

INTERNATIONAL STANDARD



GROUP SAFETY PUBLICATION

**Tests on electric and optical fibre cables under fire conditions –
Part 3-21: Test for vertical flame spread of vertically-mounted bunched wires
or cables – Category A F/R**

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2018 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IECNORM.COM : Click to view the full text of IEC 60323-2:2018 PLV



IEC 60332-3-21

Edition 2.0 2018-07
REDLINE VERSION

INTERNATIONAL STANDARD



GROUP SAFETY PUBLICATION

**Tests on electric and optical fibre cables under fire conditions –
Part 3-21: Test for vertical flame spread of vertically-mounted bunched wires
or cables – Category A F/R**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 13.220.40; 29.060.20

ISBN 978-2-8322-5877-4

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

CONTENTS

FOREWORD	3
INTRODUCTION	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	7
4 Test apparatus	7
4.1 General	7
4.2 Ignition source	7
5 Test procedure	7
5.1 Test sample	7
5.2 Determination of the number of test pieces	8
5.3 Mounting of the test sample	8
5.4 Flame application time	9
6 Evaluation of test results	9
7 Performance requirements	9
8 Retest procedure	9
9 Test report	9
Annex A (normative) Guidance on cable selection for type approval testing	11
Annex B (informative) Recommended performance requirements	12
Bibliography	13
Figure 1 – Typical arrangement and spacing of cables mounted on both sides of the standard ladder (category A F/R)	10
Table A.1 – Summary of test conditions	11

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV

INTERNATIONAL ELECTROTECHNICAL COMMISSION

TESTS ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS –

Part 3-21: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category A F/R

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.

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 60332-3-21 has been prepared by IEC technical committee 20: Electric cables.

This second edition cancels and replaces the first edition published in 2000. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) adjustments have been made to the title, and elsewhere, to emphasise the standard is applicable to optical fibre cables as well as metallic conductor types;
- b) details of the way in which cables are mounted on the ladder have been better defined in order to improve repeatability and reproducibility.

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

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

FDIS	Report on voting
20/1798/FDIS	20/1815/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 publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60332 series, published under the general title *Tests on electric and optical fibre cables under fire conditions*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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 60332-3-21 is part of a series of publications dealing with tests on electric and optical fibre cables under fire conditions.

The IEC 60332-1 and IEC 60332-2 series specify methods of test for flame spread characteristics for a single vertical insulated wire or cable. It cannot be assumed that, because a cable or wire meets the requirements of the IEC 60332-1 and IEC 60332-2 series, a vertical bunch of similar cables or wires will behave in a similar manner. This is because flame spread along a vertical bunch of cables depends on a number of features, such as

- a) the volume of combustible material exposed to the fire and to any flame which may be produced by the combustion of the cables;
- b) the geometrical configuration of the cables and their relationship to an enclosure;
- c) the temperature at which it is possible to ignite the gases emitted from the cables;
- d) the quantity of combustible gas released from the cables for a given temperature rise;
- e) the volume of air passing through the cable installation;
- f) the construction of the cable, for example armoured or unarmoured, multi- or single-core.

All of the foregoing assume that the cables are able to be ignited when involved in an external fire.

The IEC 60332-3 series gives details of a test where a number of cables are bunched together to form various test sample installations. For easier use and differentiation of the various test categories, the parts are designated as follows:

Part 3-10:	Apparatus
Part 3-21:	Category A F/R
Part 3-22:	Category A
Part 3-23:	Category B
Part 3-24:	Category C
Part 3-25:	Category D

Parts from 3-21 onwards define the various categories and the relevant procedures. The categories are distinguished by test duration, the volume of non-metallic material of the test sample and the method of mounting the sample for the test. In all categories, cables having at least one conductor of cross-sectional area greater than 35 mm² are tested in a spaced configuration, whereas cables of conductor cross-sectional area of 35 mm² or smaller and optical fibre cables are tested in a touching configuration.

The categories are not necessarily related to different safety levels in actual cable installations. The actual installed configuration of the cables may be a major determinant in the level of flame spread occurring in an actual fire.

The method of mounting described as category A F/R (Part 3-21) is intended for special cable designs used in particular installations.

Categories A, B, C and D (Part 3-22 to Part 3-25 respectively) are for general use where different non-metallic volumes are applicable.

~~Additional categories, especially to cover the use of small diameter communication cables in closely bunched configurations, will be further considered when more data are available.~~

TESTS ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS –

Part 3-21: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category A F/R

1 Scope

~~The series of International Standards covered by Parts 3-10, 3-21, 3-22, 3-23, 3-24 and 3-25~~
This part of IEC 60332 ~~specifies~~ covers category A F/R for methods of test for the assessment of vertical flame spread of vertically-mounted bunched wires or cables, ~~electrical or optical~~, under defined conditions.

This document relates only to power cables of conductor cross-sectional area greater than 35 mm² installed on the test ladder in a spaced configuration on the front and rear to achieve a nominal total volume of non-metallic material of 7 l/m of test sample. The flame application time is 40 min. This method of mounting is intended for special cable designs used in particular installations when required in the cable specification. Category A F/R is not intended for general use.

The test is intended for type approval testing. The requirements for the selection of cables for testing are given in Annex A. The flame spread is measured as the extent of damage of the cable sample. This procedure ~~may~~ can be used to demonstrate the cable's ability to limit flame spread.

A recommended performance requirement is given in annex B.

NOTE For the purposes of this document the term "electric wire or cable" covers all insulated metallic conductor cables used for the conveyance of energy or signals.

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 60332-3-10, *Tests on electric and optical fibre cables under fire conditions – Part 3-10: Test for vertical flame spread of vertically-mounted bunched wires or cables – Apparatus*

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

~~IEC 60811-1-3: Insulating and sheathing materials of electric cables – Common test methods Part 1: General application – Section 3: Methods for determining the density – Water absorption tests – Shrinkage test~~

IEC 60811-606, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 606: Physical tests – Methods for determining the density*

~~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.~~

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

ignition source

source of energy that initiates combustion

[SOURCE: ISO 13943:2017, 3.219]

3.2

char

carbonaceous residue resulting from pyrolysis or incomplete combustion

[SOURCE: ISO 13943:2017, 3.47]

3.3

flame spread

propagation of a flame front

[SOURCE: ISO 13943:2017, 3.168]

4 Test apparatus

4.1 General

The apparatus specified in IEC 60332-3-10 shall be used.

4.2 Ignition source

The ignition source shall be one ribbon-type propane gas burner as specified in IEC 60332-3-10.

5 Test procedure

5.1 Test sample

The test sample shall comprise a number of test pieces of cable from the same production length, each having a minimum length of 3,5 m.

The total number of test pieces in the test sample shall be that number required to provide a nominal total volume of non-metallic material of 7 l/m of test sample.

The test sample for type approval shall be ~~chosen within the limitations given~~ in accordance with Annex A.

The test pieces forming the test sample shall be conditioned at a temperature of $(20 \pm 10) ^\circ\text{C}$ for at least 16 h before commencing the test. The test pieces shall be dry.

5.2 Determination of the number of test pieces

In order to calculate the appropriate number of test pieces, it is necessary to determine the volume per metre of non-metallic material of one test piece.

A length of cable which shall be not less than 0,3 m long is carefully cut to ensure that the surfaces are at right angles to the cable axis, thus enabling precise measurements of its length.

The density of each non-metallic component (including cellular material) shall be measured in an appropriate way, for example ~~clause 8 of IEC 60811-1-3~~ according to IEC 60811-606, in order to obtain values expressed to the second decimal place.

Each non-metallic material C_i shall be removed from the test piece and weighed. Any non-metallic material making up less than 5 % of the total non-metallic mass of the test piece shall be assumed to have a density of 1,0 kg/dm³.

Where semi-conducting screens cannot be removed from the insulating material, the components may be considered as one for the purpose of measuring their mass and density.

The volume V_i (litres per metre of cable) of each non-metallic material C_i is calculated as follows:

$$V_i = \frac{M_i}{\rho_i \times l}$$

where

M_i is the mass of the component C_i (kg);

ρ_i is the density of the component C_i (kg/dm³);

l is the length of the test piece of cable (m).

The total volume, V , of the non-metallic materials contained in 1 m of cable is equal to the sum of the individual volumes V_1, V_2 , etc.

The number of test pieces to be mounted is obtained by taking the closest integer (0,5 and above corresponding to 1) of ~~the number of test pieces to be mounted is obtained by dividing~~ the ratio of the volume per metre specified in 5.1 and the total volume, V , of non-metallic material per metre of cable, subject to a minimum number of four test pieces (two test pieces in each layer).

5.3 Mounting of the test sample

Each test piece shall be attached individually to each rung of the ladder by means of metal wire (steel or copper). For cables up to and including 50 mm diameter use wire between 0,5 mm and 1,0 mm in diameter. For cables above 50 mm diameter use wire between 1,0 mm and ~~1,5~~ 2,5 mm in diameter.

Mount all test pieces on the ladder with the bending (due to bending of the cable on the reel), if any, in the same direction, towards the back side of the test chamber as much as possible.

To achieve straight test pieces between the steel rungs below and above the burner position, it is permitted to fix the test pieces to an additional horizontal support 200 mm to 300 mm lower than the steel rung below the burner position.

NOTE The objective is to improve the repeatability and reproducibility of the test.

The standard ladder shall be used, and the test sample shall be such that at least four test pieces are used. A minimum of two test pieces shall be mounted on the rear of the ladder.

Where more than four test pieces are required for the test sample, each successive additional piece shall be mounted alternately on the front and then the rear of the ladder.

The completed test sample shall be mounted such that

- the space between each test piece of one layer (front or rear) shall be 0,5 times the cable diameter, but not exceeding 20 mm;
- the maximum width of a single layer shall be 300 mm;
- the minimum distance between the sample edge and the inside of the ladder upright shall be 50 mm;
- test pieces mounted on the rear of the ladder shall be centred relative to the space between pieces on the front of the ladder;
- the completed array of test pieces is approximately centred on the ladder.

Figure 1 illustrates the arrangement.

5.4 Flame application time

The test flame shall be applied for 40 min, after which it shall be extinguished. The air flow rate through the test chamber shall be maintained until cable burning or glowing has ceased, or until a maximum duration of 1 h, after which any remaining cable burning or glowing shall be extinguished.

6 Evaluation of test results

After all cable burning or glowing has ceased or been extinguished, the test sample shall be wiped clean.

All soot is to be ignored if, when wiped off, the original surface is undamaged. Softening or any deformation of the non-metallic material is also to be ignored. The flame spread shall be measured as the extent of the damage. It shall be measured in metres to two decimal places from the bottom edge of the burner to the onset of char. The onset of char is 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, this indicates the onset of char.

7 Performance requirements

The performance requirements for a particular type or class of wire or cable should preferably be given in the individual cable standard. In the absence of any given requirements, the recommended performance requirements given in Annex B should be used.

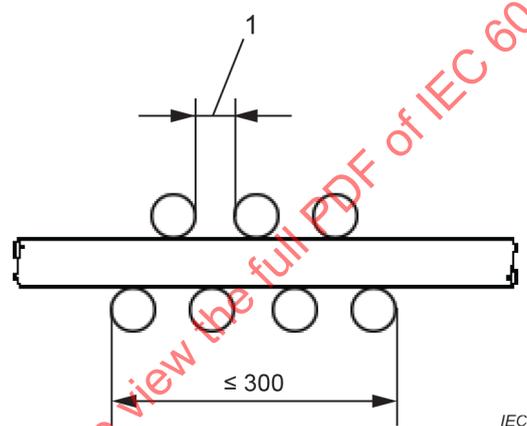
8 Retest procedure

In case of dispute, two further tests shall be undertaken as detailed in Clause 5. The test shall be deemed as satisfactory if both tests meet the stated requirement.

9 Test report

The test report shall include the following information:

- a) full description of the cable tested;
- b) manufacturer of the cable tested;
- c) the part of the standard against which the test was carried out;
- d) the number of test pieces;
- e) the total volume of non-metallic material, per metre of test sample, of the test pieces;
- f) the method of mounting, i.e. spaced;
- g) the number of layers and number of test pieces in each layer;
- h) flame application time (i.e. 40 min);
- i) the number of burners (i.e. one);
- j) the extent of damage;
- k) the time to extinction of all burning or glowing.



Key

- 1 spacing distance

Figure 1 – Typical arrangement and spacing of cables mounted on both sides of the standard ladder (category A F/R)

Annex A (normative)

Guidance on cable selection for type approval testing

The choice of cable type and conductor cross-section for type approval testing shall be as given in the cable specification, or as agreed between purchaser and manufacturer.

The limited capacity of the ladders requires consideration of the conductor cross-section selected for testing to ensure that the volume of non-metallic material can be accommodated within the ~~prescribed~~ specified method of mounting. Therefore, the selection of cables for this document shall comply with the following:

- on each face of the ladder there shall not be more cables than the number necessary to form a single layer of 300 mm width on each side, allowing for a space between each cable equal to half the cable diameter but not exceeding 20 mm;
- the minimum number of test pieces in each layer shall be two.

A summary of all conditions for type approval testing to this document is given in Table A.1.

Table A.1 – Summary of test conditions

Category and designation	A F/R
Range of conductor cross-sections (mm ²)	> 35 ^a
Non-metallic volume per metre of test sample (l)	7
Use of standard ladder, maximum width of test sample (front and rear of ladder): 300 mm	
– number of layers:	2 ^b
– number of burners:	1
Positioning of test pieces	Spaced
Flame application time (min)	40
^a At least one conductor greater than 35 mm ² .	
^b Minimum of two test pieces in each layer.	

Annex B
(informative)

Recommended performance requirements

The maximum extent of the charred portion measured on the sample shall not have reached a height exceeding 2,5 m above the bottom edge of the burner, neither at the front nor at the rear of the ladder.

This recommended performance requirement confirms, on the basis of experience gained, the value previously given in IEC TR 60332-3:1992, 2.8.1.

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV

Bibliography

IEC TR 60332-3:1992¹, *Tests on electric cables under fire conditions – Part 3: Tests on bunched wires or cables*

ISO 13943:2017, *Fire safety – Vocabulary*

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV

¹ Withdrawn.

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV

INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPEE DE SÉCURITÉ

**Tests on electric and optical fibre cables under fire conditions –
Part 3-21: Test for vertical flame spread of vertically-mounted bunched wires or
cables – Category A F/R**

**Essais des câbles électriques et des câbles à fibres optiques soumis au feu –
Partie 3-21: Essai de propagation verticale de la flamme des fils ou câbles
montés en nappes en position verticale – Catégorie A F/R**

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV

CONTENTS

FOREWORD	3
INTRODUCTION	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	6
4 Test apparatus	7
4.1 General	7
4.2 Ignition source	7
5 Test procedure	7
5.1 Test sample	7
5.2 Determination of the number of test pieces	7
5.3 Mounting of the test sample	8
5.4 Flame application time	9
6 Evaluation of test results	9
7 Performance requirements	9
8 Retest procedure	9
9 Test report	9
Annex A (normative) Guidance on cable selection for type approval testing	11
Annex B (informative) Recommended performance requirements	12
Bibliography	13
Figure 1 – Typical arrangement and spacing of cables mounted on both sides of the standard ladder (category A F/R)	10
Table A.1 – Summary of test conditions	11

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**TESTS ON ELECTRIC AND OPTICAL FIBRE CABLES
UNDER FIRE CONDITIONS –****Part 3-21: Test for vertical flame spread of
vertically-mounted bunched wires or cables – Category A F/R**

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 60332-3-21 has been prepared by IEC technical committee 20: Electric cables.

This second edition cancels and replaces the first edition published in 2000. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) adjustments have been made to the title, and elsewhere, to emphasise the standard is applicable to optical fibre cables as well as metallic conductor types;
- b) details of the way in which cables are mounted on the ladder have been better defined in order to improve repeatability and reproducibility.

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

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

FDIS	Report on voting
20/1798/FDIS	20/1815/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 publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60332 series, published under the general title *Tests on electric and optical fibre cables under fire conditions*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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.

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV

INTRODUCTION

IEC 60332-3-21 is part of a series of publications dealing with tests on electric and optical fibre cables under fire conditions.

The IEC 60332-1 and IEC 60332-2 series specify methods of test for flame spread characteristics for a single vertical insulated wire or cable. It cannot be assumed that, because a cable or wire meets the requirements of the IEC 60332-1 and IEC 60332-2 series, a vertical bunch of similar cables or wires will behave in a similar manner. This is because flame spread along a vertical bunch of cables depends on a number of features, such as

- a) the volume of combustible material exposed to the fire and to any flame which may be produced by the combustion of the cables;
- b) the geometrical configuration of the cables and their relationship to an enclosure;
- c) the temperature at which it is possible to ignite the gases emitted from the cables;
- d) the quantity of combustible gas released from the cables for a given temperature rise;
- e) the volume of air passing through the cable installation;
- f) the construction of the cable, for example armoured or unarmoured, multi- or single-core.

All of the foregoing assume that the cables are able to be ignited when involved in an external fire.

The IEC 60332-3 series gives details of a test where a number of cables are bunched together to form various test sample installations. For easier use and differentiation of the various test categories, the parts are designated as follows:

Part 3-10:	Apparatus
Part 3-21:	Category A F/R
Part 3-22:	Category A
Part 3-23:	Category B
Part 3-24:	Category C
Part 3-25:	Category D

Parts from 3-21 onwards define the various categories and the relevant procedures. The categories are distinguished by test duration, the volume of non-metallic material of the test sample and the method of mounting the sample for the test. In all categories, cables having at least one conductor of cross-sectional area greater than 35 mm² are tested in a spaced configuration, whereas cables of conductor cross-sectional area of 35 mm² or smaller and optical fibre cables are tested in a touching configuration.

The categories are not necessarily related to different safety levels in actual cable installations. The actual installed configuration of the cables may be a major determinant in the level of flame spread occurring in an actual fire.

The method of mounting described as category A F/R (Part 3-21) is intended for special cable designs used in particular installations.

Categories A, B, C and D (Part 3-22 to Part 3-25 respectively) are for general use where different non-metallic volumes are applicable.

TESTS ON ELECTRIC AND OPTICAL FIBRE CABLES UNDER FIRE CONDITIONS –

Part 3-21: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category A F/R

1 Scope

This part of IEC 60332 covers category A F/R for methods of test for the assessment of vertical flame spread of vertically-mounted bunched wires or cables, under defined conditions.

This document relates only to power cables of conductor cross-sectional area greater than 35 mm² installed on the test ladder in a spaced configuration on the front and rear to achieve a nominal total volume of non-metallic material of 7 l/m of test sample. The flame application time is 40 min. This method of mounting is intended for special cable designs used in particular installations when required in the cable specification. Category A F/R is not intended for general use.

The test is intended for type approval testing. The requirements for the selection of cables for testing are given in Annex A. The flame spread is measured as the extent of damage of the cable sample. This procedure can be used to demonstrate the cable's ability to limit flame spread.

A recommended performance requirement is given in Annex B.

NOTE For the purposes of this document the term "electric wire or cable" covers all insulated metallic conductor cables used for the conveyance of energy or signals.

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 60332-3-10, *Tests on electric and optical fibre cables under fire conditions – Part 3-10: Test for vertical flame spread of vertically-mounted bunched wires or cables – Apparatus*

IEC 60811-606, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 606: Physical tests – Methods for determining the density*

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

ignition source

source of energy that initiates combustion

[SOURCE: ISO 13943:2017, 3.219]

3.2

char

carbonaceous residue resulting from pyrolysis or incomplete combustion

[SOURCE: ISO 13943:2017, 3.47]

3.3

flame spread

propagation of a flame front

[SOURCE: ISO 13943:2017, 3.168]

4 Test apparatus

4.1 General

The apparatus specified in IEC 60332-3-10 shall be used.

4.2 Ignition source

The ignition source shall be one ribbon-type propane gas burner as specified in IEC 60332-3-10.

5 Test procedure

5.1 Test sample

The test sample shall comprise a number of test pieces of cable from the same production length, each having a minimum length of 3,5 m.

The total number of test pieces in the test sample shall be that number required to provide a nominal total volume of non-metallic material of 7 l/m of test sample.

The test sample for type approval shall be in accordance with Annex A.

The test pieces forming the test sample shall be conditioned at a temperature of $(20 \pm 10) ^\circ\text{C}$ for at least 16 h before commencing the test. The test pieces shall be dry.

5.2 Determination of the number of test pieces

In order to calculate the appropriate number of test pieces, it is necessary to determine the volume per metre of non-metallic material of one test piece.

A length of cable which shall be not less than 0,3 m long is carefully cut to ensure that the surfaces are at right angles to the cable axis, thus enabling precise measurements of its length.

The density of each non-metallic component (including cellular material) shall be measured in an appropriate way, for example according to IEC 60811-606, in order to obtain values expressed to the second decimal place.

Each non-metallic material C_i shall be removed from the test piece and weighed. Any non-metallic material making up less than 5 % of the total non-metallic mass of the test piece shall be assumed to have a density of $1,0 \text{ kg/dm}^3$.

Where semi-conducting screens cannot be removed from the insulating material, the components may be considered as one for the purpose of measuring their mass and density.

The volume V_i (litres per metre of cable) of each non-metallic material C_i is calculated as follows:

$$V_i = \frac{M_i}{\rho_i \times l}$$

where

M_i is the mass of the component C_i (kg);

ρ_i is the density of the component C_i (kg/dm^3);

l is the length of the test piece of cable (m).

The total volume, V , of the non-metallic materials contained in 1 m of cable is equal to the sum of the individual volumes V_1, V_2 , etc.

The number of test pieces to be mounted is obtained by taking the closest integer (0,5 and above corresponding to 1) of the ratio of the volume per metre specified in 5.1 and the total volume, V , of non-metallic material per metre of cable, subject to a minimum number of four test pieces (two test pieces in each layer).

5.3 Mounting of the test sample

Each test piece shall be attached individually to each rung of the ladder by means of metal wire (steel or copper). For cables up to and including 50 mm diameter use wire between 0,5 mm and 1,0 mm in diameter. For cables above 50 mm diameter use wire between 1,0 mm and 2,5 mm in diameter.

Mount all test pieces on the ladder with the bending (due to bending of the cable on the reel), if any, in the same direction, towards the back side of the test chamber as much as possible.

To achieve straight test pieces between the steel rungs below and above the burner position, it is permitted to fix the test pieces to an additional horizontal support 200 mm to 300 mm lower than the steel rung below the burner position.

NOTE The objective is to improve the repeatability and reproducibility of the test.

The standard ladder shall be used, and the test sample shall be such that at least four test pieces are used. A minimum of two test pieces shall be mounted on the rear of the ladder.

Where more than four test pieces are required for the test sample, each successive additional piece shall be mounted alternately on the front and then the rear of the ladder.

The completed test sample shall be mounted such that

- the space between each test piece of one layer (front or rear) shall be 0,5 times the cable diameter, but not exceeding 20 mm;
- the maximum width of a single layer shall be 300 mm;
- the minimum distance between the sample edge and the inside of the ladder upright shall be 50 mm;

- test pieces mounted on the rear of the ladder shall be centred relative to the space between pieces on the front of the ladder;
- the completed array of test pieces is approximately centred on the ladder.

Figure 1 illustrates the arrangement.

5.4 Flame application time

The test flame shall be applied for 40 min, after which it shall be extinguished. The air flow rate through the test chamber shall be maintained until cable burning or glowing has ceased, or until a maximum duration of 1 h, after which any remaining cable burning or glowing shall be extinguished.

6 Evaluation of test results

After all cable burning or glowing has ceased or been extinguished, the test sample shall be wiped clean.

All soot is to be ignored if, when wiped off, the original surface is undamaged. Softening or any deformation of the non-metallic material is also to be ignored. The flame spread shall be measured as the extent of the damage. It shall be measured in metres to two decimal places from the bottom edge of the burner to the onset of char. The onset of char is 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, this indicates the onset of char.

7 Performance requirements

The performance requirements for a particular type or class of wire or cable should preferably be given in the individual cable standard. In the absence of any given requirements, the recommended performance requirements given in Annex B should be used.

8 Retest procedure

In case of dispute, two further tests shall be undertaken as detailed in Clause 5. The test shall be deemed as satisfactory if both tests meet the stated requirement.

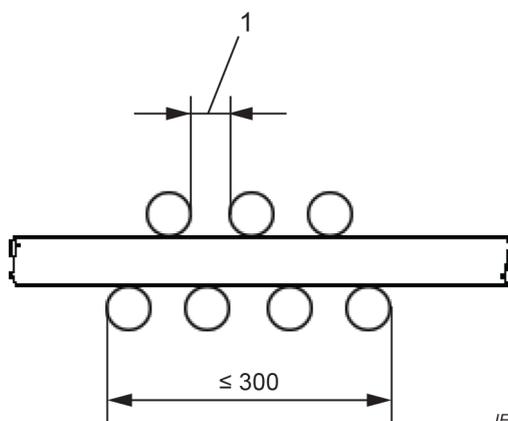
9 Test report

The test report shall include the following information:

- a) full description of the cable tested;
- b) manufacturer of the cable tested;
- c) the part of the standard against which the test was carried out;
- d) the number of test pieces;
- e) the total volume of non-metallic material, per metre of test sample, of the test pieces;
- f) the method of mounting, i.e. spaced;
- g) the number of layers and number of test pieces in each layer;
- h) flame application time (i.e. 40 min);
- i) the number of burners (i.e. one);
- j) the extent of damage;

k) the time to extinction of all burning or glowing.

Dimensions in millimetres



Key

1 spacing distance

Figure 1 – Typical arrangement and spacing of cables mounted on both sides of the standard ladder (category A F/R)

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV

Annex A (normative)

Guidance on cable selection for type approval testing

The choice of cable type and conductor cross-section for type approval testing shall be as given in the cable specification, or as agreed between purchaser and manufacturer.

The limited capacity of the ladders requires consideration of the conductor cross-section selected for testing to ensure that the volume of non-metallic material can be accommodated within the specified method of mounting. Therefore, the selection of cables for this document shall comply with the following:

- on each face of the ladder there shall not be more cables than the number necessary to form a single layer of 300 mm width on each side, allowing for a space between each cable equal to half the cable diameter but not exceeding 20 mm;
- the minimum number of test pieces in each layer shall be two.

A summary of all conditions for type approval testing to this document is given in Table A.1.

Table A.1 – Summary of test conditions

Category and designation	A F/R
Range of conductor cross-sections (mm ²)	> 35 ^a
Non-metallic volume per metre of test sample (l)	7
Use of standard ladder, maximum width of test sample (front and rear of ladder): 300 mm	
– number of layers:	2 ^b
– number of burners:	1
Positioning of test pieces	Spaced
Flame application time (min)	40
^a At least one conductor greater than 35 mm ² . ^b Minimum of two test pieces in each layer.	

Annex B
(informative)

Recommended performance requirements

The maximum extent of the charred portion measured on the sample shall not have reached a height exceeding 2,5 m above the bottom edge of the burner, neither at the front nor at the rear of the ladder.

This recommended performance requirement confirms, on the basis of experience gained, the value previously given in IEC TR 60332-3:1992, 2.8.1.

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV

Bibliography

IEC TR 60332-3:1992¹, *Tests on electric cables under fire conditions – Part 3: Tests on bunched wires or cables*

ISO 13943:2017, *Fire safety – Vocabulary*

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV

¹ Withdrawn.

SOMMAIRE

AVANT-PROPOS.....	15
INTRODUCTION.....	17
1 Domaine d'application.....	18
2 Références normatives	18
3 Termes et définitions	18
4 Appareillage d'essai.....	19
4.1 Généralités	19
4.2 Source d'allumage.....	19
5 Procédure d'essai.....	19
5.1 Echantillon d'essai	19
5.2 Détermination du nombre de tronçons de câble.....	19
5.3 Montage de l'échantillon d'essai	20
5.4 Durée d'application de la flamme	21
6 Evaluation des résultats d'essai	21
7 Exigences de performance.....	21
8 Procédure de contre-essai	21
9 Rapport d'essai	21
Annexe A (normative) Recommandations pour la sélection des câbles pour l'essai d'acceptation de type	23
Annexe B (informative) Recommandation d'exigences de performance	24
Bibliographie	25
 Figure 1 – Disposition typique et espacement des câbles montés sur les deux côtés de l'échelle standard (catégorie A F/R).....	22
 Tableau A.1 – Résumé des conditions d'essai	23

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

**ESSAIS DES CÂBLES ÉLECTRIQUES ET DES CÂBLES
À FIBRES OPTIQUES SOUMIS AU FEU –****Partie 3-21: Essai de propagation verticale de la flamme des fils
ou câbles montés en nappes en position verticale – Catégorie A F/R**

AVANT-PROPOS

- 1) La Commission Electrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. A cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
- 2) Les décisions ou accords officiels de l'IEC concernant les questions techniques représentent, dans la mesure du possible, un accord international sur les sujets étudiés, étant donné que les Comités nationaux de l'IEC intéressés sont représentés dans chaque comité d'études.
- 3) Les Publications de l'IEC se présentent sous la forme de recommandations internationales et sont agréées comme telles par les Comités nationaux de l'IEC. Tous les efforts raisonnables sont entrepris afin que l'IEC s'assure de l'exactitude du contenu technique de ses publications; l'IEC ne peut pas être tenue responsable de l'éventuelle mauvaise utilisation ou interprétation qui en est faite par un quelconque utilisateur final.
- 4) Dans le but d'encourager l'uniformité internationale, les Comités nationaux de l'IEC s'engagent, dans toute la mesure possible, à appliquer de façon transparente les Publications de l'IEC dans leurs publications nationales et régionales. Toutes divergences entre toutes Publications de l'IEC et toutes publications nationales ou régionales correspondantes doivent être indiquées en termes clairs dans ces dernières.
- 5) L'IEC elle-même ne fournit aucune attestation de conformité. Des organismes de certification indépendants fournissent des services d'évaluation de conformité et, dans certains secteurs, accèdent aux marques de conformité de l'IEC. L'IEC n'est responsable d'aucun des services effectués par les organismes de certification indépendants.
- 6) Tous les utilisateurs doivent s'assurer qu'ils sont en possession de la dernière édition de cette publication.
- 7) Aucune responsabilité ne doit être imputée à l'IEC, à ses administrateurs, employés, auxiliaires ou mandataires, y compris ses experts particuliers et les membres de ses comités d'études et des Comités nationaux de l'IEC, pour tout préjudice causé en cas de dommages corporels et matériels, ou de tout autre dommage de quelque nature que ce soit, directe ou indirecte, ou pour supporter les coûts (y compris les frais de justice) et les dépenses découlant de la publication ou de l'utilisation de cette Publication de l'IEC ou de toute autre Publication de l'IEC, ou au crédit qui lui est accordé.
- 8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
- 9) L'attention est attirée sur le fait que certains des éléments de la présente Publication de l'IEC peuvent faire l'objet de droits de brevet. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets et de ne pas avoir signalé leur existence.

La Norme internationale IEC 60332-3-21 a été préparée par le comité d'études 20 de l'IEC: Câbles électriques.

Cette deuxième édition annule et remplace la première édition parue en 2000. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) des ajustements ont été apportés au titre, et ailleurs, afin de souligner que la Norme s'applique aux câbles à fibre optique, ainsi qu'aux types de conducteurs métalliques;

- b) les détails sur la manière dont les câbles sont montés sur l'échelle ont été mieux définis afin d'améliorer la répétabilité et la reproductibilité.

Elle a le statut d'une publication groupée de sécurité conformément au Guide IEC 104.

Le texte de cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
20/1798/FDIS	20/1815/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette Norme internationale.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

Une liste de toutes les parties de la série IEC 60332, publiées sous le titre général *Essais des câbles électriques et des câbles à fibres optiques soumis au feu*, peut être consultée sur le site web de l'IEC.

Les futures normes de cette série porteront dorénavant le nouveau titre général cité ci-dessus. Le titre des normes existant déjà dans cette série sera mis à jour lors de la prochaine édition.

Le comité a décidé que le contenu de cette publication ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "<http://webstore.iec.ch>" dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconduite,
- supprimée,
- remplacée par une édition révisée, ou
- amendée.

IECNORM.COM : Click to view the full PDF of IEC 60332-3-21:2018 RLV

INTRODUCTION

L'IEC 60332-3-21 fait partie d'une série de publications traitant des essais des câbles électriques et des câbles à fibres optiques soumis au feu.

Les séries IEC 60332-1 et IEC 60332-2 spécifient des méthodes d'essai pour caractériser la propagation de la flamme sur un fil isolé ou un câble seul en position verticale. On ne peut pas présumer que lorsqu'un fil ou câble satisfait aux exigences des séries IEC 60332-1 et IEC 60332-2, des fils ou câbles similaires disposés en nappe en position verticale se comporteront de la même façon. Cela est dû au fait que la propagation de la flamme le long d'une nappe de câbles en position verticale dépend d'un certain nombre de paramètres, tels que

- a) le volume des matériaux combustibles exposés au feu et aux flammes qui peuvent être produites par la combustion des câbles;
- b) la configuration géométrique des câbles et leur situation par rapport à leur environnement;
- c) la température à laquelle il est possible d'enflammer les gaz émis par les câbles;
- d) la quantité de gaz combustible émis par les câbles pour une élévation de température donnée;
- e) le volume d'air passant à travers l'installation des câbles;
- f) la construction des câbles, par exemple armés ou non armés, mono ou multiconducteurs.

Tout ce qui précède présume que les câbles peuvent être enflammés lorsqu'ils sont impliqués dans un incendie externe.

La série IEC 60332-3 donne les détails d'un essai où un certain nombre de câbles sont disposés en nappes pour constituer différentes installations des échantillons. Pour être d'un usage plus facile et pour différencier les différentes catégories d'essais, les parties sont désignées comme suit.

Partie 3-10: Appareillage

Partie 3-21: Catégorie A F/R

Partie 3-22: Catégorie A

Partie 3-23: Catégorie B

Partie 3-24: Catégorie C

Partie 3-25: Catégorie D

Les Parties 3-21 et au-delà définissent les différentes catégories et les procédures qui s'y rapportent. Les catégories sont distinguées par la durée de l'essai, le volume de matériaux non métalliques de l'échantillon d'essai et la méthode de montage de l'échantillon pour l'essai. Dans toutes les catégories, les câbles ayant au moins un conducteur de section supérieure à 35 mm² sont soumis à l'essai dans une configuration espacée, tandis que les câbles dont les conducteurs sont d'une section inférieure ou égale à 35 mm² et les câbles à fibres optiques sont soumis à l'essai dans une configuration jointive.

Les catégories ne sont pas nécessairement liées à différents niveaux de sécurité dans les installations de câbles réelles. La configuration réelle des câbles installés peut être un élément déterminant majeur dans le niveau de propagation de la flamme survenant dans un incendie réel.

La méthode de montage décrite en catégorie A F/R (Partie 3-21) est destinée aux câbles spéciaux utilisés dans des installations particulières.

Les catégories A, B, C et D (Parties 3-22 à 3-25 respectivement) sont pour un usage général là où des volumes de matériaux non métalliques différents sont impliqués.

ESSAIS DES CÂBLES ÉLECTRIQUES ET DES CÂBLES À FIBRES OPTIQUES SOUMIS AU FEU –

Partie 3-21: Essai de propagation verticale de la flamme des fils ou câbles montés en nappes en position verticale – Catégorie A F/R

1 Domaine d'application

La présente partie de l'IEC 60332 couvre la catégorie A F/R pour les méthodes d'essai pour l'évaluation de la propagation verticale de la flamme des fils ou câbles, disposés en nappes en position verticale, dans des conditions définies.

Le présent document concerne uniquement les câbles d'énergie ayant au moins un conducteur de section supérieure à 35 mm² installés sur l'échelle d'essai dans une configuration espacée sur la face avant et la face arrière afin d'obtenir un volume nominal total de matériau non métallique de 7 l/m d'échantillon d'essai. La durée d'application de la flamme est de 40 min. Cette méthode de montage est prévue pour les constructions de câbles spéciales utilisées dans des installations particulières lorsque cela est requis dans la spécification de câble. La catégorie A F/R n'est pas prévue pour une utilisation générale.

L'essai est prévu pour des essais d'acceptation de type. Les exigences pour la sélection des câbles pour l'acceptation de type sont données à l'Annexe A. La propagation de la flamme est mesurée comme étant l'étendue de la partie endommagée de l'échantillon de câble. Cette procédure peut être utilisée pour démontrer l'aptitude du câble à limiter la propagation de la flamme.

L'Annexe B donne une recommandation pour l'exigence de performance.

NOTE Pour les besoins du présent document, le terme «fils ou câbles électriques» couvre tous les câbles isolés à conducteur métallique utilisés pour le transport d'énergie ou de signaux.

2 Références normatives

Les documents suivants cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60332-3-10, *Essais des câbles électriques et des câbles à fibres optiques soumis au feu – Partie 3-10: Essai de propagation verticale de la flamme des fils ou câbles montés en nappes en position verticale – Appareillage*

IEC 60811-606, *Câbles électriques et à fibres optiques – Méthodes d'essai pour les matériaux non-métalliques – Partie 606: Essais physiques – Méthodes de détermination de la masse volumique*

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions suivants s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse <http://www.electropedia.org/>
- ISO Online browsing platform: disponible à l'adresse <http://www.iso.org/obp>

3.1

source d'allumage

source d'énergie qui provoque une combustion

[SOURCE: ISO 13943:2017, 3.219]

3.2

résidu charbonneux

résidu carboné résultant d'une pyrolyse ou d'une combustion incomplète

[SOURCE: ISO 13943:2017, 3.47]

3.3

propagation de flamme

propagation d'un front de flamme

[SOURCE: ISO 13943:2017, 3.168]

4 Appareillage d'essai

4.1 Généralités

L'appareillage spécifié dans l'IEC 60332-3-10 doit être utilisé.

4.2 Source d'allumage

La source d'allumage doit être constituée par un brûleur à propane du type à ruban, tel qu'il est spécifié dans l'IEC 60332-3-10.

5 Procédure d'essai

5.1 Echantillon d'essai

L'échantillon d'essai doit comprendre un certain nombre de tronçons de câble issus de la même longueur de production, ayant chacun une longueur minimale de 3,5 m.

Le nombre total de tronçons de câble constituant l'échantillon d'essai doit être égal au nombre requis pour fournir un volume total nominal de matériau non métallique de 7 l/m d'échantillon d'essai.

L'échantillon d'essai pour l'acceptation de type doit être conforme à l'Annexe A.

Les tronçons de câble formant l'échantillon d'essai doivent être conditionnés à une température de (20 ± 10) °C pendant au moins 16 h avant de commencer l'essai. Les tronçons de câble doivent être secs.

5.2 Détermination du nombre de tronçons de câble

Pour calculer le nombre approprié de tronçons de câbles, il est nécessaire de déterminer le volume par mètre de matériau non métallique d'un tronçon de câble.