

# 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**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 13.220.40; 29.020; 29.060.20

ISBN 978-2-8322-5490-5

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms and definitions .....	8
4 Test environment.....	8
5 Test apparatus .....	8
5.1 Test equipment.....	8
5.2 Test wall and mounting .....	12
5.3 Source of heat .....	14
5.3.1 Burner .....	14
5.3.2 Flow meters and flow rates .....	15
5.3.3 Verification .....	16
5.4 Shock-producing device.....	16
5.5 Positioning of source of heat.....	17
5.6 Continuity checking arrangements for electric power and control cables with rated voltage up to and including 600 V/1 000 V .....	17
5.7 Fuses.....	17
6 Test specimen (electric power and control cables with rated voltage up to and including 600 V/1 000 V).....	17
6.1 Test specimen preparation.....	17
6.2 Test specimen mounting .....	18
7 Test procedure (electric power and control cables with rated voltage up to and including 600 V/1 000 V).....	18
7.1 Test equipment and arrangement.....	18
7.2 Electrical connections .....	18
7.3 Flame and shock application.....	20
7.4 Electrification .....	20
8 Performance requirements (electric power and control cables with rated voltage up to and including 600 V/1 000 V).....	21
8.1 Flame application time .....	21
8.2 Acceptance criteria .....	21
9 Retest procedure .....	21
10 Test report (electric power and control cables with rated voltage up to and including 600 V/1 000 V).....	21
11 Cable marking .....	21
Annex A (normative) Verification procedure for the source of heat .....	22
A.1 Measuring equipment.....	22
A.2 Procedure .....	22
A.3 Evaluation.....	22
A.4 Further verification.....	23
A.5 Verification report .....	23
Annex B (informative) Guidance on the choice of recommended test apparatus.....	24
B.1 Burner and venturi .....	24
B.2 Test wall material.....	24
Bibliography.....	25

Figure 1 – Schematic diagram of test configuration ..... 10

Figure 2 – Plan view of fire test equipment ..... 11

Figure 3 – End elevation of fire test equipment (not to scale) ..... 12

Figure 4 – Typical rubber bush (hardness: 50-60 shore A) for fastening wall..... 14

Figure 5 – Burner face ..... 15

Figure 6 – Schematic diagram of an example of a burner control system ..... 16

Figure 7 – Example of method of mounting a sample for test ..... 18

Figure 8 – Basic circuit diagram – Electric power and control cables with rated voltage  
up to 600 V/1 000 V ..... 20

Figure A.1 – Temperature measuring arrangement ..... 22

## 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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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.

A bilingual version of this publication may be issued at a later date.

## 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 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.

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

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: 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*