

Method of test for resistance to fire of larger unprotected power and control cables for use in emergency circuits

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National foreword

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Method of test for resistance to fire of larger unprotected power and control cables for use in emergency circuits

Méthode d'essai de résistance au feu des câbles de contrôle et d'énergie de grande dimension non protégés pour utilisation dans les circuits de secours

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

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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 the Technical Committee CENELEC TC 20, Electric cables.

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1 Scope

This European Standard specifies a test method for cables designed to have intrinsic resistance to fire and intended for use as emergency circuits.

The standard is applicable to power and control cables for emergency circuits of rated voltage not exceeding 0,6 /1 kV.

The test method is intended for cables with an overall diameter exceeding 20 mm. Cables of smaller diameter shall be tested in accordance with EN 50200.

The test method is based on the direct impingement on the cable of the flame from a propane burner giving a constant temperature attack of a notional 842 °C and under the influence of mechanical impact.

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 (including amendments).

EN 50200	Method of test for resistance to fire of unprotected small cables for use in emergency circuits
EN 60269-3	Low voltage fuses — Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for domestic and similar applications)
EN 60584-1	Thermocouples — Part 1: Reference tables
EN 60695-4	Fire hazard testing — Part 4: Terminology concerning fire tests

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 120 min, or the required survival time given in the particular cable standard.

4.2 Point of failure

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

- the voltage is not maintained during the test duration, as indicated by fuse failure or by interruption of the circuit breaker;
- a conductor ruptures during the test duration, as indicated by the lamp extinguishing.

Failure by either one of the criteria listed shall be sufficient to show 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 in the range 10 °C to 40 °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 involves 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 3 m smoke cube as specified in EN 50268-1.

NOTE 3 Shields, such as those described in EN 50268-1, may need to be placed in an appropriate position to protect the 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 test ladder on to which the cable is mounted, comprising steel framework fastened to a rigid support as described in 6.2;
- b) a continuity checking and voltage withstand 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;
- e) a test wall equipped with thermocouples for verification of the source of heat as described in Clause 7.

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

6.2 The test ladder and its mounting

The test ladder consists of a steel framework as shown in Figure 1. The two central vertical elements of the ladder are adjustable in order to accommodate different sizes of cable under test. The test ladder is approximately 1 200 mm long and 600 mm high, and the total mass of the test ladder shall be (18 ± 1) kg. Ballast, if required, shall be placed on the steel supports.

Each horizontal element shall have a mounting hole not more than 200 mm from each end, the exact position and diameter being determined by the particular supporting bush and supporting framework used. The test ladder shall be fastened to a rigid support by four bonded rubber bushes of hardness 50 to 60 Shore A fitted between the horizontal steel elements of the ladder and the support framework, as shown in Figures 1 and 2 so as to allow movement under impact.

NOTE 1 Angle iron approximately 45 mm wide and 6 mm thick, with suitable slots cut to allow for movement of vertical elements and fixing of the bolts and clips, has been found to be a suitable material for construction of the ladder.

NOTE 2 A typical rubber bush which has been found to be suitable is shown in Figure 4.

6.3 Continuity checking and voltage withstand arrangement

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.

6.4 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 10 mm. The face of the burner shall have three staggered rows of drilled holes nominally 1,32 mm in diameter and drilled at centres 3,2 mm from one another, 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 EN 50200, Annex A.

Mass flow meters shall be used as the means of controlling accurately the input flow rates of fuel and air to the burner.

NOTE 1 Rotameter type flow meters may be used as an alternative, but are not recommended. Guidance on their use, and the application of appropriate correction factors, may be found in EN 50200. Figure 6 shows an example of a rotameter type system.

By reference to the centre point of the cable to be tested, the burner shall be positioned centrally at a horizontal distance of $(H \pm 2)$ mm from the burner face to the centre of the cable and at a vertical distance of $(V \pm 2)$ mm from the burner centre line to the centre of the cable, as shown in Figure 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 conditions (1 bar and 20 °C) shall be as follows:

propane: $(10,0 \pm 0,4)$ litres/min;

air: (160 ± 8) litres/min.

The burner and control system of this test shall be subject to verification following the procedure given in Clause 7. The exact burner position to be used during cable testing shall be determined during the verification procedure, where the values of V and H to be used shall be determined.

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

NOTE 2 The burner should be rigidly fixed during the test so as to prevent movement relative to the test sample.