SLOVENSKI STANDARD
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Method of test for resistance to fire of unprotected small cables for use in emergency circuits

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Prüfung des Isolationserhaltes im Brandfall von Kabeln mit kleinen Durchmessern für die Verwendung in Notstromkreisen bei ungeschützter Verlegung

Méthode d'essai de résistance au feu des câbles de petites dimensions sans protection pour utilisation dans les circuits de secours

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English version

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This European Standard was approved by CENELEC on 1999-08-01. 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

Foreword

This European Standard was prepared by Working Group 10 of the Technical Committee CENELEC TC 20, Electric cables.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50200 on 1999-08-01.

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) 2000-08-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2002-08-01

Annexes designated 'normative' are part of the body of the standard.
Annexes designated 'informative' are given for information only.
In this standard annex C is normative and annexes A, B, D and E are informative.

This European Standard has been prepared under Mandate M/117, given jointly to CEN and CENELEC by the Commission of the European Communities and the European Free Trade Association, and supports Essential Requirement No.2 "Safety in case of fire" of the Construction Products Directive.

The cable is tested in a representative installed condition, under conditions of minimum bending radius, and the test is based upon a minimum test temperature of 830°C. This is typical of the gas temperature reached after 30 min exposure to the time/temperature conditions prescribed in EN 1363-1.

The test method in this document includes exposure to fire with mechanical shock under specified conditions, but the apparatus and methodology have been developed such that additional aspects can be included at a later date if required.

Contents

1 Scope

This European Standard specifies the test method for cables designed to have intrinsic resistance to fire and intended for use as emergency circuits for alarm, lighting and communication purposes.

This standard is applicable to cables, for emergency circuits, of rated voltage not exceeding 600/1 000 V, including those of rated voltage below 80 V, and for emergency circuit optical cables.

NOTE: Although test procedures for electronic data and communication cables and optical fibre cables are given in this document, these areas are under active development and the given procedures may be subject to future review.

This standard is not applicable to cables intended for use in public telecommunications networks.

The test method is limited to cables with an overall diameter not exceeding 20 mm.

The test method, which is based on the direct impingement of flame from a propane burner giving a constant temperature attack of a notional 842°C, can be used for cables for emergency circuits required to comply with sub-clause 4.3.1.4.6(a) of the Interpretative Document for Essential Requirement No. 2 'Safety in Case of Fire' (94/C62/01) of the Construction Products Directive (89/106/EEC). In such cases the test method only applies, for metallic conductor cables, to those with conductor sizes up to and including 2,5mm^2. For optical cables, only the 20 mm diameter limit applies.

This standard includes (annex D) a means of linking the measured survival time to the fire resistance classification for these cables, as required by sub-clause 4.3.1.4.6(a) of 94/C62/01.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 60269-3		Low voltage fuses -- Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for domestic and similar applications) (IEC 60269-3)
EN 60584-1		Thermocouples -- Part 1: Reference tables (IEC 60584-1)
EN 60695-4		Fire hazard testing -- Part 4: Terminology concerning fire tests (IEC 60695-4)
IEC 60793-1-4	1995	Optical fibres -- Part 1: Generic specification -- Section 4: Measuring methods for transmission and optical characteristics

3 Definitions

For the purposes of this standard the definitions given in EN 60695-4 apply.

4 Duration of survival

4.1 Time

The duration of survival, measured in minutes, to the point of failure shall be recorded for each cable tested up to a maximum survival time of 90 min.

4.2 Point of failure

The criteria for determining the point of failure shall be as follows:

a) **Electric power and control cables of rated voltage up to 600/1 000 V**

1) The voltage is not maintained during the test duration, as indicated by fuse failure or by interruption of the circuit breaker.

2) A conductor ruptures during the test duration, as indicated by the lamp extinguishing.

b) **Electric data and communications cables with no rated voltage**

1) The voltage is not maintained during the test duration, as indicated by fuse failure or by interruption of the circuit breaker.

2) A conductor ruptures during the test duration, as indicated by the lamp extinguishing.

c) **Optical fibre cables**

1) The maximum increase in attenuation exceeds the value given in the cable standard during the test duration.

In the case of cables in (a) and (b), failure by either one of the criteria listed shall be sufficient to show a failure for that cable.

5 Test environment

The test shall be carried out in a suitable chamber with facilities for disposing of any noxious gases resulting from the burning. Sufficient ventilation shall be available to sustain the flame for the duration of the test.

The chamber and test apparatus shall be at (25 ± 15)°C at the start of each test.

The same ventilation and shielding conditions shall be used in the chamber during both the verification and cable test procedures.

NOTE 1: The test given in this standard may involve the use of dangerous voltages and temperatures. Suitable precautions should be taken against shock, burning, fire and explosion risks that may be involved and against any noxious fumes that may be produced.

NOTE 2: An example of a suitable chamber is the 3m smoke cube as specified in EN 50268-1.

NOTE 3: Shields, such as those as described in EN 50268-1, may need to be placed in an appropriate position to protectthe burner from draughts that may influence the flame geometry.

6 Test apparatus

6.1 Test equipment

The test equipment consists of the following:

a) A vertical wall, on to which the cable is mounted, comprising a board manufactured from heat resisting non-combustible material fastened to steel supports as described in 6.2.

b) A continuity checking arrangement as described in 6.3.

c) A source of heat comprising a horizontally mounted ribbon burner as described in 6.4.

d) A shock producing device as described in 6.5.

A general arrangement of the test equipment is shown in Figures 1, 2 and 3.

6.2 The wall and its mounting

The wall consists of a board of heat resisting non-combustible and non-metallic material fastened rigidly to two horizontal steel supports, one at the top of the board and the other at the bottom. Vertical supports may also be used. The board is approximately 900 mm long, 300 mm high and 9 mm thick, and the total mass of the wall (i.e. board and steel supports) shall be (10 ± 0,5) kg. Ballast, if required, shall be placed inside the steel supports.

Guidance on the choice of suitable material for the wall is given in annex A.

NOTE 1: Supports made from square section steel tube approximately 25 mm x 25 mm and approximately 1 m long have been found to be suitable

NOTE 2: The top support should be fastened to the board so that its upper face is slightly above the upper edge of the board, so that the shock producing device impacts on the support and not the board.

Each support shall have a horizontal hole at each end, the exact position and diameter being determined by the particular supporting bush and supporting framework used. The wall shall be fastened to a rigid support by four bonded rubber bushes fitted between the horizontal steel supports of the wall and the support framework, as shown in Figure 1, so as to allow movement under impact.

NOTE 3: A typical rubber bush which has been found to be suitable is shown in Figure 4.

In order to check the mounting of the wall, the static deflection following application of a load to the centre of the upper support of the wall shall periodically be measured.

The values of load and deflection shall comply with the following:

Load (kg)	Deflection (mm)
25 ± 0,2	1,5 ± 0,3

6.3 Continuity checking arrangement

6.3.1 Electric power and control cables with rated voltage up to 600/1 000 V

During the test a current for continuity checking is passed through all conductors of the cable and this shall be provided by a three phase star connected or single phase transformer(s) of sufficient capacity to maintain the test voltage up to the maximum leakage current allowable.

NOTE 1: Due note should be taken of the fuse characteristics when determining the power rating of the transformer.

This current is achieved by connecting, at the other end of the sample, a suitable load and indicating device (e.g. lamp) to each conductor, or group of conductors.

NOTE 2: A current of 0,25 A at the test voltage, through each conductor or group of conductors, has been found to be suitable.

6.3.2 Electric data and communication cables with no rated voltage

During the test a current for continuity checking is passed through all conductors of the cable and this shall be provided by a three phase star connected or single phase transformer(s) of sufficient capacity to maintain the test voltage up to the maximum leakage current allowable.

NOTE 1: Due note should be taken of the fuse characteristics when determining the power rating of the transformer.

This current is achieved by connecting, at the other end of the sample, a suitable load and indicating device (e.g. lamp) to each conductor, or group of conductors.

NOTE 2: A current of 0,25 A at the test voltage, through each conductor or group of conductors, has been found to be suitable.

6.3.3 Optical fibre cables

At the conclusion of the test, check each fibre (or those fibres indicated in the relevant cable specification as fire resistant) for continuity.

6.4 Source of heat

The source of heat shall be a ribbon type propane gas burner with a nominal burner face length of 500 mm with Venturi mixer. A centre-feed burner is recommended. The nominal burner face width shall be 15 mm. The face of the burner shall have three staggered rows of drilled holes, nominally 1,32 mm in diameter and drilled on 3,2 mm centres, as shown in Figure 5. Additionally, a row of small holes milled on each side of the burner plate, to serve as pilot holes for keeping the flame burning, is permitted.

Guidance on the choice of recommended burner systems is given in annex A.

The burner shall be fitted with an accurate means of controlling the fuel and air input flow rates either by means of a rotameter-type flowmeter or a mass flowmeter.

Figure 6 shows an example of a rotameter-type system. Corrections for variations in temperature or pressure from that specified for the rotameter-type flowmeters shall be applied when necessary. Guidance on the application of correction factors is given in annex B.

NOTE: Mass flowmeters are recommended for ease of use and accuracy of control.

By reference to the wall the burner shall be positioned centrally at a horizontal distance of (40 ± 2) mm from the burner face to the wall as shown in Figures 2 and 3. The burner shall be positioned in the test chamber such that it is at least 200 mm above the floor of the chamber or any solid mounting table and 500 mm from any chamber wall.

The flow rates used for the test at reference condition (1 bar and 20°C) shall be as follows:

Propane: (5 ± 0,2) litres/minute
Air: (80 ± 4) litres/minute

The burner and control system shall be subject to verification following the procedure given in clause 7.

For the purposes of this test, the air shall have a dew point not higher than 0°C.

6.5 Shock producing device

The shock producing device consists of a mild steel round bar (25 ± 0,1) mm in diameter and (600 ± 5) mm long. The bar is freely pivoted about an axis parallel to the wall, which is in the same horizontal plane as, and (200 ± 5) mm away from, the upper edge of the wall. The axis divides the bar into two unequal parts of length (400 ± 5) mm and approximately 200 mm respectively; the longer section impacting the wall. The bar drops under its own weight from an angle of 60° to the horizontal to strike the upper steel support of the wall at its midpoint as shown in Figure 1 and Figure 3.

7 Verification procedure for source of heat

7.1 The flame temperature shall be measured using two 1,5 mm mineral insulated, stainless steel sheathed thermocouples Type K to EN 60584-1, mounted on the test wall as shown in Figure 7. The thermocouple tips shall be (10 ± 0,5) mm in front of the test wall. The horizontal line of the thermocouples shall be approximately 100 mm above the bottom of the wall.

Position the burner (40 ± 2) mm horizontally from the wall and (65 ± 10) mm vertically below the centre line of the thermocouple as shown in Figure 3.

Ignite the burner and adjust the gas and air supplies to those given in 6.4.

7.2 Monitor the temperature as recorded by the thermocouples over a period of 10 min to ensure conditions are stable.

7.3 The verification procedure shall be considered satisfied if the average of the two thermocouple readings over the 10 min falls within the requirement of (830 + 40, -0)°C and the maximum difference of the average individual thermocouple readings does not exceed 40°C. At least one measurement shall be made every 30 s in order to obtain the average.

NOTE: The actual method of obtaining the average thermocouple reading over the period is not specified but it is recommended that a recorder with averaging facilities is used in order to damp the variability caused by point measurement.

7.4 If the verification is not successful, the flow rates shall be altered within the tolerances given in 6.4 and/or distances altered within the tolerances given in 7.1 and a further verification carried out.

7.5 The positions established for successful verification shall be recorded (see 9.1.2).

7.6 If no successful verification can be achieved within the tolerances given, then the burner system shall be considered as incapable of providing the source of heat required by this standard.

8 Test sample

8.1 Sample preparation

8.1.1 Electric power and control cables with rated voltage up to 600/1 000 V

The sample to be tested shall be a piece of cable not less than 1 200 mm long with approximately 100 mm of sheath and outer coverings removed at each end. At each end of the cable, each conductor shall be suitably prepared for electrical connections, and the exposed conductors shall be spread apart to avoid contact with each other.

8.1.2 Electric data and communication cables with no rated voltage

The sample to be tested shall be a piece of cable not less than 1 200 mm long with approximately 100 mm of sheath or outer coverings removed at each end. At each end of the cable, each conductor shall be suitably prepared for electrical connections, and the exposed conductors shall be spread apart to avoid contact with each other.

8.1.3 Optical fibre cables

The sample to be tested shall be a piece of cable (at least 5 m) sufficiently long that the two ends emerge from the test chamber, with approximately 100 mm of sheath or outer coverings removed at each end. For multi-fibre cables, one fibre shall be selected from the outermost layer of the cable. At each end of the cable sample, lengths of identical optical fibre shall be connected, if necessary, to give a total length appropriate to the optical measuring method used.

8.2 Sample mounting

The cable shall be bent to form an approximate 'U' shape. The internal radius of each bend shall be the manufacturer's declared minimum bending radius and the overall distance between the vertical portions of the cable shall be approximately 475 mm as shown in Figure 8.

The cable shall be mounted centrally on the wall using metal clips, as recommended by the manufacturer for the cable under test, for example, copper P clips. The clips, which shall be earthed, shall support the cable at either end of the radiused section and in the centre as shown in Figure 8. The type of clips used shall be detailed in the Test Report.

NOTE: By agreement between the user and manufacturer of the cable alternative clips may be used for the testing of multicore cable, but in this case the test shall only be considered valid for cable installed with such clips.

9 Cable test procedure

9.1 General

9.1.1 Remove the thermocouple assembly and position the cable test sample on the wall as described in 8.2.

9.1.2 Position the burner (40 ± 2) mm horizontally from the wall, and at the same vertical distance below the bottom line of the cable as determined in the verification procedure for the distance between burner and thermocouple centre lines.

9.1.3 Fuses used in the test procedures in 9.2.1 and 9.2.2 shall be Type DII complying with EN 60269-3. Alternatively, a circuit breaker with equivalent characteristics may be used.

Where a circuit breaker is used, its equivalent characteristics shall be demonstrated by reference to the characteristic curve shown in annex C.

The fuse shall be the reference method in the case of dispute.

9.2 Procedure for different cable types

9.2.1 Electric power and control cables with rated voltage up to 600/1 000 V

At the transformer end of the sample, earth the neutral conductor and any protective conductor. Any metal screens, drain wire or metallic layer shall be interconnected and earthed. Connect the transformer(s) to the conductors, excluding any conductor which is specifically identified as intended for use as a neutral or a protective conductor, as shown in the circuit diagram (Figure 9a).

Where a metallic sheath, armour or screen acts as a neutral or protective conductor, it shall be connected as shown in the circuit diagram (Figure 9a), as for a neutral or protective conductor.

For single, twin-or three-phase conductor cables, connect each phase conductor to a separate phase of the transformer(s) output with a 2 A fuse or circuit breaker with equivalent characteristics in each phase.

For multicore cables having four or more conductors (excluding any neutral or protective conductors), the conductors shall be divided into three roughly equal groups, ensuring that adjacent conductors are, as far as possible, in different groups.

For multipair cables the conductors shall be divided into two equal groups, ensuring that the a-core of each pair is connected to one phase and the b-core of each pair is connected to another phase (L1 and L2 of Figure 9a). Quads shall be treated as 2 pairs.

For multitriple cables the conductors shall be divided into three equal groups, ensuring that the a-core of each triple is connected to one phase, the b-core of each triple to another phase and the c-core of each triple to the third phase of the transformer. (L1, L2 and L3 of Figure 9a)

Connect the conductors of each group in series and connect each group to a separate phase of the transformer output with a 2 A fuse or circuit breaker with equivalent characteristics in each phase.

NOTE: For cable constructions not specifically identified above, the test voltage should be applied, as far as is practicable, to ensure that adjacent conductors are connected to different phases.

At the end of the sample remote from the transformer

- connect each phase conductor, or group of conductors , to one terminal of the load and indicating device (as described in 6.3.1), the other terminal being earthed;

- connect the neutral conductor and any protective conductor to one terminal of the load and indicating device (as described in 6.3.1), the other terminal being connected to L1 (or L2 or L3) at the transformer end (see Figure 9a).

9.2.2 Electric data and communication cables with no rated voltage

At the transformer end of the sample, earth any earth conductor. Any metal screens, drain wire or metallic layer shall be interconnected and earthed. Connect the transformer(s) to the conductors, excluding any conductor which is specifically identified as intended for use as an earth conductor, as shown in the circuit diagram (Figure 9b).