

**NORME
INTERNATIONALE
INTERNATIONAL
STANDARD**

**CEI
IEC**

60332-2-2

Première édition
First edition
2004-07

**PUBLICATION GROUPEE DE SÉCURITÉ
GROUP SAFETY PUBLICATION**

**Essais des câbles électriques
et à fibres optiques soumis au feu –**

Partie 2-2:

**Essai de propagation verticale de la flamme
sur conducteur ou câble isolé de petite section –
Procédure pour une flamme de type à diffusion**

**Tests on electric and optical fibre cables
under fire conditions –**

Part 2-2:

**Test for vertical flame propagation
for a single small insulated wire or cable –
Procedure for diffusion flame**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**TESTS ON ELECTRIC AND OPTICAL FIBRE CABLES
UNDER FIRE CONDITIONS –****Part 2-2: Test for vertical flame propagation
for a single small insulated wire or cable –
Procedure for diffusion flame**

FOREWORD

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International Standard IEC 60332-2-2 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 first edition of International Standard IEC 60332-2-2, together with IEC 60332-2-1, cancel and replace the third edition of IEC 60332-2, published in 1989, and constitute a technical revision, calling for the re-structurization of the standard into two separate parts.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|-------------|------------------|
| 20/700/FDIS | 20/714/RVD |

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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 this publication will remain unchanged until the maintenance result 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.

TESTS ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS –

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

1 Scope

This part of IEC 60332 specifies the procedure for testing the resistance to vertical flame propagation for a single small vertical electrical insulated conductor or cable, or optical cable, under fire conditions. The apparatus is given in IEC 60332-2-1.

This standard gives the procedure for testing small optical fibre cables or a small insulated conductor or cable when the method specified in IEC 60332-1-2 is not suitable because some small optical fibre cables may break or small conductors may melt during the application of the flame. The recommended range of application is for the testing of small single insulated conductors or cables of less than 0,5 mm² cross-section.

NOTE 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.)

Recommended requirements for performance are given in Annex A.

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 60332-2-1, *Tests on electric and optical cables under fire conditions – Part 2-1: Test for vertical flame propagation for a single small insulated wire or cable – Apparatus*

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

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 terms and definitions are taken from IEC 60695-4.

3.1

ignition source

source of energy that initiates combustion

[IEC 60695-4:1993, definition 2.76]

3.2

char

carbonaceous residue resulting from pyrolysis or incomplete combustion

[IEC 60695-4:1993, definition 2.12]

4 Test apparatus

The apparatus specified in IEC 60332-2-1 shall be used.

5 Procedure

5.1 Sample

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

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 an 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

5.3.1 Cables with metallic conductors

The test piece shall be straightened and fixed by means of a suitable size of metallic wire in a vertical position in the centre of the metal screen, as described in 4.2 of IEC 60332-2-1. A load of 5 N/mm² of conductor area shall be attached 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 (see Figure 1).

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

5.3.2 Optical fibre cables

The test piece shall be secured to two horizontal supports by means of a suitable size of metallic wire 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 (see Figure 2).

The vertical axis of the test piece shall be arranged centrally within the screen (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

5.4.1.1 Cables with metallic conductors

The burner shall be arranged as shown in Figure 3. The centre-line of the burner shall be at an angle of $45^\circ \pm 2^\circ$ to the centre line of the test piece. The horizontal distance between the centre line of the burner orifice and the surface of the test piece shall be (10 ± 1) mm. The distance between the point at which the burner centre line and test piece centre line intersect and the point where the load of 5 N/mm^2 is applied shall be (100 ± 10) mm. The distance between the point at which the burner and the test piece centre lines intersect and the lower edge of the top support shall not exceed 465 mm.

The flame shall be applied so that it envelops the test piece.

5.4.1.2 Optical fibre cables

The burner shall be arranged as shown in Figure 4. The centre-line of the burner shall be at an angle of $45^\circ \pm 2^\circ$ to the centre-line of the test piece. The horizontal distance between the centre line of the burner orifice and the surface of the test piece shall be (10 ± 1) mm. The distance between the point at which the burner centre-line and the test-piece centre-line intersect and the top edge of the lower support shall be (100 ± 10) mm. The distance between the point at which the burner and test piece centre-lines intersect and the lower edge of the upper horizontal support shall not exceed 465 mm.

The flame shall be applied so that it envelops the test piece.

5.4.2 Test duration

5.4.2.1 Cables with metallic conductors

The flame shall be applied to the test piece for a duration of (20 ± 1) s. If the test piece is intact, i.e. no melting of conductor, the test shall be evaluated in accordance with Clause 6. Should the metallic conductor prematurely melt, at a time T less than the test duration, the test shall be repeated on a further test piece for a duration of $(T - 2)$ s. The assessment shall then be based only on the further test piece.

5.4.2.2 Optical fibre cables

The flame shall be applied to the test piece for a duration of (20 ± 1) s.

6 Evaluation of test results

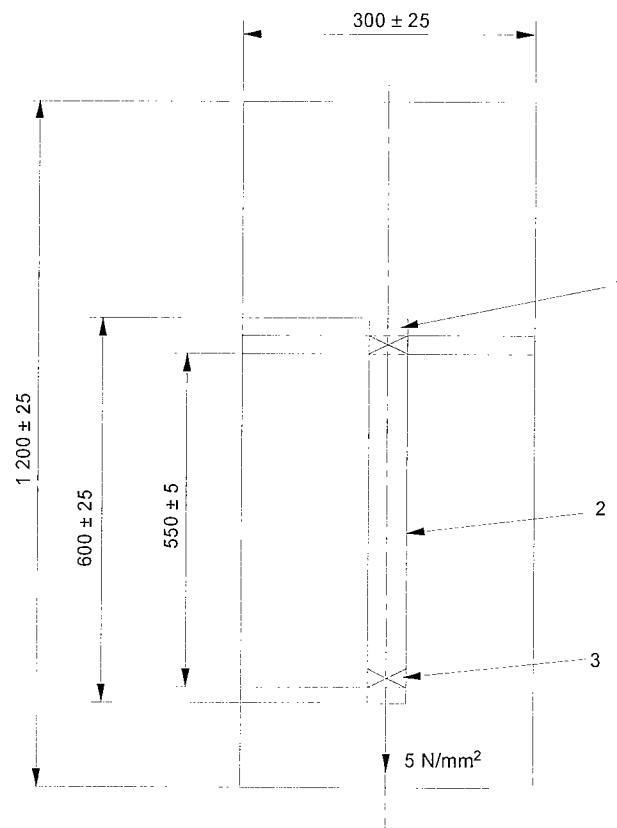
After all burning has ceased, the test piece shall be wiped clean.

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.

.....

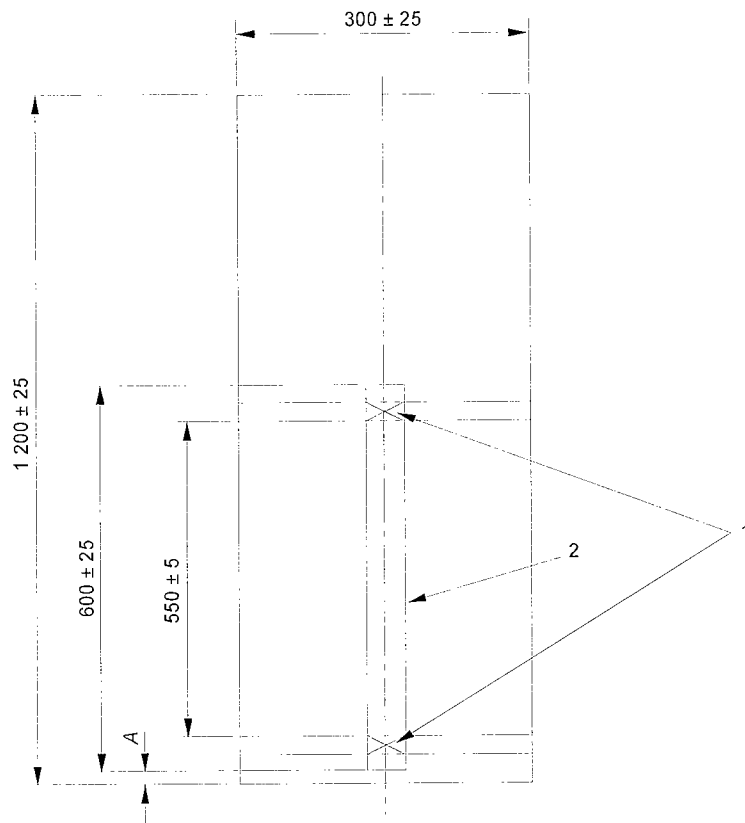
Dimensions in millimetres

Key

- 1 support and cable fixing
- 2 test piece
- 3 fixing for load

IEC 1004/04

Figure 1 – Arrangement of test piece (metallic conductor)

Dimensions in millimetres

IEC 1005/04

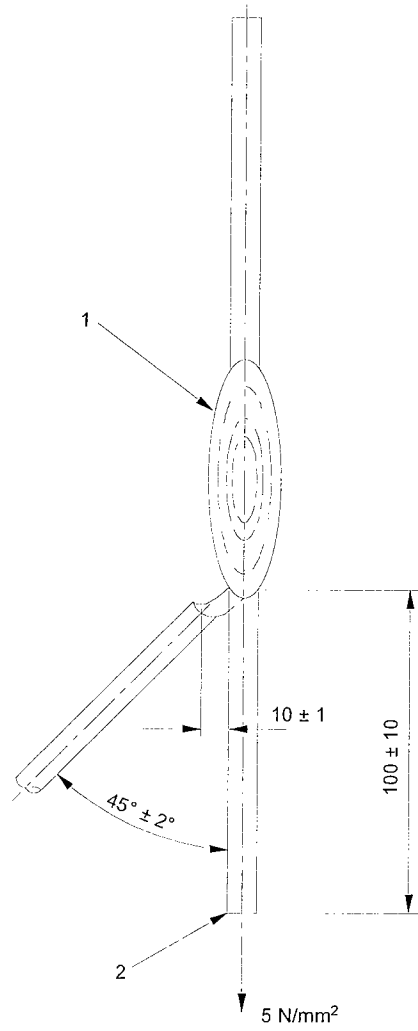
Key

- 1 support arm and metallic wire fixing
- 2 test piece

Distance A: Length from base of screen to bottom of sample = 50 mm (approximately)

Figure 2 – Arrangement of test piece (optical fibre cable)

Dimensions in millimetres



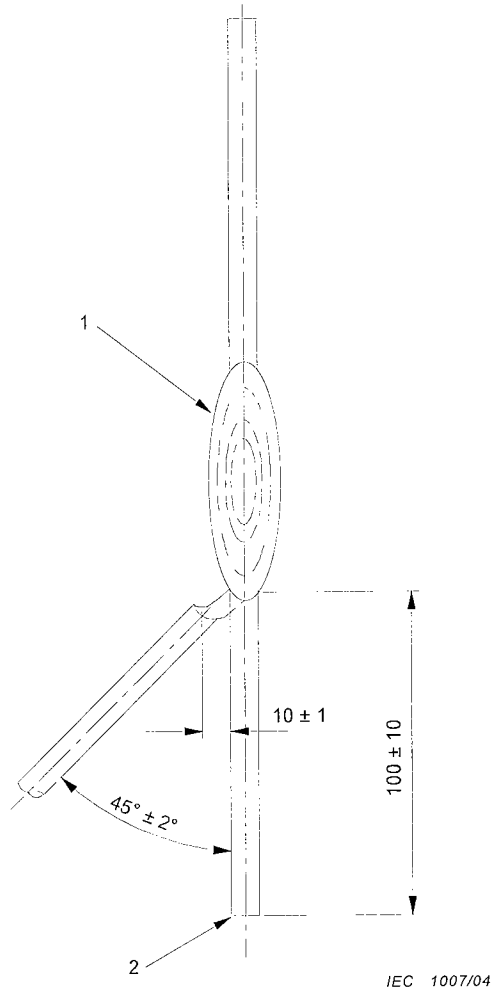
Key

- 1 flame to envelop test piece
- 2 point of attachment of load

IEC 1006/04

Figure 3 – Application of burner to test piece (metallic conductor)

Dimensions in millimetres



Key

- 1 flame to envelop test piece
- 2 top edge of lower support

Figure 4 – Application of burner to test piece (optical fibre cable)

Annex A
(informative)

Recommended performance requirements

The performance requirements for a particular type or class of insulated conductor or cable should preferably be given in the individual cable standard. In the absence of any given requirement, it is recommended that those given below should be taken as a minimum acceptable level.

The insulated conductor or cable shall pass the test if the distance between the lower edge of the top support and the onset of charring is greater than 50 mm.

In addition, a failure shall be recorded if charring extends downwards to a point greater than 540 mm from the lower edge of the top support.

If a failure is recorded, two more tests shall be carried out. If both tests result in passes, the insulated conductor or cable shall be deemed to have passed the test.

Bibliography

IEC 60332-1-2, *Tests on electric and optical 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*

IEC 60332-3 (all part), *Tests on electric cables under fire conditions – Part 3: Test for vertical flame spread of vertically mounted bunched wires or cables*



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