

INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPEE DE SÉCURITÉ

**Tests for electric cables under fire conditions – Circuit integrity –
Part 11: Apparatus – Fire alone at a flame temperature of at least 750 °C**

**Essais pour câbles électriques soumis au feu – Intégrité des circuits –
Partie 11: Appareillage – Incendie seul avec flamme à une température d'au
moins 750 °C**

[IEC 60331-11:1999](https://standards.iteh.ai/)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**TESTS FOR ELECTRIC CABLES UNDER FIRE CONDITIONS –
CIRCUIT INTEGRITY –****Part 11: Apparatus – Fire alone at a flame temperature
of at least 750 °C**

FOREWORD

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IEC 60331-11 edition 1.1 contains the first edition (1999) [documents 20C/81/FDIS and 20C/86/RVD] and its amendment 1 (2009) [documents 20/1052/FDIS and 20/1056/RVD].

A vertical line in the margin shows where the base publication has been modified by amendment 1.

International Standard IEC 60331-11 has been prepared by subcommittee 20C: Burning characteristics of electric cables, of IEC technical committee 20: Electric cables.

| IEC 60331-11 is to be used in conjunction with Parts 21, 23 or 25.

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

Annex A forms an integral part of this standard.

Annexes B, C and D are for information only.

The committee has decided that the contents of the base publication and its amendments 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

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INTRODUCTION

IEC 60331 consists of the following parts under the general title: *Tests for electric cables under fire conditions – Circuit integrity*:

Part 1, *Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter exceeding 20 mm*

Part 2, *Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter not exceeding 20 mm*

Part 3, *Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV tested in a metal enclosure*

Part 11, *Apparatus – Fire alone at a flame temperature of at least 750 °C*

Part 21, *Procedures and requirements – Cables of rated voltage up to and including 0,6/1,0 kV*

Part 23, *Procedures and requirements – Electric data cables*

Part 25, *Procedures and requirements – Optical fibre cables*

NOTE Parts 21, 23 and 25 relate to fire-only conditions at a flame temperature of at least 750 °C.

Since its first edition (1970), IEC 60331 has been extended and has introduced a range of test apparatus in order that a test may be carried out on large and small power, control, data and optical fibre cables.

When first published in 1999, IEC 60331-11 introduced a range of improvements, based upon practical experience gained with IEC 60331(1970), which have been retained. These improvements cover the following:

- the definition of the burner and its positioning in the test, especially to ensure that no interference with the test flame will arise from debris falling from the test sample;
- the definition of the fuel, the flow rate and control of its supply;
- the control, measurement and verification of the temperature.

TESTS FOR ELECTRIC CABLES UNDER FIRE CONDITIONS – CIRCUIT INTEGRITY –

Part 11: Apparatus – Fire alone at a flame temperature of at least 750 °C

1 Scope

This part of IEC 60331 specifies the test apparatus to be used for testing cables required to maintain circuit integrity when subject to fire alone where the test condition is based upon a flame with a controlled heat output corresponding to a temperature of at least 750 °C.

It also provides in annex A the method of verification of the burner and control system used for the test.

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 60584-1:1995, *Thermocouples – Part 1: Reference tables*

IEC Guide 104:1997, *The preparation of safety publications and the use of basic safety publications and group safety publications*

3 Definition

For the purpose of this part of IEC 60331, the following definition applies.

3.1

circuit integrity

ability to continue to operate in the designated manner whilst subjected to a specified flame source for a specified period

4 Test conditions

4.1 Test environment

The test shall be carried out in a suitable chamber with facilities for disposing of any noxious gases resulting from burning. Sufficient ventilation shall be available to sustain the flame for the duration of the test.

NOTE 1 An example of a suitable chamber is given in IEC 61034-1.

The chamber shall be maintained in an external environment where the temperature is between 5 °C and 40 °C.

The same ventilation and shielding conditions shall be used in the chamber during both the verification and cable test procedures.

NOTE 2 Shields, such as those described in IEC 61034-1, may need to be placed in an appropriate position to protect the burner from draughts that may influence the flame geometry.

NOTE 3 The test given in this standard may involve the use of dangerous voltages and temperatures. Suitable precautions should be taken against the risk of shock, burning, fire and explosion that may be involved, and against any noxious fumes that may be produced.

5 Test apparatus

5.1 Sample supporting system

The cable sample, as described in the relevant procedure in Parts 21, 23 or 25 of IEC 60331, shall be held horizontally by means of suitable supports at each end of the sheathed or protected portion. The sample shall be securely clamped at one end to prevent movement and supported at the other end to allow for thermal expansion in the longitudinal direction. The middle portion of the cable shall be supported by two metal rings placed approximately 300 mm apart; these, as well as any other metal parts of the supporting apparatus, shall be earthed. The rings shall have an inside diameter of approximately 150 mm and shall be made from a circular steel rod of (10 ± 2) mm in diameter. The cable supporting arrangement is shown in figure 1.

For unarmoured cables of less than 10 mm in diameter, three additional metal supporting rings, each placed approximately 150 mm from the two previously specified rings, shall be used to support the cable.

5.2 Source of heat

5.2.1 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 2. 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 system is given in annex B.

5.2.2 Mass flow meters/controllers should 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 is given in Annex C. Figure 3 shows an example of a rotameter type system.

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

The flow rates used for the test at reference conditions (1 bar and 20 °C) shall be as follows:

- air: (80 ± 5) l/min per 500 mm burner face length;
- propane: $(5 \pm 0,25)$ l/min per 500 mm burner face length.

NOTE 2 The purity of the propane is not defined. Industrial grades that contain impurities are allowed, provided that the verification requirements are achieved.

5.2.3 The burner and control system shall be subject to verification following the procedure given in annex A.

5.3 Positioning of source of heat

The burner face shall be positioned in the test chamber so that it is at least 200 mm above the floor of the chamber and at least 300 mm from any chamber wall.

The burner shall be aligned with the test sample, as shown in figure 4, so that:

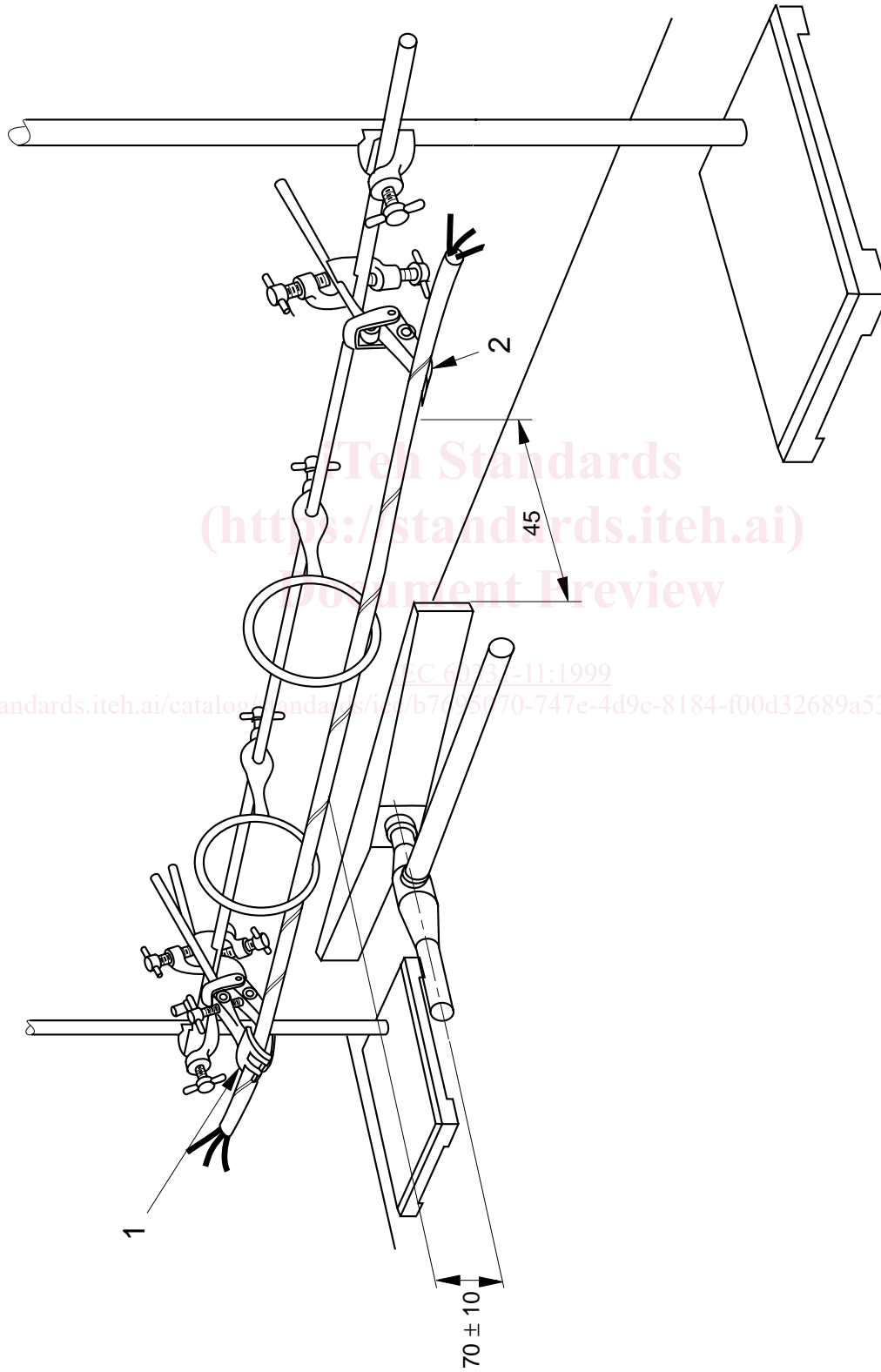
- its horizontal central plane is at a distance of (70 ± 10) mm below the lowest point of the test sample;
- its vertical front face is approximately 45 mm from the central vertical plane of the test sample.

The exact burner location to be used during cable testing shall be determined using the verification procedure given in annex A.

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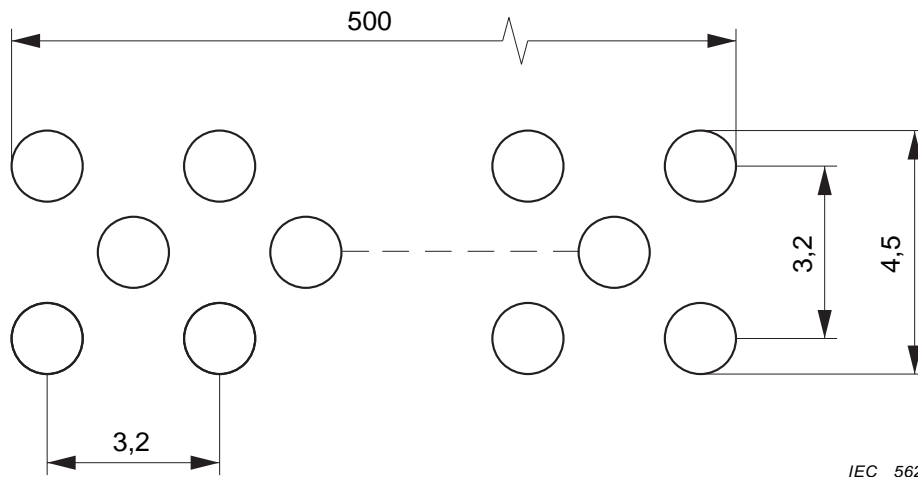
Dimensions in millimetres
(Untoleranced dimension is approximate)

Key

1 Clamp

2 Support

Figure 1 – Example of cable supporting arrangement



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Dimensions in millimetres

Tolerance on all dimensions $\pm 5\%$

Round holes, 1,32 mm diameter, on 3,2 mm centres staggered in three rows and centred on face of burner

Figure 2 – Burner face

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