

INTERNATIONAL STANDARD



GROUP SAFETY PUBLICATION

**Tests for electric cables under fire conditions – Circuit integrity –
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**

IEC 60331-2:2018

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**TESTS FOR ELECTRIC CABLES UNDER FIRE CONDITIONS –
CIRCUIT INTEGRITY –****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**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60331-2 has been prepared by IEC technical committee 20: Electric cables.

This second edition cancels and replaces the first edition published in 2009. It constitutes a technical revision.

The significant technical changes with respect to the previous edition are as follows:

- extension of the scope with metallic data and telecom cables and optical fibre cables, although details for the specific point of failure, continuity checking arrangement, test sample, test procedure and test report relevant to metallic data and telecom cables and optical fibre cables are not given by IEC 60331-2;
- improved description of the test environment;
- mandatory use of mass flow meters/controllers as the means of controlling accurately the input flow rates of fuel and air to the burner;
- improved figure illustrating method of mounting of the sample regarding bending radius;
- improved description of the information to be included in the test report.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
20/1783A/FDIS	20/1793/RVD

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

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

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

A list of all parts of the IEC 60331 series, published under the title: *Tests for electric cables under fire conditions – Circuit integrity*, can be found on the IEC website.

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.

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

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

NOTE 2 Parts 11, 21, 23 and 25 are no longer subject to maintenance. IEC 60331 Parts 1 and 2 are the recommended test procedures

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.

Successful tests carried out in accordance with this standard will enable an identification to be marked on the product.

TESTS FOR ELECTRIC CABLES UNDER FIRE CONDITIONS – CIRCUIT INTEGRITY –

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

1 Scope

~~This part of IEC 60331 specifies the test apparatus and procedure and gives the performance requirements, including recommended flame application times, for low voltage power cables of rated voltage up to and including 0,6/1,0 kV and control cables with a rated voltage which are required to maintain circuit integrity when subject to fire and mechanical shock under specified conditions. It is intended for use when testing cables not greater than 20 mm overall diameter.~~

This part of IEC 60331 specifies the test method for cables which are required to maintain circuit integrity when subject to fire and mechanical shock under specified conditions.

This document is applicable to cables of rated voltage not exceeding 600 V/1 000 V, including those of rated voltage below 80 V, metallic data and telecom cables and optical fibre cables.

It is intended for use when testing cables of not greater than 20 mm overall diameter.

NOTE Cables of larger diameter ~~should~~ are intended to be tested using the apparatus, procedure and requirements of IEC 60331-1.

~~This standard describes the means of test specimen preparation, the continuity checking arrangements, the electrical testing procedure, the method of burning the cables and the method of shock production, and gives requirements for evaluating test results~~

This document includes details for the specific point of failure, continuity checking arrangement, test sample, test procedure and test report relevant to electric power and control cables with rated voltage up to and including 600 V/1000 V. Details for the specific point of failure, continuity checking arrangement, test sample, test procedure and test report relevant to metallic data and telecom cables and optical fibre cables are not given by IEC 60331-2.

Although the scope is restricted to cables with rated voltage up to and including 0,6/1,0 kV, the procedure can be used, with the agreement of the manufacturer and the purchaser, for cables with rated voltage up to and including 1,8/3 (3,3) kV, provided that suitable fuses are used.

Annex A provides the method of verification of the burner and control system used for the test.

Requirements are stated for an identification that may optionally be marked on the cable to signify compliance with this standard.

CAUTION – 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.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *Thermocouples – Part 1: ~~Reference tables~~ EMF specifications and tolerances*

IEC 60269-3, *Low-voltage fuses – Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications) – Examples of standardized systems of fuses A to F*

~~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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

circuit integrity

ability of an electric cable to continue to operate in the designated manner whilst subjected to a specified flame source for a specified period of time under specified conditions

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draught-free environment

space in which the results of tests are not significantly affected by the local air speed

4 ~~Test conditions~~ — Test environment

The test shall be carried out in a draught-free environment within a suitable chamber, of minimum volume ~~10~~ 20 m³, 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. Air inlets and the exhaust chimney should be located in such a way that the burner flame remains stable during the verification procedure and test. If necessary, the burner shall be shielded from any draughts by the use of draught shields. 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 achieved 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.

~~NOTE — Guidance on the choice of suitable chambers is given in Annex B.~~

NOTE Experience has shown a chamber similar to the "3 m cube" specified in IEC 61034-1 to be suitable.

The chamber and test apparatus shall be at a temperature of between 10 °C and 40 °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—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 Test equipment

The test equipment shall consist of the following:

- a) a test wall onto which the cable is mounted, comprising a board manufactured from heat-resistant, non-combustible material ~~with~~ suitable for the temperatures involved fastened to steel supports and mounted on a rigid support as described in 5.2;
- b) a source of heat comprising a horizontally mounted ribbon burner as described in 5.3;
- c) a shock-producing device as described in 5.4;
- d) a test wall equipped with thermocouples for verification of the source of heat as described in Annex A;
- e) a continuity checking arrangement as described in 5.6;
- f) fuses as described in 5.7.

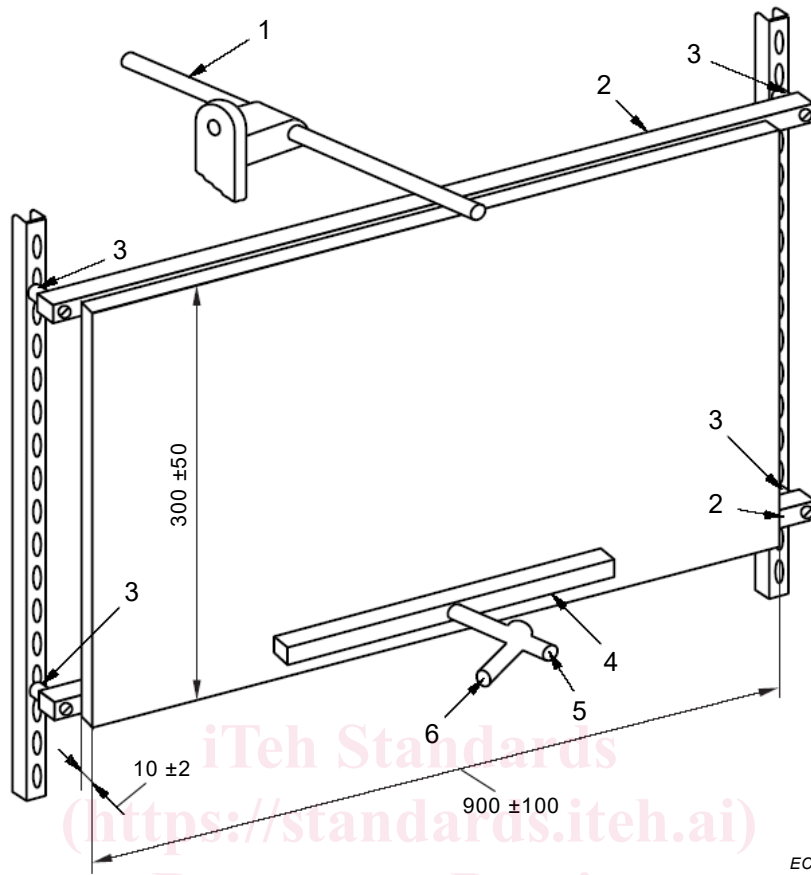
A general arrangement of the test equipment is shown in Figure 1, Figure 2 and Figure 3.

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Dimensions in millimetres

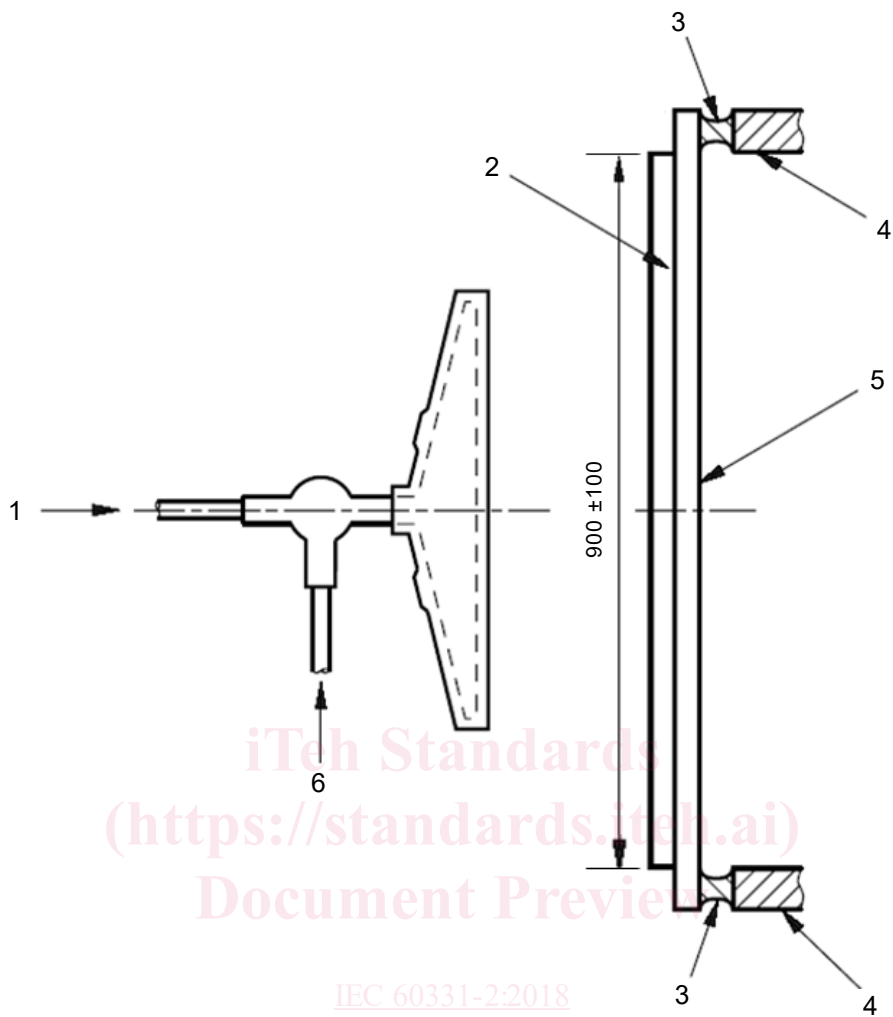


Key

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

Figure 1 – Schematic diagram of test configuration

Dimensions in millimetres



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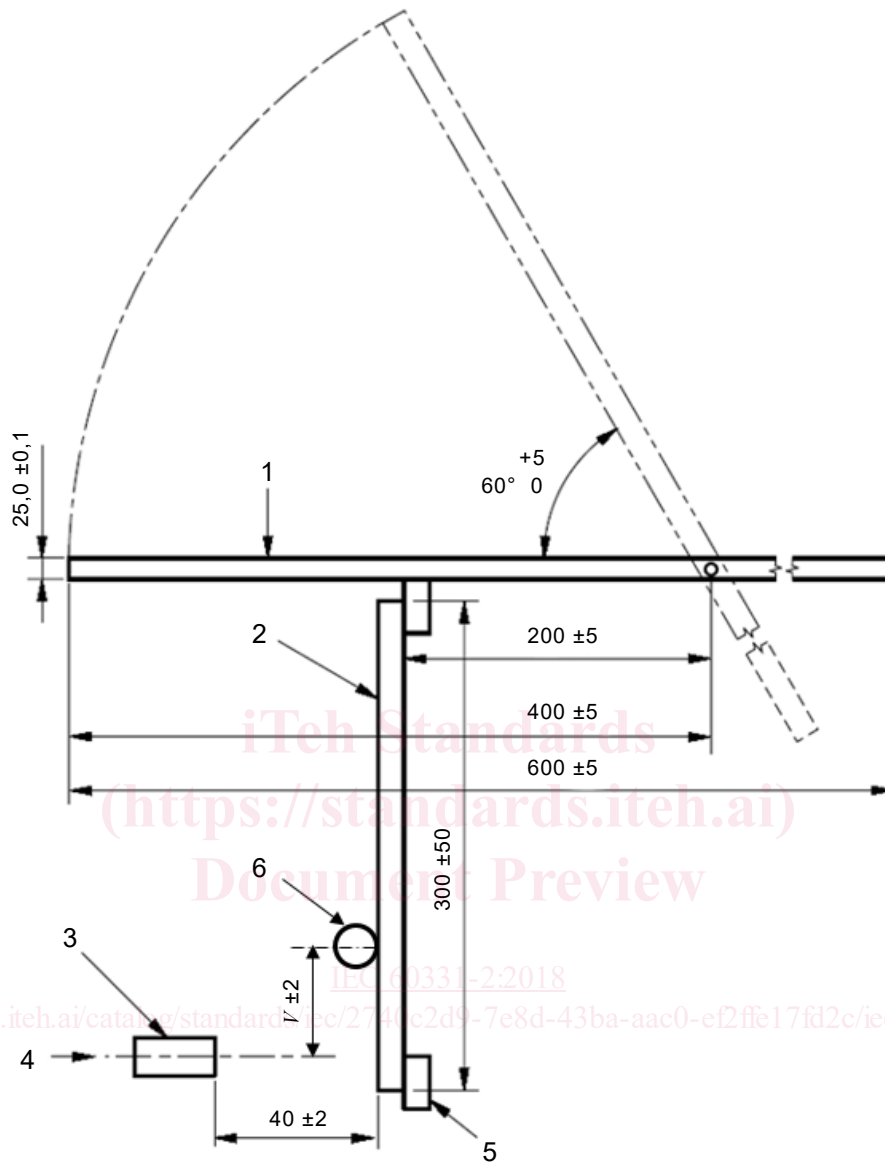
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Key

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

Figure 2 – Plan view of fire test equipment

Dimensions in millimetres



IEC

Key

- | | | | |
|---|---|---|----------------------------|
| 1 | shock-producing device | 4 | centre line of burner face |
| 2 | board | 5 | support framework |
| 3 | gas burner | 6 | test sample |
| V | Vertical distance from centre line of burner to the centre of the test specimen | | |

Figure 3 – End elevation of fire test equipment
(not to scale)

5.2 Test wall and mounting

The test wall shall consist of a board of heat-resistant, 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, as shown in Figure 1. Vertical supports may also be used. The board shall be (900 ± 100) mm long, (300 ± 50) mm high and (10 ± 2) mm thick and the total mass of the test wall (i.e. board and steel supports) shall be (10,0 ± 0,5) kg. Ballast, if required, shall be placed on the steel supports.