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Edition 1.1 2015-07
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GROUP SAFETY PUBLICATION
PUBLICATION GROUPÉE DE SÉCURITÉ

Tests on electric and optical fibre cables under fire conditions –
Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame

Essais des câbles électriques et à fibres optiques soumis au feu –
Partie 1-2: Essai de propagation verticale de la flamme sur conducteur ou câble isolé – Procédure pour flamme à prémélange de 1 kW

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TESTS ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS –

Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame

FOREWORD

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 60332-1-2 edition 1.1 contains the first edition (2004-07) [documents 20/697/FDIS and 20/711/RVD] and its amendment 1 (2015-07) [documents 20/1591/FDIS and 20/1598/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60332-1-2 has been prepared by IEC technical committee 20: Electric cables.

It has the status of a group safety publication in accordance with IEC Guide 104.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IEC 60332 consists of the following parts, under the general title *Tests on electric and optical fibre cables under fire conditions:*

Part 1-1: Test for vertical flame propagation for a single insulated wire or cable – Apparatus

Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1kW pre-mixed flame

Part 1-3: Test for vertical flame propagation for a single insulated wire or cable – Procedure for determination of flaming droplets/particles

Part 2-1: Test for vertical flame propagation for a single small insulated wire or cable – Apparatus

Part 2-2: Test for vertical flame propagation for a single small insulated wire or cable - Procedure for diffusion flame

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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TESTS ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS –

Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame

1 Scope

This part of IEC 60332 specifies the procedure for testing the resistance to vertical flame propagation for a single vertical electrical insulated conductor or cable, or optical fibre cable, under fire conditions. The apparatus is given in IEC 60332-1-1.

NOTE 1 Testing to IEC 60332-1-2 may be performed simultaneously with that to IEC 60332-1-3 if required.

Recommended requirements for performance are given in Annex A.

IEC 60332-1-2 specifies the use of a 1 kW pre-mixed flame and is for general use, except that the procedure specified may not be suitable for the testing of small single insulated conductors or cables of less than 0,5 mm² total cross-section because the conductor melts before the test is completed, or for the testing of small optical fibre cables because the cable is broken before the test is completed. In these cases, the procedure given in IEC 60332-2-2 is recommended.

NOTE 2 Since the use of insulated conductor or cable which retards flame propagation and complies with the recommended requirements of this standard is not sufficient by itself to prevent propagation of fire under all conditions of installation, it is recommended that wherever the risk of propagation is high, for example in long vertical runs of bunches of cables, special installation precautions should also be taken. It cannot be assumed that because the sample of cable complies with the performance requirements recommended in this standard, that a bunch of cables will behave in a similar manner. (See IEC 60332-3 series.)

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.

IEC 60332-1-1, *Tests on electric and optical fibre cables under fire conditions – Part 1-1: Test for vertical flame propagation for a single insulated wire or cable – Apparatus*

IEC 60695-4, *Fire hazard testing – Part 4: Terminology concerning fire tests*

IEC 60811-203, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 203: General tests – Measurement of overall dimensions*

IEC Guide 104, *The preparation of safety publications and the use of basic safety publications and group safety publications*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. The definitions are taken from IEC 60695-4.

3.1
ignition source
source of energy that initiates combustion

[~~IEC 60695-4:1993, definition 2.76~~ SOURCE: ISO 13943:2008, 1.489]

3.2
char
carbonaceous residue resulting from pyrolysis or incomplete combustion

[~~IEC 60695-4:1993, definition 2.12~~ SOURCE: ISO 13943:2008, 4.38]

4 Test apparatus

The apparatus specified in IEC 60332-1-1 shall be used.

5 Procedure

5.1 Sample

The test sample shall be a piece of single insulated conductor or cable (600 ± 25) mm long.

The test sample diameter shall be measured using the method given in IEC 60811-203. The measurement shall be made at each of three places, separated by at least 100 mm.

The average of the three values obtained shall be rounded to obtain the overall diameter. If the calculation gives 5 or more for the second decimal figure, raise the first to the next number; thus, for example, 5,75 is rounded to 5,8. If the calculation gives 4 or less for the second decimal figure, maintain the first number; thus, for example, 5,74 is rounded to 5,7.

The overall diameter obtained shall be used for the selection of the time for flame application.

5.2 Conditioning

Before testing, all test pieces shall be conditioned at (23 ± 5) °C for not less than 16 h at a relative humidity of (50 ± 20) %.

In the case of a single insulated conductor or cable with a finish of paint or lacquer, this conditioning shall follow an initial period where the test piece shall be kept at a temperature of (60 ± 2) °C for 4 h.

5.3 Positioning of test piece

The test piece shall straightened and secured to two horizontal supports by means of a suitable size of copper wire, in a vertical position in the centre of the metal ~~screen~~ enclosure, as described in ~~4.2 of~~ IEC 60332-1-1, so that the distance between the bottom of the upper support and the top of the lower support is (550 ± 5) mm. In addition, the test piece shall be positioned so that the bottom of the specimen is approximately 50 mm from the base of the ~~screen~~ enclosure (see Figure 1).

The vertical axis of the test piece shall be arranged centrally within the ~~screen~~ enclosure (i.e. 150 mm from each side and 225 mm from the rear).

5.4 Flame application

Safety warning

Precautions shall be taken to safeguard personnel against the following when conducting tests:

a) the risk of fire or explosion;

b) the inhalation of smoke and/or noxious products, particularly when halogenated materials are burned;

c) harmful residues.

5.4.1 Positioning of flame

~~One~~ A burner, as described in ~~4.3 of~~ IEC 60332-1-1, shall be ignited and the ~~recommended~~ flow rates of gas and air adjusted to the specified values. The burner shall be positioned so that the tip of the ~~inner~~ blue cone impinges on the surface of the test piece at a distance of (475 ± 5) mm from the lower edge of the upper horizontal support, whilst the burner is at an angle of (45 ± 2)° to the vertical axis of the test piece (see Figure 2). The burner position shall be fixed throughout the flame application time.

For flat-form cables, the flame impingement shall be on the middle of the flat side of the cable.

In case of an electrical insulated conductor or cable, should the test piece move significantly during the test so as to render the result invalid, the test piece shall be held straight by the attachment of a load of approximately 5 N/mm^2 of conductor area to the lower part of the sample so that the distance between the point where the load is attached and the lower edge of the top support measures (550 ± 5) mm. In such cases, the test piece shall not be secured to the lower support.

5.4.2 Test duration

The flame shall be applied continuously for the period of time corresponding to the diameter shown in Table 1.

Table 1 – Time for flame application

Overall diameter of test piece[a] mm	Time for flame application[b] s
$D \leq 25$	60 ± 2
$25 < D \leq 50$	120 ± 2
$50 < D \leq 75$	240 ± 2
$D > 75$	480 ± 2

[a] ~~Where non-circular cables (for example, flat-form constructions) are to be tested, the circumference shall be measured and used to calculate an equivalent diameter, as if the cable were circular.~~ For non-circular cables in which the major to minor axis ratio is less than 3, the nominal minor axis shall be used as the overall diameter (D). For non-circular cables in which the major to minor axis ratio lies between 3 and 16, the overall diameter (D) shall be taken as the sum of the major and minor axis divided by 3,14 (π). For cables in which the major to minor axis ratio exceeds 16, the test criteria shall be given in the product standard or, if not, agreed between manufacturer and purchaser.

[b] ~~For flat cables having a ratio of major to minor axis greater than 17:1, the flame application time remains under consideration.~~

At the end of the specified ~~test duration~~ flame application time, the burner shall be removed and the flame of the burner extinguished.

6 Evaluation of test results

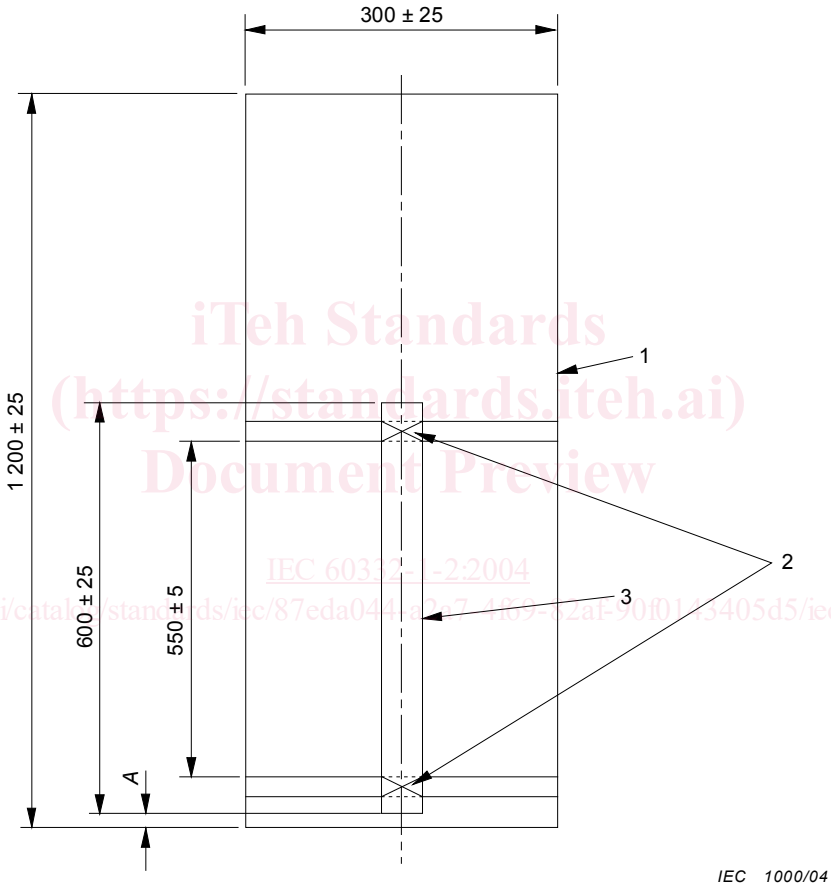
After all burning has ceased, the test piece shall be wiped clean.

All soot shall be ignored if, when wiped off, the original surface is undamaged. Softening or any deformation of the non-metallic materials shall also be ignored. The distance from the lower edge of the top support to the upper onset of charring and the distance from the lower edge of the top support to the lower onset of charring shall be measured to the nearest millimetre.

The onset of char shall be determined as follows.

Press against the cable surface with a sharp object, for example, a knife blade. Where the surface changes from a resilient to a brittle (crumbling) surface indicates the onset of charring.

Dimensions in millimetres



Key

1 ~~metallic screen~~ metal enclosure

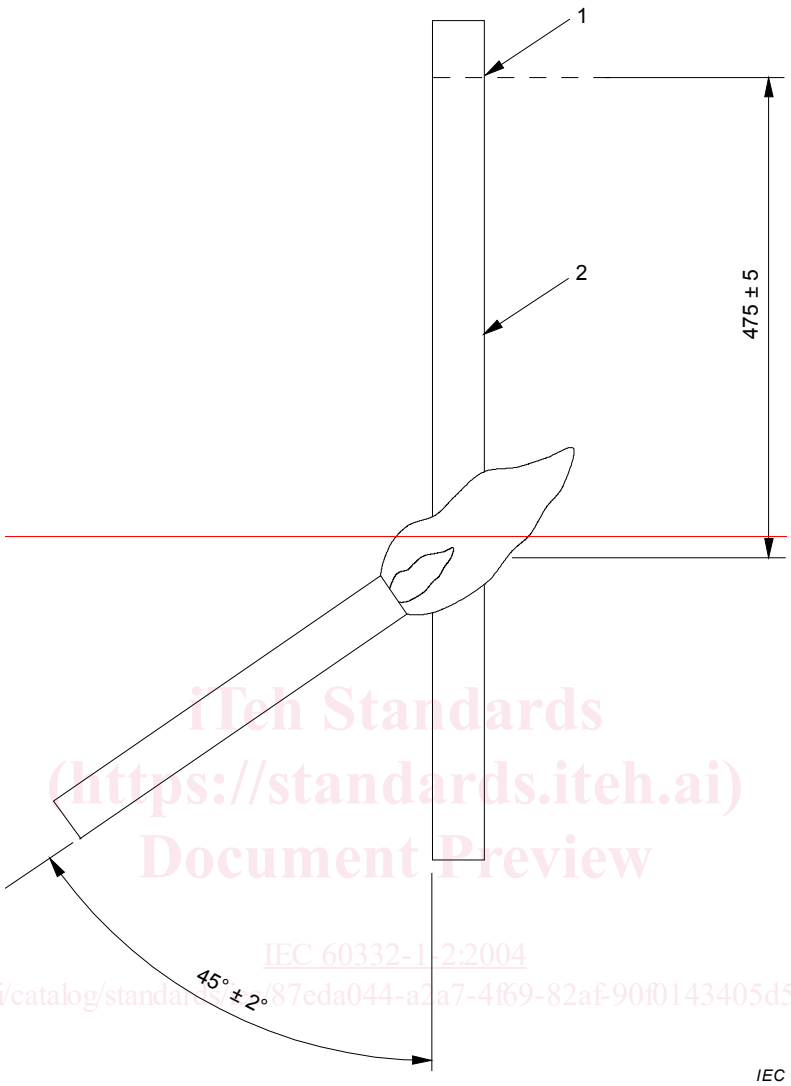
2 support arm and copper wire fixing

3 test piece

Distance A: Length from base of ~~screen~~ enclosure to bottom of test piece = 50 mm (approximately)

Figure 1 – Arrangement of test piece in test apparatus

Dimensions in millimetres



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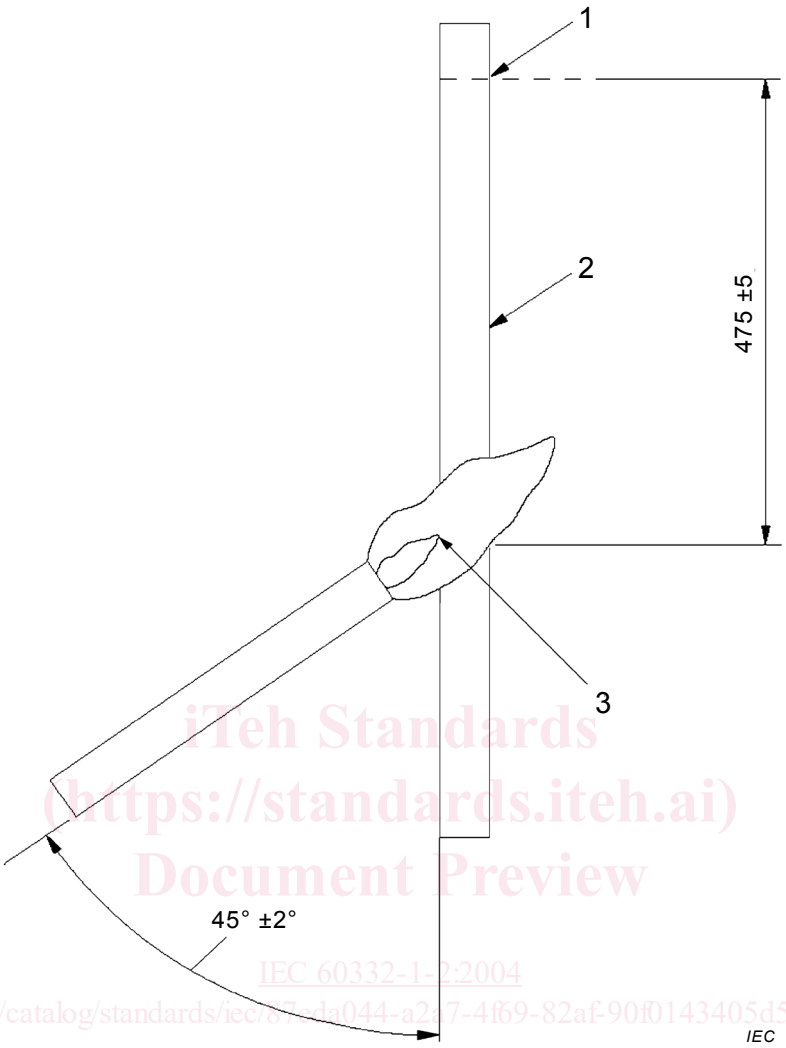

Key

1 lower edge of top support

2 test piece

3 position of impingement of blue cone

Figure 2 – Application of flame to test piece