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

The European Standard EN 50200:2006 has the status of a British Standard
National foreword

This British Standard is the official English language version of EN 50200:2006. It supersedes BS EN 50200:2000 which is withdrawn and BS 8434-1:2003 which will be withdrawn on 1 March 2009.

The UK participation in its preparation was entrusted by Technical Committee GEL/20, Electric cables, to Subcommittee GEL/20/18, Fire testing, which has the responsibility to:

— aid enquirers to understand the text;
— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the BSI Electronic Catalogue or of British Standards Online.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 29 and a back cover.

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

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

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

This European Standard was approved by CENELEC on 2006-03-01. 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.

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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 European Standard was prepared by Working Group 10 of the Technical Committee CENELEC TC 20, Electric cables. This edition is a consolidation of the original text of EN 50200:2000 approved on 1999-08-01 and the text of the draft amendment prepared by WG 10 and agreed at 115 BT (D115/055, confirmed by D116/162 at 116th Technical Board (BT)) to go forward to the Unique Acceptance Procedure at which a positive vote was achieved.

This consolidated text was submitted to the formal vote and was approved by CENELEC as EN 50200 on 2006-03-01.

This European Standard supersedes EN 50200:2000.

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) 2007-03-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2009-03-01

This European Standard was originally 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 constant temperature attack at 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 and satisfies the requirements of Mandate M/117 for the PH classification. The standard also includes (Annex E) a means of applying a water spray to the cable during the test, which is not required under Mandate M/117.
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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 Subclause 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 2,5 mm\(^2\). 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 Subclause 4.3.1.4.6(a) of 94/C62/01.

The standard also includes (Annex E) a means of applying a water spray to the cable during the test. Although there is no requirement under the Construction Products Directive for cables to withstand water spray when assessing resistance to fire, such a requirement may be a feature of particular product standards.

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.

**HD 60269-3-1** Low-voltage fuses Part 3-1: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications) Sections I to IV: Examples of types of standardized fuses (IEC 60269-3-1:2004, modified)

**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 120 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.

NOTE The test procedure given in 9.2.1 connects the neutral core to earth. This may not be appropriate if the cable is designed for use on systems where the neutral is not earthed. If required by the cable standard, it is permissible for the neutral conductor to be tested as if a phase conductor. Where a metallic sheath, armour or screen acts as a neutral conductor, it shall always be connected to earth.

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 3 m smoke cube as specified in EN 61034-1.

NOTE 3 Shields, such as those as described in EN 61034-1, 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 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;

e) 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:

<table>
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<tr>
<th>Load (kg)</th>
<th>Deflection (mm)</th>
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<td>1,5 ± 0,3</td>
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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 10 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.

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

NOTE 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 Annex B. Figure 6 shows an example of a rotameter type system.

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) l/min | Air: (80 ± 4) l/min |

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

a) the average of the readings from the two thermocouples over the 10 min period falls within the requirement of (830 + 40, -0) °C and

b) the maximum difference between the averaged readings for each of the two thermocouples over the 10 min period does not exceed 40 °C.

At least one measurement shall be made on each thermocouple every 30 sec 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 HD 60269-3-1. 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).

For multicore cables, the conductors (excluding any earth conductor) shall be divided into two 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 9b). 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 9b).

Connect the conductors of each group in series and connect each group to a separate phase of the voltage source 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 conductor, or group of conductors, to one terminal of the load and indicating device (as described in 6.3.2) the other terminal being earthed;
- connect any earth conductor to one terminal of the load and indicating device (as described in 6.3.2), the other terminal being connected to L1 (or L2 or L3) at the transformer end (see Figure 9b).

9.2.3 Optical fibre cables

Connect the fibre(s) (or those fibres indicated in the relevant cable specification) to an optical apparatus to monitor and/or measure the change in optical transmittance in accordance with IEC 60793-1-4, method C10. Unless otherwise stated in the appropriate standard, the test shall be carried out at the declared nominal wavelength of operation.
9.3 Ignition and shock production

Ignite the burner and adjust the propane and air flow rates to those obtained during the verification procedure (see Clause 7).

Immediately after igniting the burner, switch on the electricity supply as indicated in 9.4, activate the shock producing device and start the test duration timer. The shock producing device shall impact the wall after 5 min ± 10 s from activation and subsequently at 5 min ± 10 s intervals.

9.4 Electrification or optical monitoring

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

For electric power and control cables of rated voltage up to and including 600/1 000 V, switch on the electricity supply and adjust the voltage to the rated voltage of the cable (subject to a minimum voltage of 100 V a.c.), i.e. the test voltage between conductors shall equal the rated voltage between conductors and the test voltage from conductor to earth shall equal the rated voltage from conductor to earth.

9.4.2 Electric data and communication cables with no rated voltage

For electric data and communication cables with no rated voltage, switch on the electricity supply and unless otherwise stated in the appropriate standard adjust the voltage to (110 ± 10) V a.c. phase to earth.

9.4.3 Optical fibre cables

For optical fibre cables, switch on the optical apparatus and monitor the attenuation.

9.5 End-point

The test shall be continued either:

i) to a time required to achieve a particular fire resistance classification, as defined in Interpretative Document No.2 of the Construction Products Directive (see Annex D), or

ii) to the point of failure.

The point of failure shall be as defined in 4.2.

NOTE A particular cable standard may require an alternative survival time and/or measure of the point of failure. In such cases no classification against the Construction Products Directive shall be claimed.

10 Test report

The test report shall include the following information:

a) the number of this EN;

b) full description of cable tested;

c) manufacturer of cable tested;

d) test voltage or test wavelength;

e) any options used in methodology (i.e. type of test wall, rotameter type flow meter), and point of failure mechanism;

f) type and disposition of clips supporting cable sample;

g) the actual cable bending radius used for the test;

h) method used for temperature monitoring during the verification procedure;

i) the survival time achieved;

j) the classification, if any, claimed against Subclause 4.3.1.4.6 (a) of the Interpretative Document for Essential Requirement No. 2 (94/C62/01) of the Construction Products Directive (89/106/EEC).
Dimensions in millimetres
(Dimensions are approximate)

**Key**

1. shock producing device
2. steel support
3. rubber bush
4. ribbon gas burner
5. air inlet pipe
6. propane inlet pipe

**Figure 1 - Schematic of test wall**
This figure is purely representational and does not indicate nor imply relative sizes or dispositions of components of the test.

**Key**

1. entry for air
2. board
3. rubber bush
4. support framework
5. horizontal steel support for board
6. entry for propane gas

**Figure 2 - Plan view of fire test equipment (not to scale)**
Figure 3 - End elevation of fire test equipment (not to scale)

Key

1. shock producing device
2. test wall
3. gas burner
4. centre line of burner face

Dimensions in millimetres
(Dimensions are approximate except where tolerated)
Figure 4 - Typical rubber bush (hardness: 50-60 shore A) for fastening wall

Round holes, 1.32 mm diameter, on 3.2 mm centres, staggered in three rows and centred on face of the burner

Figure 5 - Burner face
Figure 6 - Schematic diagram of an example of a fuel control system using rotameters

Key

1 regulator
2 piezoelectric igniter
3 flame failure device
4 control thermocouples
5 propane cylinder
6 screw valve (6A = alternative position)
7 pilot feed
8 gas flow
9 flowmeters
10 venturi mixer
11 burner
12 ball valve
13 air flow
14 compressed air cylinder
Key
1  thermocouple supports  
2  thermocouple tip  
3  burner  
4  1,5 mm type K sheathed thermocouples

Figure 7 - Temperature measuring arrangement

Key
1  Metal clips  

R = minimum bending radius of cables

Figure 8 - Example of method of mounting a sample for test
**Key**

L1, L2, L3 = phase conductors (L2, L3 if present)

N = neutral conductor (if present)

PE = protective earth (if present)

1 transformer

2 fuse (2 A)

3 connection to phase L3 (or L1 or L2)

4 metal clips

5 test conductor or group

6 load and indicating device (e.g. lamp)

7 sample

8 metal screen (if present)

---

**Figure 9a - Basic circuit diagram -**

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

L1, L2, L3 = line conductors (L2, L3 if present)
E = earth conductor (if present)

1 transformer
2 fuse (2 A)
3 connection to phase L3 (or L1 or L2)
4 metal clips
5 test conductor or group
6 load and indicating device (e.g. lamp)
7 sample
8 metal screen (if present)

Figure 9b - Basic circuit diagram -
Electric data and communication cables with no rated voltage
Annex A
(informative)

Guidance on the choice of test equipment

NOTE The information given in this annex, covering named products and their suppliers, is given for the convenience of users of this standard and does not constitute an endorsement by CENELEC TC 20 of the product named. Equivalent products may be used if they can be shown to lead to the same results.

A.1 Burner and Venturi

A commercially available burner face meeting the requirements of this standard is the AGF burner insert 11-55, and a suitable 500 mm burner including the specified burner face is available from AGF, reference 1857B.

A recommended Venturi mixer is the AGF 14-18.

AGF
American Gas Furnace Company
PO Box 496
Elizabeth
New Jersey 07207
USA

A.2 Mass flow meters

Commercially available mass flow meters suitable for use in carrying out tests according to this standard are supplied by, amongst others:

1. Brooks Instrument Rosemount
2. Kobold Instruments MAS Flow Monitor

A.3 Test wall material

Examples of materials which have been found to be suitable for the wall are:

i) Tenmat Limited, UK - Sindanyo H61
ii) Frenzelit-Werke, Germany - Isoplan 1100
iii) Skamol, Denmark - Skamolex V-1100 Mk.2
iv) Elit, France - Monolax 500

A.4 Rubber bushing

Commercially available bushings which have been found to be suitable for mounting the wall include:

i) Autogem rubber bushing Type SM1 (UK)
ii) Paulstra "Radiaxfl R diabolo" Type RON 521403 (France)
iii) Vibro Stop TA 431 (Germany)
A.5 Guidance on provision of a suitable test chamber

The chamber must have a sufficient volume such that fire effluents released during combustion do not alter the test conditions. Experience has shown a chamber similar to the 3 m cube specified in EN 61034-1 to be suitable. Windows may be installed in the walls of the chamber in order to observe the behaviour of the cable during the test. Fume exhaust should be by means of natural draught through a chimney located at least 1 m from the burner. A damper may be used for adjustment of ventilation conditions. The use of forced ventilation is not recommended.

Air inlet to the chamber should be through orifices located near the base of the chamber. Air inlets and an exhaust chimney should be located in such a way that the burner flame remains stable during the verification procedure and test.
Annex B
(informative)

Flowmeter calibration correction factors

B.1 General

When using the rotameter type flowmeters to monitor the supply rate of the gases, two factors need to be considered in order to use them correctly. It is important

a) to know what the flowmeter is indicating when used under the actual operating conditions;

b) to know under what conditions of temperature and gas pressure the flowmeter was calibrated, and under what conditions it was designed to operate.

Considering point (a), most flowmeters are designed to indicate the volumetric flow rate at atmospheric temperature and pressure, i.e. 20 °C and 1 bar. However, considering point (b), not all flowmeters are calibrated and designed to work at the same temperature and pressure, and care should be taken to ensure that the temperature and pressure of the gas flowing through a flowmeter are correct for that particular meter. Working the flowmeter at temperatures and pressures different from these conditions requires application of a correction factor such as provided hereafter.

B.2 Example

B.2.1 General

Assume that an air flow rate of 80 l/min at 1 bar and 20 °C is required at the burner:

Flowmeter 1 : Calibrated to operate at 2,4 bar absolute and 15 °C, but to indicate l/min at 1 bar and 15 °C

Flowmeter 2 : Calibrated to operate at 1 bar absolute and 20 °C, but to indicate l/min at 1 bar and 20 °C

Assume that the air supply pressure up to and including the flowmeters is alternatively at 1 bar (see B.2.2) or at 2,4 bar (see B.2.3), and 20 °C.

The calibration correction factor is given as follows:

\[ C = \left[ \frac{P_1}{P_2} \times \frac{T_2}{T_1} \right] \]

where

- \( T \) is the absolute temperature, in kelvins (K);
- \( P \) is the absolute pressure, in bars (bar);
- \( P_1, T_1 \) are the calibration conditions;
- \( P_2, T_2 \) are the operating conditions.
B.2.2 Air supplied at 1 bar

Flowmeter 1

This will require a correction factor to be used since the meter is operating in conditions removed from its designed operating conditions:

\[ P_1 = 2.4 \text{ bar} \quad T_1 = 15 \, ^\circ\text{C} = 288 \, \text{K} \]
\[ P_2 = 1 \text{ bar} \quad T_2 = 20 \, ^\circ\text{C} = 293 \, \text{K} \]

Substituting these values:

\[ C = \sqrt{\frac{2.4}{1} \times \frac{293}{288}} = 1.56 \]

Thus to set a flow rate of 80 l/min at reference conditions a reading on this flowmeter of 125 l/min (80 x 1.56) is required.

Flowmeter 2

Since this meter is operating under its design conditions, the required flow rate of 80 l/min can be read directly from the meter with no correction factor necessary.

B.2.3 Air supplied at 2.4 bar

Flowmeter 1

This will require a correction factor for temperature, but not for pressure since the meter is operating at its design pressure:

\[ P_1 = 2.4 \text{ bar} \quad T_1 = 15 \, ^\circ\text{C} = 288 \, \text{K} \]
\[ P_2 = 2.4 \text{ bar} \quad T_2 = 20 \, ^\circ\text{C} = 293 \, \text{K} \]

Substituting these values:

\[ C = \sqrt{\frac{2.4}{2.4} \times \frac{293}{288}} = 1.01 \]

Thus to set a flow rate of 80 l/min at reference conditions, a reading of 81 l/min (1.01 x 80) on this flowmeter is required.

Flowmeter 2

This will also require a correction factor since it is operating in conditions removed from its design conditions:

\[ P_1 = 1 \text{ bar} \quad T_1 = 20 \, ^\circ\text{C} = 293 \, \text{K} \]
\[ P_2 = 2.4 \text{ bar} \quad T_2 = 20 \, ^\circ\text{C} = 293 \, \text{K} \]

Substituting these values:

\[ C = \sqrt{\frac{1}{2.4} \times \frac{293}{293}} = 0.65 \]

Thus to set a flow rate of 80 l/min at reference conditions, a reading of 52 l/min (0.65 x 80) on this flowmeter is required.
Annex C
(normative)

Fuse characteristic curve

NOTE This is taken from Figure 1a "Time-current zones for "gG" fuse-links" of HD 60269-3-1. Where a circuit breaker is used instead of a 2 A fuse, the requirement that it shall have equivalent characteristics to the fuse should be interpreted by reference to the zone for 2 A as delineated by the pair of curves closest to the y-axis and between which the number "2" appears.
Annex D
(informative)

Guidance for range of classification

The purpose of this annex is to provide guidance as to the derivation of the fire resistance classifications for continuity of power supply or signal, as included in the Interpretative Document no. 2 of the Construction Products Directive, from test data.

Functional requirement (PH) and Interpretation

The ability of electrical cables or optical cables to maintain a reliable form of power supply or signal from the source to the safety installation(s) when exposed to fire.

The performance criterion is continuity of power supply or signal.

The PH classification refers to a constant temperature attack of a notional 842 °C.

Classification

The following classes are defined in the Interpretative Document no. 2.

Classification PH 15, 30, 60, 90, 120

Two results in which the measured duration of survival equals or exceeds the stated classification (i.e. 15, 30, 60, 90 or 120 min) are needed to obtain classification.

Range of classification

A range of cables of the same general construction and materials and differing only in conductor or fibre size or number of conductors may be classified on the basis of the following tests:

Classification Category 1 - Single core electric power and control cables of a particular rated voltage

- Test the smallest conductor size in the range

Classification Category 2 - Multicore electric power and control cables of a particular rated voltage

- Test the smallest conductor size having the largest number of cores and also test the largest conductor size having the smallest number of cores.

Classification Category 3 - Multipair/multitriple electric power and control cables of a particular rated voltage

- Test as for Category 2 except that a test on screened pairs/triples covers unscreened types but not vice versa and a test on multitriples covers multipairs but not vice versa.

Classification Category 4 - Electric data and communication cables

- Test as for Category 2 or Category 3 as appropriate to the construction

Classification Category 5 - Optical fibre cables of a particular fibre type

- Test the smallest number of fibres in the range and test the largest number of fibres in the range.
Annex E
(informative)

Guidance for using optional water spray protocol

E.1 General

There is no requirement under the Construction Products Directive to withstand a water spray when assessing resistance to fire, but such requirements may be features of national standards or codes of practice or particular product standards.

Where the water spray requirement is needed, the requirements given in Clauses 4 to 10 of this Standard shall apply with the modifications in E.2.

E.2 Modifications for optional water spray protocol

Subclause 4.1

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 30 min, with the water spray being applied for the last 15 min of the test.

Subclause 6.1 add

f) A water spray device as follows:

The water spray bar shall consist of a metallic tube (copper or stainless steel) of nominal thickness 1,00 mm and overall diameter (15,5 ± 1,0 ) mm, closed at one end and open at the other to allow the inflow of water.

The tube shall have one row of 17 holes of nominal 0,85 mm diameter drilled on 30 mm centres as shown in Figure E.1.

The bar shall be positioned centrally with respect to the test sample as shown in Figure E.2.

The output of water from the bar shall be at a flow rate of (0,80 ± 0,05) l/min. This shall be verified by volumetric measurement.

The tube shall be capable of adjustment such that the resulting water spray is centralised around the burned portion of the test sample.

The use of a metal plate device over the burner to avoid ingress of water is permitted. If a plate is used, the calibration shall be carried out with the metal plate in place.

NOTE 1 A steel plate of suitable thickness extending horizontally approximately 12 mm from the burner face and fixed approximately 12 mm vertically above the centre line of the burner has been found to be satisfactory

NOTE 2 If the metal plate device is not used the flame is likely to be extinguished. In such cases the gas supply should be turned off and a new test carried out.

Subclause 9.3

Ignite the burner and adjust the propane and air flow rates to those obtained during the verification procedure (see Clause 7).
Immediately after igniting the burner, switch on the electricity supply as indicated in 9.4, activate the shock producing device and start the test duration timer. The shock producing device shall impact the wall after 5 min ± 10 s from activation and subsequently at 5 min ± 10 s intervals.

After 15 min and with the flame and shock still being applied, the water spray shall be started. The application of water shall continue until the end-point of the test.

Subclause 9.5

The test shall be continued either:

i) until 15 min of fire and impact alone, followed by 15 min of fire, impact and water (total 30 min) has been completed, or

ii) to the point of failure.

Clause 10 add

k) The application of water spray (if applied)
l) The survival time achieved in accordance with this Annex E

Key

1 inflow of water
2 closed end
3 metallic tube – Diameter = (15,5 ± 1,0) mm
H 17 holes at nominal 30 mm centres

Figure E.1 - Water spray tube
Key

1  test wall
2  water spray tube
3  test sample
4  metal plate (see note in E.2)
5  burner
6  spray directed at sample
7  centre point of spray

Figure E.2 - Water spray application
Bibliography

The following documents are referenced in the text for information.

EN 1363-1 Fire resistance tests - Part 1: General requirements

EN 61034-1 Measurement of smoke density of cables burning under defined conditions - Part 1: Test apparatus (IEC 61034-1)
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