noses to an accuracy of ± 0,01 mm.

Take the average value as the wire diameter.

(b) Flat wires or strips

Take at random 10 flat wires or strips or 10 % of the total number of flat wires or strips, whichever is the smaller, from a sample of the completed cable.

Determine the thickness and width of each flat wire of this sampling by using either a micrometer with flat noses to an accuracy of ± 0,01 mm or a vernier calliper with flat noses to an accuracy of ± 0,02 mm.

Take the average value as the wire thickness and wire width.

(c) Metallic tapes thickness

Take and straighten a sample of each armour tape, remove the non-metallic coating if any, and determine the tape thickness at six different places.

The measurement shall be made with either a micrometer or a vernier calliper, both with two flat noses of approximately 5 mm in diameter, to a respective accuracy of ± 0,01 mm or ± 0,02 mm. For tapes up to 40 mm in width the thickness shall be measured at the centre of the width. For wider tapes the measurements shall be made 20 mm from each edge of the tape and the average of the results taken as the thickness.

Take the smallest value to be compared with the specified thickness with a tolerance given in the particular specification.

2.1.5 Measurement of thickness of metallic sheath

The thickness of lead sheaths shall be determined by one of the following methods, at the discretion of the manufacturer. (Methods of measuring thickness of other types of metallic sheath are under consideration.)

(a) Strip method

The measurement shall be made on a test piece of sheath about 50 mm in length removed from the finished cable length. The test piece shall be taken a sufficient distance from the cable end to allow a proper measurement to be made.

The piece shall be slit longitudinally and carefully flattened. After cleaning the test piece, a number of measurements shall be taken along the circumference of the sheath and not less than 10 mm away from the edge of the flattened piece to ensure that the minimum thickness is measured. The measurement shall be made with a micrometer with plane faces of 2 mm to 8 mm diameter and an accuracy of ± 0,01 mm.

(b) Ring method

The measurements shall be made on a ring of the sheath carefully cut from the sample. The thickness shall be determined at a sufficient number of points around the circumference of the ring to ensure that the minimum thickness is measured.

The measurements shall be made with a micrometer having either one flat nose and one ball nose, or one flat nose and a flat rectangular nose 0,8 mm wide and 2,4 mm long. The ball nose or the flat rectangular nose shall be applied to the inside of the ring. The accuracy of the micrometer shall be ± 0,01 mm.

2.1.6 Check of application of screen or armour tapes, or wires

2.1.6.1 Method 1

Take a cable sample 300 mm long, at not less than 150 mm from the end of a factory length. Measure the gap between adjacent edges of the tape(s), and also the tape width. Measurement is made at 4 positions along the sample, with an accuracy better than 0,5 mm.

2.1.6.2 Method 2

Remove two rings of the oversheath each 50 mm in length, cut at a distance of 5 D and 15 D, respectively, (where D is the overall diameter) from one end of the cable length, so as to expose the metallic tapes or wires.

Make a visual examination of the exposed components and measure the largest gap between adjacent wires or tapes. The measurement shall be made with an accuracy better than 0,5 mm and the result shall be given to one decimal place.

2.1.7 Percentage coverage of a braided metallic layer

The percentage coverage "*B*" of the braiding shall be calculated by the following equation:

$$B = \frac{100d}{q}\left(m_1 n_1 + m_2 n_2 - m_1 n_1 m_2 n_2 \frac{d}{q}\right)$$

where

$$q = \frac{\pi DS}{\sqrt{\pi^2 D^2 + S^2}}$$

D = mean diameter of braiding (= diameter under metallic layer + 2 d, mm);

d = nominal diameter of the wires of the braid, mm;

S = lay of the wires of the braiding, mm;

m_1 = number of spindles in one direction;

m_2 = number of spindles in the other direction;

n_1; n_2 = number of wires per spindle according to the direction.

2.1.8 Measurement of the gap between non-metallic tapes of taped bedding

See 2.1.6.1

2.1.9 Measurement of rubber layer thickness

2.1.9.1 Single rubber layer

The diameters over the copper concentric neutral/earth conductor and the laid up cores shall be determined by a diameter tape at the same position. The nominal thickness of the rubber layer is to be taken as half the difference between these two diameters, less the diameter of one copper wire comprising the neutral/earth layer.

2.1.9.2 (Spare)

2.1.10 Irregularities of semi-conducting layers and insulation

2.1.10.1 Method 1 – Irregularities of semi-conducting conductor screen and insulation

(a) Procedure

See 2.1.10.2

(b) Requirements

(i) Irregularities of semi-conducting conductor screen (Figure 2.1.10.1 a))

The semi-conducting conductor screen shall be as far as possible free from irregularities; in any case, there shall be no pronounced irregularities.

Sporadic irregularities may be allowed if the following requirements are complied with:

- irregularities of the semi-conducting conductor screen may not penetrate by more than 0,080 mm into the insulation;
- when the height *H* of the irregularities is not less than 0,040 mm, the ratio (*B*)/(*H*) must be greater than or equal to 3;
- irregularities where (*H*) is less than 0,040 mm are not taken into consideration.

(ii) Irregularities of the insulation into semi-conducting conductor screen (Figure 2.1.10.1 b))

Irregularities of the insulation shall not penetrate into the semi-conducting conductor screen by more than 0,20 mm.

(iii) Irregularities inside the insulation (Figure 2.1.10.1 c))

Sporadic irregularities are allowed taking into account the following conditions:

- Irregularities for which the maximum dimension (*L*) is less than 0,05 mm are not considered;
- Irregularities for which the maximum dimension (*L*) is greater than 0,20 mm are not authorised;
- If irregularities are observed for which the maximum dimension (*L*) is greater than 0,05 mm but less than or equal to 0,20 mm a second sample, taken close to the first one, shall be examined and shall not be permitted to show irregularities.