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Common test methods for cables under fire conditions - Measurement of smoke density of cables burning under defined conditions - Part 1: Apparatus

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Allgemeine Prüfverfahren für das Verhalten von Kabeln und isolierten Leitungen im Brandfall - Messung der Rauchdichte von Kabeln und isolierten Leitungen beim Brennen unter definierten Bedingungen -- Teil 1: Prüfeinrichtung

Méthodes d'essai communes aux câbles soumis au feu - Mesure de la densité de fumées dégagées par des câbles brûlant dans des conditions définies -- Partie 1: Appareillage

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English version

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Méthodes d'essai communes aux câbles soumis au feu
Mesure de la densité de fumées dégagées par des câbles brûlant dans des conditions définies
Partie 1: Appareillage

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Teil 1: Prüfeinrichtung

This European Standard was approved by CENELEC on 1999-04-01. 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

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Foreword

This European Standard was prepared by the Technical Committee CENELEC TC20 'Electric Cables', and agreed at its Dublin meeting (April 1997).

The text of the draft was submitted to the Unique Acceptance Procedure and approved by CENELEC as EN 50268-1 on 1999-04-01.

This European Standard supersedes HD 606.1 S1:1992

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) 2000-04-01

- latest date by which national standards conflicting with the EN have to be withdrawn (dow) 2001-04-01

Annexes designated 'informative' are given for information only. In this standard Annexes A and B are informative.

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1 Scope

EN 50268 specifies a method of test for measurement of smoke density of cables burning under defined conditions. It is suitable for electric insulated conductor or cable, or optical cables. This Part 1 details the apparatus. The procedure, together with an Informative Annex of recommended requirements for compliance, is given in Part 2.

NOTE Experience has shown that the test protocol is not suitable for some cables that exceed 70 mm overall diameter. In such cases the manufacturer should be consulted.

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 60695-4: Fire hazard testing – Part 4: Terminology concerning fire tests.

NOTE IEC 60695 is in the course of re-numbering its Parts and Sections. This will also affect the equivalent ENs.

3 Definitions

For the purposes of this Part 1 of EN 50268 the definitions in EN 60695-4 apply.

4 Details of test enclosure

The equipment shall comprise a cubic enclosure with inside dimensions of 3 000 mm ± 30 mm and constructed of a suitable material fixed on to a steel angle frame. One side shall have a door, with a glass inspection window. Transparent sealed windows (minimum size 100 mm x 100 mm) shall be provided on two opposite sides to permit the transmission of a beam of light from the horizontal photometric system. The distance from the floor to the centre of these windows shall be 2 150 mm ± 100 mm (see Figure 1 for plan view).

The walls of the enclosure shall include orifices at ground level, i.e. not greater than 100 mm above the level of the chamber floor, for the passage of cables etc., and to permit the enclosure to be at atmospheric pressure. No orifice shall be directly behind the fire source or on the same wall. A minimum of two orifices shall be provided and the total area of the orifices open during the test shall be 50 cm^2 ± 10 cm^2. The ambient temperature outside the enclosure shall be 20° C ± 10° C and the enclosure shall not be directly exposed to sunlight or extreme climatic changes.

NOTE It should normally be possible to extract fumes from the enclosure after each test through a duct complete with valve which should be closed during the test. The duct may include a fan to increase the rate of extraction. It is recommended that the door of the enclosure be opened to assist the extraction process.

A draught screen, 1 500 mm long and 1 000 mm high, shall be placed in the enclosure, at the position shown in Figure 1. It shall abut the back wall at a point 750 mm from the side wall, and shall be curved to intersect the centre line of the enclosure at a point 1 400 mm from the back wall.

5 Photometric system

5.1 The photometric system is illustrated in Figure 2. The light source and the receiver shall be placed externally in the centre of both windows in the two opposite walls of the cube without making physical contact. The light beam shall traverse the cube through the glass windows in the side walls.

5.2 The light source shall be a halogen lamp with a tungsten filament with a clear quartz bulb having the following characteristics:

nominal power:	100 W
nominal voltage:	12 V d.c.
nominal luminous flux:	2 000 lm to 3 000 lm
nominal colour temperature:	2 800 K to 3 200 K

The bulb shall be supplied with a voltage of 12,0 V ± 0,1 V (mean value). During the test the voltage shall be stabilised to a range of ± 0,01 V (see A.2c) for additional guidance). The lamp shall be mounted in a housing and the beam adjusted by a lens system to give an evenly illuminated circular area of 1,5 m ± 0,1 m diameter on the interior of the opposite wall.

5.3 The receptor photocell shall be of the selenium or silicon type with a spectral response matching the International Commission on Illumination (CIE) photopic observer (equivalent to the human eye). The photocell shall be mounted at the end of 150 mm ± 10 mm tube with a dust protection window at the other end. The inside of the tube shall be matt black to prevent reflections. The photocell shall be connected to a potentiometric recorder to produce a linear proportional output. The cell shall be resistance-loaded to operate in its linear range and the input impedance of the recorder shall be at least 10^4 times greater than the load resistance of the cell which shall not exceed 100 Ω.

5.4 The photometric system shall be energised before the blank test. When stability has been attained, the zero and full scale reading of the recorder shall be adjusted for light on the detector corresponding to 0% (absence of light) and 100% luminous transmission.

NOTE Periodically, for example at the beginning of a test series, the performance of the photocell should be verified by placing standard neutral density filters in the light beam. It is essential that these filters cover the entire optical entry port of the photocell and the values of absorbance (or optical density) measured by the photocell fall within ±5% of the calibrated value of the filter. The filters should also permit the verification of the linearity of response of the detector which should be proportional to the absorbance of light in the range used.

6 Standard fire source

The standard fire source shall be 1,00 litre ± 0,01 litre of alcohol having the following composition by volume:

ethanol:	90% ± 1%
methanol:	4% ± 1%
water:	6% ± 1%

When a denaturing agent is added to the alcohol, it shall have no effect on the smoke emission of any cable under test.

The alcohol shall be contained in a tray made from galvanised or stainless steel with jointed sealed edges, a trapezoidal trunk section and the following interior dimensions (see Figure 3):

bottom base:	210 mm x 110 mm
top base:	240 mm x 140 mm
height:	80 mm

All dimensions ± 2 mm

Thickness of tray: 1,0 mm ± 0,1 mm

The tray shall be supported at a height of 100 mm ± 10 mm from the floor to permit air circulation around and beneath the tray.

7 Smoke mixing

In order to ensure uniform distribution of the smoke, a table-type fan shall be placed on the floor of the cube as shown in Figure 1, the fan axis being between 200 mm and 300 mm from the floor and the distance from the wall being 500 mm ± 50 mm. The fan shall have a blade sweep of 300 mm ± 60 mm and a flow rate of 7 m³/min to 15 m³/min. Air shall then be blown horizontally by the fan during the tests but the ignition source shall be protected by the screen as shown.

NOTE Suitable fans may be found by reference to IEC 60879 'Performance and construction of electric circulating fans and regulators.'

8 Blank test

8.1 Purpose

The purpose of the blank test is to condition the interior of the cube to the specified temperature range, when necessary, prior to carrying out tests.

8.2 Procedure

8.2.1 Burn approximately 1 litre of alcohol as detailed in 6, in order to preheat the test enclosure.

8.2.2 Purge the inside of the cube of all combustion products by operating the extraction system.

9 Qualification of test apparatus

In order to ensure that the combination of the test cube and the optical system produce results consistent with other test cubes when identical cables are burned under the same conditions, the test apparatus shall be subject to qualification. Qualification shall be achieved by carrying out the Qualification Burning Test (clause 10). The test apparatus shall meet the stated requirements.

10 Qualification burning test

10.1 Purpose

The purpose of the qualification burning test is to verify that the smoke produced in the cube gives standard absorbance values within the limits quoted in 10.6 for both of the alcohol/toluene smoke sources described in 10.3.

10.2 Preparation of cube

Clean the windows of the photometric system to regain 100% transmission after stabilisation of the voltage.

Immediately before commencing the test, the temperature inside the cube shall be within the range 25°C ± 5°C when measured at the internal door surface at a height of 1,5 m to 2,0 m and a minimum of 0,2 m from the walls. If necessary, carry out a blank test in order to condition the interior of the cube to the specific temperature range.

10.3 Qualification smoke sources

Mixtures of PA (pro analysis) toluene and alcohol (as defined in 6) shall be made up in the following proportions by volume:

(i) parts toluene to 96 parts alcohol;
(ii) parts toluene to 90 parts alcohol;

using a pipette and volumetric flask for accuracy of measurement.

NOTE PA toluene has a purity of greater than 99,5%.

The mixtures shall be contained in a tray as described in 6.

10.4 Test procedure

Burn 1,00 litre ± 0,01 litre of the test solutions specified in 10.3. Record the minimum measured transmittance level I_t during the test.

10.5 Calculation

Calculate the measured absorbance (A_m) as follows:

$$A_m = \lg \frac{I_o}{I_t}$$

where I_o is the initial transmittance.

Calculate the standard absorbance (A_o):

$$A_o = \frac{A_m}{\%\,\text{toluene}} \times \frac{\text{volume of cube (m}^3\text{)}}{\text{optical light path (m)}}$$

10.6 Requirements

The calculated values of A_o shall fall between the following limits:

4% toluene:	0,18 to 0,26;
10% toluene:	0,80 to 1,20.