IEC 60695-2-12

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REDLINE VERSION

INTERNATIONAL STANDARD

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HORIZONTAL PUBLICATION

Fire hazard testing –
Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability index (GWFI) test method for materials

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability index (GWFI) test method for materials

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.
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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60695-2-12:2010+AMD1:2014 CSV. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 60695-2-12 has been prepared by IEC technical committee 89: Fire hazard testing. It is an International Standard.

This third edition cancels and replaces the second edition published in 2010 and Amendment 1:2014. This edition constitutes a technical revision.

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

a) New terms and definitions with regards to times and durations have been added to Clause 3, with an effect on the application of the test method.

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

FDIS	Report on voting
89/1537/FDIS	89/1545/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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

This standard is to be used in conjunction with IEC 60695-2-10.

A list of all the parts in the IEC 60695 series, under the general title *Fire hazard testing*, can be found on the IEC web site.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document 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 document using a colour printer.

INTRODUCTION

In the design of any electrotechnical product, the risk of fire and the potential hazards associated with fire need to be considered. In this respect the objective of component, circuit, and product design, as well as the choice of materials, is to reduce to acceptable levels the potential risks of fire during normal operating conditions, reasonable foreseeable abnormal use, malfunction and/or failure. IEC 60695-1-10 [1] [1], together with its companion IEC 60695-1-11 [2], has been developed to provide guidance on how this is to be accomplished.

The primary aims of IEC 60695-1-10 and IEC 60695-1-11 are to provide guidance on how to:

a) prevent ignition caused by an electrically energized component part, and

b) confine any resulting fire within the bounds of the enclosure of the electrotechnical product in the event of ignition.

Secondary aims of IEC 60695-1-10 and IEC 60695-1-11 include the minimization of any flame spread beyond the product's enclosure and the minimization of the harmful effects of fire effluents such as heat, smoke, toxicity and/or corrosivity.

Fires involving electrotechnical products can also be initiated from external non-electrical sources. Considerations of this nature ~~should be~~ are normally dealt with in the overall fire hazard assessment.

In electrotechnical equipment, overheated metal parts can act as ignition sources. In glow-wire tests, a ~~red-hot~~ glowing wire is used to simulate such an ignition source.

IEC 60695-2-10 describes a glow-wire test apparatus and common test procedure, IEC 60695-2-11 [3] describes a glow-wire flammability test for end products, and IEC 60695-2-13 describes a glow-wire ignition temperature (GWIT) test method for materials.

This document describes a glow-wire flammability index test for materials. It ~~should~~ is intended to be used to measure, describe, and rank the properties of materials in response to heat caused by contact with an electrically heated wire under controlled laboratory conditions. This may be useful for the evaluation of materials for use in products that may be exposed to excess thermal stress such as a fault current flowing through a wire, overloading of components, and/or bad connections. It ~~should~~ is not intended to be used to solely describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test ~~may~~ can be used as elements of a fire hazard assessment which takes into account all of the factors which are pertinent to a particular end use.

This document may involve hazardous materials, operations, and equipment. It does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

[1] Numbers in square brackets refer to the bibliography.

FIRE HAZARD TESTING –

Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability index (GWFI) test method for materials

1 Scope

This part of IEC 60695 specifies the details of the glow-wire test to be applied to test specimens of solid electrical insulating materials or other solid materials for flammability testing to determine the glow-wire flammability index (GWFI).

GWFI is the highest temperature, determined during this standardized procedure, at which the tested material does not ignite or, if it does, extinguishes within 30 s after removal of the glow-wire and is not totally consumed; and molten drips, if they occur, do not ignite the wrapping tissue.

This test method is a materials test carried out on a series of standard test specimens. The data obtained, along with data from the glow-wire ignition temperature (GWIT) test method for materials, IEC 60695-2-13, can then be used in a preselection process in accordance with IEC 60695-1-30 [4] to judge the ability of materials to meet the requirements of IEC 60695-2-11.

NOTE As an outcome of conducting a fire hazard assessment, an appropriate series of preselection flammability and ignition tests ~~may~~ can allow a reduction of end product testing.

This basic safety publication ~~is~~ focusing on safety test method(s) is primarily intended for use by technical committees in the preparation of ~~standards~~ safety publications in accordance with the principles laid down in IEC Guide 104 and ISO/IEC Guide 51.

One of the responsibilities of a technical committee is, wherever applicable, to make use of basic safety publications in the preparation of its publications. ~~The requirements, test methods or test conditions of this basic safety publication will not apply unless specifically referred to or included in the relevant publications.~~

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 60695-1-30:2008, *Fire hazard testing – Part 1-30: Guidance for assessing the fire hazard of electrotechnical products – Preselection testing process – General guidelines*~~

IEC 60695-2-10~~:2000~~, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-13, *Fire hazard testing – Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignition temperature (GWIT) test method for materials*

IEC 60695-4:2021, *Fire hazard testing – Part 4: Terminology concerning fire tests for electrotechnical products*

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

~~ISO/IEC Guide 51, *Safety aspects – Guidelines for inclusion in standards*~~

ISO 291:2008, *Plastics – Standard atmospheres for conditioning and testing*

ISO 293, *Plastics – Compression moulding of test specimens of thermoplastic materials*

ISO 294 (all parts), *Plastics – Injection moulding of test specimens of thermoplastic materials*

ISO 295, *Plastics – Compression moulding of test specimens of thermosetting materials*

ISO 13943:2017, *Fire safety – Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO~~/IEC~~ 13943:2017 and IEC 60695-4:2012, some of which are reproduced below for the user's convenience, and in IEC 60695-2-10 regarding times and durations, and the following 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
combustion
exothermic reaction of a substance with an oxidizing agent

Note 1 to entry: Combustion generally emits fire effluent accompanied by flames and/or glowing.

[SOURCE: ~~ISO /IEC 13943:2008, definition 4.46~~ ISO 13943:2017, 3.55]

3.2
flame, noun
rapid, self-sustaining, sub-sonic propagation of combustion in a gaseous medium, usually with emission of light

[SOURCE: ~~ISO /IEC 13943:2008, definition 4.133~~ ISO 13943:2017, 3.159]

3.3
flame event
sustained flaming and/or glowing combustion

3.4
flammability
ability of a material or product to burn with a flame under specified conditions

[SOURCE: ISO 13943:2017, 3.178]

3.5
glowing, noun
luminosity caused by heat

[SOURCE: ~~ISO/IEC 13943:2008, definition 4.168~~ ISO 13943:2017, 3.196]

3.6
glowing combustion
combustion of a material in the solid phase without flame but with emission of light from the combustion zone

[SOURCE: ~~ISO/IEC 13943:2008, definition 4.169~~ ISO 13943:2017, 3.197]

3.7
ignition
DEPRECATED: sustained ignition
<general> initiation of combustion

[SOURCE: ~~ISO/IEC 13943:2008, definition 4.187~~ ISO 13943:2017, 3.217]

3.8
ignition
DEPRECATED: sustained ignition
<flaming combustion> initiation of sustained flame

[SOURCE: ~~ISO/IEC 13943:2008, definition 4.188~~ ISO 13943:2017, 3.218]

3.9
molten drip
falling droplet of material which has been softened or liquefied by heat

Note 1 to entry: The droplets can be flaming or not flaming.

[SOURCE: ~~ISO/IEC 13943:2008, definition 4.232~~ ISO 13943:2017, 3.275]

3.10
preselection
process of assessing and choosing candidate materials, components or subassemblies for making an end product

[SOURCE: ~~IEC 60695-1-30:2008, definition 3.2~~ IEC 60695-4:2012, 3.2.21]

4 Test specimens

4.1 Test specimen preparation

Test specimens shall be fabricated using the appropriate ISO method, e.g. casting and injection moulding in accordance with the ISO 294 series, compression moulding in accordance with ISO 293 or ISO 295, or transfer moulding to the necessary shape as specified in 4.2. Where this is not possible, the test specimen shall be cut and/or sliced from a representative sample of the material (for example, produced using the same fabrication process as would be used to mould a part of a product).

After any fabrication or cutting operation, ~~care shall be taken to remove~~ all dust and any particles shall be removed from the surface; cut edges shall be fine sanded to a smooth finish.

4.2 Test specimen dimensions

The dimensions of the planar sections of the test specimens shall be at least 60 mm in length and 60 mm in width (measured inside the clamping areas) and shall be provided in all thicknesses under consideration. ~~The preferred values include 0,1 mm ± 0,02 mm, 0,2 mm ± 0,02 mm, 0,4 mm ± 0,05 mm, 0,75 mm ± 0,1 mm, 1,5 mm ± 0,15 mm, 3,0 mm ± 0,2 mm, or 6,0 mm ± 0,4 mm.~~ The preferred values of thickness include 0,1 mm ± 0,02 mm, 0,2 mm ± 0,03 mm, 0,4 mm ± 0,04 mm, 0,75 mm ± 0,15 mm, 1,5 mm ± 0,15 mm, 3,0 mm ± 0,25 mm, or 6,0 mm ± 0,4 mm.

NOTE A set of 30 test specimens per thickness will, in general, be adequate to concurrently establish the GWFI and the glow wire ignition temperature, GWIT (see IEC 60695-2-13).

4.3 Testing ranges in formulations

4.3.1 General

The results of tests carried out on test specimen sets of different colour, thickness, density, molecular mass, anisotropic type/direction, additives, fillers, and/or reinforcements can vary. When agreed between the parties involved, the test programmes outlined in 4.3.2 and 4.3.3 may be employed in order to evaluate these variations.

4.3.2 Density, melt flows and filler/reinforcement

Test specimens covering all combinations of minimum and maximum levels of density, melt flows and filler/reinforcement content ~~may~~ shall be provided and considered representative of the range if the test results yield the same GWFI. If the test results do not yield the same GWFI for all test specimens representing the range, evaluation shall be limited to the materials with the specific levels of density, melt flows and filler/reinforcement tested. In addition, test specimens with intermediate density, melt flows, and filler/reinforcement content shall be tested to determine the representative range for each GWFI determination. However, as an alternative, the least favourable performance of the specific levels of density, melt flows and filler/reinforcement tested ~~may~~ shall be considered representative of intermediate levels without additional testing.

4.3.3 Colour

When evaluating a range of colours, test specimens that

a) contain no colouring,

b) contain the highest level of organic pigments/colorants/dyes and/or carbon black,

c) contain the highest level of inorganic pigments, and

d) contain pigments/colorants/dyes which are known to adversely affect flammability characteristics

are considered representative of the colour range if the test results yield the same GWFI.

If the colours do not yield the same GWFI, when evaluating a range of colours, the GWFI with the least favourable performance should yield the GWFI for an all colour range.

5 Apparatus

~~The description of the test apparatus is specified in Clause 5 of IEC 60695-2-10.~~

~~The wrapping tissue and wooden board to be placed underneath the test specimen are specified in 5.3 of IEC 60695-2-10.~~

The test apparatus of IEC 60695-2-10 shall be used.

6 Temperature measuring system verification

The ~~method of~~ verification of the temperature measuring system ~~is~~ as specified in IEC 60695-2-10 shall have been performed.

7 Conditioning and test conditions

7.1 Conditioning of test specimens

The test specimens shall be conditioned for a minimum of 48 h at 23 °C ± 2 °C and at a relative humidity between 40 % and 60 % (in accordance with ISO 291:2008, Clause 6, Table 2, Class 2). Once removed from the conditioning atmosphere, the test specimens shall be tested within 4 h ~~(see ISO 291, Clause 6, Table 2, Class 2)~~.

7.2 Conditioning of the wrapping tissue and the wooden board

~~The wrapping tissue and the wooden board to be placed underneath the test specimen are specified in 5.3 of IEC 60695-2-10. They shall be conditioned for a minimum of 48 h at 23 °C ± 2 °C and at a relative humidity between 40 % and 60 %. Once removed from the conditioning atmosphere, the wrapping tissue and wooden board shall be used within 1 h (see ISO 291, Clause 6, Table 2, Class 2).~~

The wrapping tissue and the wooden board to be placed underneath the test specimen as well as their conditioning are specified in IEC 60695-2-10. Once removed from the conditioning atmosphere, the wrapping tissue and wooden board shall be used within 4 h.

7.3 Testing conditions

The test specimens shall be tested in a laboratory atmosphere having a temperature between 15 °C and 35 °C and a relative humidity less than or equal to 75 %.

8 Test procedure

8.1 General

The test specimens shall be identified ~~and examined visually~~.

The general test procedure shall be as specified in IEC 60695-2-10.

8.2 Initial test temperatures

The glow-wire is heated to one of the initial test temperatures specified in Table 1, which is considered to be just high enough to cause ignition. If unknown, the initial test temperature shall not exceed 650 °C.

NOTE When determining both the GWIT and GWFI, it has been found to be useful to first perform the procedure in IEC 60695-2-13. Once the GWIT has been determined, this ~~should be used as~~ information is useful to set the initial test temperature for the GWFI test.

Table 1 – Initial test temperatures

Initial test temperatures °C	Tolerances °~~K~~C
550	±10
600	±10
650	±10
700	±10
750	±10
800	±15
850	±15
900	±15
960	±15

8.3 Test temperatures

A set of three test specimens shall be prepared for testing at a chosen initial test temperature.

If one of the three test specimens fails to withstand the test criteria as defined in 10.1, the test shall be repeated with three new test specimens at a test temperature preferably 50~~ K~~ °C (60~~ K~~ °C for 960 °C) lower.

If the three test specimens withstand the test criteria as defined in 10.1, the test shall be repeated with three new test specimens at a test temperature preferably 50~~ K~~ °C (60~~ K~~ °C for 900 °C) higher.

Repeat the tests with three new test specimens each time and reduce the interval of test temperatures to 25~~ K~~ °C (30~~ K~~ °C for 960 °C) in the final approach to determine the maximum test temperature at which all three test specimens withstand the test criteria as defined in 10.1.

However, there is no need to go to the higher temperature if it has already been determined that at least one of the three test specimens will not withstand the test criteria as defined in 10.1.

NOTE ~~1~~ The minimum test temperature is 550 °C. The maximum test temperature is 960 °C.

~~NOTE 2 60 K and 30 K are the appropriate temperature intervals for temperatures above 900 °C.~~

~~NOTE 3 It is recommended to start with a test temperature of 650 °C.~~

9 Observations and measurements

~~**9.1 General**~~

~~The following observations and measurements shall be recorded.~~

9.1 Initial observations

After identifying and visually inspecting the test specimens, the following shall be recorded:

a) a description of the tested material, including thickness, colour, type and manufacturer;

b) a description of the method for the preparation of the test specimens, if available;

c) the direction of any anisotropy, if known, relative to the dimensions of the test specimen; and

d) the pre-test conditioning of the test specimens and wrapping tissue.

9.2 Test observations

During the time of application of the glow-wire, t_{APP} (30 s ± 1 s), and during a further period of 30 s, time of observation, t_{OBS}, the test specimen and the wrapping tissue placed below it shall be observed and the following shall be recorded:

~~a) the time, t_R, of the longest sustained flaming and/or glowing combustion observed after the removal of the glow-wire tip from the test specimen (to the nearest 0,5 s),~~

~~b) the test temperatures from Clause 8,~~

~~c) total consumption of the test specimen, if this occurs,~~

~~d) ignition of the wrapping tissue, if this occurs, and~~

~~e) additional observations that may be agreed to by both parties.~~

~~NOTE If the measured value is 30,2 s this should be recorded as 30,0 s. If the measured value is 30,3 s this should be recorded as 30,5 s.~~

a) whether there is no ignition; or, if there is ignition, the time of ignition, t_I for the test specimen;

a) the time of extinguishment, t_E;

b) based on the recording of measured values t_I and t_E, the calculated value for t_R shall be recorded as well;

c) the test temperatures from Clause 8;

d) whether the test specimen is totally consumed;

e) whether there is any ignition of the wrapping tissue placed underneath the test specimen; and

f) additional observations that may be agreed to by both parties.

10 Evaluation of test results

10.1 Test criteria

~~The test specimen is considered to have withstood this test if there is no ignition, or if all of the following situations apply:~~

~~a) the longest sustained flames or glowing of the test specimen after removal of the glow-wire, t_R, extinguish within 30 s;~~

~~b) the specimen is not totally consumed; and~~

~~c) there is no ignition of the wrapping tissue.~~

The test specimen is considered to have achieved the severity level of a specific test temperature of T °C, if

a) there is no ignition, or

b) all of the following situations apply when ignition has occurred:

   1) flames or glowing combustion of the test specimen extinguish within 30 s after removal of the glow-wire (t_{OBS}), i.e. $t_R \leq 30$ s;

   2) the test specimen is not totally consumed; and

   3) the wrapping tissue placed underneath the test specimen does not ignite.

10.2 Glow-wire flammability index

The GWFI is the highest temperature at which three test specimens at the relevant thickness withstand the test as defined in 10.1.

In those cases where the material under test did not ignite during the determination of the GWIT (see IEC 60695-2-13) at the highest temperature taken from Table 1, the GWFI test procedure need not be conducted. The GWFI for this material will be 960 °C at the relevant thickness.

The GWFI shall be reported in the following manner:

for example, for a test specimen of 3,0 mm thickness and a GWFI temperature of 850 °C:

GWFI: 850 / 3,0

In case of different GWFIs per thickness, these GWFIs shall be reported per thickness.

In those cases where the GWFI is to be utilized over a range of thicknesses, it may be appropriate to consider the GWFI at the minimum and maximum thickness and the other preferred thicknesses in the range.

The GWFI representative for a range of thicknesses shall be reported in the following manner, for example, for a range of thicknesses of 0,75 mm up to 3,0 mm and a GWFI temperature of 850 °C:

GWFI: 850 / 0,75 – 3,0

11 Test report

The test report shall include the following information:

a) a reference to IEC 60695-2-12;
b) the test temperatures from 8.3;
c) the observations and measurements from Clause 9; and
d) the GWFI from 10.2.

Bibliography

~~IEC 60695-11(all parts), *Fire hazard testing – Part 11:Test flames*~~

~~ISO/IEC 13943:2008, *Fire safety – Vocabulary*~~

[1] IEC 60695-1-10, *Fire hazard testing – Part 1-10: Guidance for assessing the fire hazard of electrotechnical products – General guidelines*

[2] IEC 60695-1-11, *Fire hazard testing – Part 1-11: Guidance for assessing the fire hazard of electrotechnical products – Fire hazard assessment*

[3] IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

[4] IEC 60695-1-30, *Fire hazard testing – Part 1-30: Guidance for assessing the fire hazard of electrotechnical products – Preselection testing process – General guidelines*

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Essais relatifs aux risques du feu –
Partie 2-12: Essais au fil incandescent/chauffant – Méthode d'essai d'indice d'inflammabilité au fil incandescent (GWFI) pour matériaux

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FDIS	Report on voting
89/1537/FDIS	89/1545/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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

This standard is to be used in conjunction with IEC 60695-2-10.

A list of all the parts in the IEC 60695 series, under the general title *Fire hazard testing*, can be found on the IEC web site.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

In the design of any electrotechnical product, the risk of fire and the potential hazards associated with fire need to be considered. In this respect the objective of component, circuit, and product design, as well as the choice of materials, is to reduce to acceptable levels the potential risks of fire during normal operating conditions, reasonable foreseeable abnormal use, malfunction and/or failure. IEC 60695-1-10 [1] [1], together with its companion IEC 60695-1-11 [2], has been developed to provide guidance on how this is to be accomplished.

The primary aims of IEC 60695-1-10 and IEC 60695-1-11 are to provide guidance on how to:

a) prevent ignition caused by an electrically energized component part, and

b) confine any resulting fire within the bounds of the enclosure of the electrotechnical product in the event of ignition.

Secondary aims of IEC 60695-1-10 and IEC 60695-1-11 include the minimization of any flame spread beyond the product's enclosure and the minimization of the harmful effects of fire effluents such as heat, smoke, toxicity and/or corrosivity.

Fires involving electrotechnical products can also be initiated from external non-electrical sources. Considerations of this nature are normally dealt with in the overall fire hazard assessment.

In electrotechnical equipment, overheated metal parts can act as ignition sources. In glow-wire tests, a glowing wire is used to simulate such an ignition source.

IEC 60695-2-10 describes a glow-wire test apparatus and common test procedure, IEC 60695-2-11 [3] describes a glow-wire flammability test for end products, and IEC 60695-2-13 describes a glow-wire ignition temperature (GWIT) test method for materials.

This document describes a glow-wire flammability index test for materials. It is intended to be used to measure, describe, and rank the properties of materials in response to heat caused by contact with an electrically heated wire under controlled laboratory conditions. This may be useful for the evaluation of materials for use in products that may be exposed to excess thermal stress such as a fault current flowing through a wire, overloading of components, and/or bad connections. It is not intended to be used to solely describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test can be used as elements of a fire hazard assessment which takes into account all of the factors which are pertinent to a particular end use.

This document may involve hazardous materials, operations, and equipment. It does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

[1] Numbers in square brackets refer to the bibliography.

FIRE HAZARD TESTING –

Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability index (GWFI) test method for materials

1 Scope

This part of IEC 60695 specifies the details of the glow-wire test to be applied to test specimens of solid electrical insulating materials or other solid materials for flammability testing to determine the glow-wire flammability index (GWFI).

GWFI is the highest temperature, determined during this standardized procedure, at which the tested material does not ignite or, if it does, extinguishes within 30 s after removal of the glow-wire and is not totally consumed; and molten drips, if they occur, do not ignite the wrapping tissue.

This test method is a materials test carried out on a series of standard test specimens. The data obtained, along with data from the glow-wire ignition temperature (GWIT) test method for materials, IEC 60695-2-13, can then be used in a preselection process in accordance with IEC 60695-1-30 [4] to judge the ability of materials to meet the requirements of IEC 60695-2-11.

NOTE As an outcome of conducting a fire hazard assessment, an appropriate series of preselection flammability and ignition tests can allow a reduction of end product testing.

This basic safety publication focusing on safety test method(s) is primarily intended for use by technical committees in the preparation of safety publications in accordance with the principles laid down in IEC Guide 104 and ISO/IEC Guide 51.

One of the responsibilities of a technical committee is, wherever applicable, to make use of basic safety publications in the preparation of its publications.

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 60695-2-10, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-13, *Fire hazard testing – Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignition temperature (GWIT) test method for materials*

IEC 60695-4:2021, *Fire hazard testing – Part 4: Terminology concerning fire tests for electrotechnical products*

ISO 291:2008, *Plastics – Standard atmospheres for conditioning and testing*

ISO 293, *Plastics – Compression moulding of test specimens of thermoplastic materials*

ISO 294 (all parts), *Plastics – Injection moulding of test specimens of thermoplastic materials*

ISO 295, *Plastics – Compression moulding of test specimens of thermosetting materials*

ISO 13943:2017, *Fire safety – Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13943:2017 and IEC 60695-4:2012, some of which are reproduced below for the user's convenience, and in IEC 60695-2-10 regarding times and durations, and the following 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
combustion
exothermic reaction of a substance with an oxidizing agent

Note 1 to entry: Combustion generally emits fire effluent accompanied by flames and/or glowing.

[SOURCE: ISO 13943:2017, 3.55]

3.2
flame, noun
rapid, self-sustaining, sub-sonic propagation of combustion in a gaseous medium, usually with emission of light

[SOURCE: ISO 13943:2017, 3.159]

3.3
flame event
sustained flaming and/or glowing combustion

3.4
flammability
ability of a material or product to burn with a flame under specified conditions

[SOURCE: ISO 13943:2017, 3.178]

3.5
glowing, noun
luminosity caused by heat

[SOURCE: ISO 13943:2017, 3.196]

3.6
glowing combustion
combustion of a material in the solid phase without flame but with emission of light from the combustion zone

[SOURCE: ISO 13943:2017, 3.197]

3.7
ignition
DEPRECATED: sustained ignition
<general> initiation of combustion

[SOURCE: ISO 13943:2017, 3.217]

3.8
ignition
DEPRECATED: sustained ignition
<flaming combustion> initiation of sustained flame

[SOURCE: ISO 13943:2017, 3.218]

3.9
molten drip
falling droplet of material which has been softened or liquefied by heat

Note 1 to entry: The droplets can be flaming or not flaming.

[SOURCE: ISO 13943:2017, 3.275]

3.10
preselection
process of assessing and choosing candidate materials, components or subassemblies for making an end product

[SOURCE: IEC 60695-4:2012, 3.2.21]

4 Test specimens

4.1 Test specimen preparation

Test specimens shall be fabricated using the appropriate ISO method, e.g. casting and injection moulding in accordance with the ISO 294 series, compression moulding in accordance with ISO 293 or ISO 295, or transfer moulding to the necessary shape as specified in 4.2. Where this is not possible, the test specimen shall be cut and/or sliced from a representative sample of the material (for example, produced using the same fabrication process as would be used to mould a part of a product).

After any fabrication or cutting operation, all dust and any particles shall be removed from the surface; cut edges shall be fine sanded to a smooth finish.

4.2 Test specimen dimensions

The dimensions of the planar sections of the test specimens shall be at least 60 mm in length and 60 mm in width (measured inside the clamping areas) and shall be provided in all thicknesses under consideration. The preferred values of thickness include 0,1 mm ± 0,02 mm, 0,2 mm ± 0,03 mm, 0,4 mm ± 0,04 mm, 0,75 mm ± 0,15 mm, 1,5 mm ± 0,15 mm, 3,0 mm ± 0,25 mm, or 6,0 mm ± 0,4 mm.

NOTE A set of 30 test specimens per thickness will, in general, be adequate to concurrently establish the GWFI and the glow wire ignition temperature, GWIT (see IEC 60695-2-13).

4.3 Testing ranges in formulations

4.3.1 General

The results of tests carried out on test specimen sets of different colour, thickness, density, molecular mass, anisotropic type/direction, additives, fillers, and/or reinforcements can vary. When agreed between the parties involved, the test programmes outlined in 4.3.2 and 4.3.3 may be employed in order to evaluate these variations.

4.3.2 Density, melt flows and filler/reinforcement

Test specimens covering all combinations of minimum and maximum levels of density, melt flows and filler/reinforcement content shall be provided and considered representative of the range if the test results yield the same GWFI. If the test results do not yield the same GWFI for all test specimens representing the range, evaluation shall be limited to the materials with the specific levels of density, melt flows and filler/reinforcement tested. In addition, test specimens with intermediate density, melt flows, and filler/reinforcement content shall be tested to determine the representative range for each GWFI determination. However, as an alternative, the least favourable performance of the specific levels of density, melt flows and filler/reinforcement tested shall be considered representative of intermediate levels without additional testing.

4.3.3 Colour

When evaluating a range of colours, test specimens that

a) contain no colouring,
b) contain the highest level of organic pigments/colorants/dyes and/or carbon black,
c) contain the highest level of inorganic pigments, and
d) contain pigments/colorants/dyes which are known to adversely affect flammability characteristics

are considered representative of the colour range if the test results yield the same GWFI.

If the colours do not yield the same GWFI, when evaluating a range of colours, the GWFI with the least favourable performance should yield the GWFI for an all colour range.

5 Apparatus

The test apparatus of IEC 60695-2-10 shall be used.

6 Temperature measuring system verification

The verification of the temperature measuring system as specified in IEC 60695-2-10 shall have been performed.

7 Conditioning and test conditions

7.1 Conditioning of test specimens

The test specimens shall be conditioned for a minimum of 48 h at 23 °C ± 2 °C and at a relative humidity between 40 % and 60 % (in accordance with ISO 291:2008, Clause 6, Table 2, Class 2). Once removed from the conditioning atmosphere, the test specimens shall be tested within 4 h.

7.2 Conditioning of the wrapping tissue and the wooden board

The wrapping tissue and the wooden board to be placed underneath the test specimen as well as their conditioning are specified in IEC 60695-2-10. Once removed from the conditioning atmosphere, the wrapping tissue and wooden board shall be used within 4 h.

7.3 Testing conditions

The test specimens shall be tested in a laboratory atmosphere having a temperature between 15 °C and 35 °C and a relative humidity less than or equal to 75 %.

8 Test procedure

8.1 General

The test specimens shall be identified.

The general test procedure shall be as specified in IEC 60695-2-10.

8.2 Initial test temperatures

The glow-wire is heated to one of the initial test temperatures specified in Table 1, which is considered to be just high enough to cause ignition. If unknown, the initial test temperature shall not exceed 650 °C.

NOTE When determining both the GWIT and GWFI, it has been found to be useful to first perform the procedure in IEC 60695-2-13. Once the GWIT has been determined, this information is useful to set the initial test temperature for the GWFI test.

Table 1 – Initial test temperatures

Initial test temperatures °C	Tolerances °C
550	±10
600	±10
650	±10
700	±10
750	±10
800	±15
850	±15
900	±15
960	±15

8.3 Test temperatures

A set of three test specimens shall be prepared for testing at a chosen initial test temperature.

If one of the three test specimens fails to withstand the test criteria as defined in 10.1, the test shall be repeated with three new test specimens at a test temperature preferably 50 °C (60 °C for 960 °C) lower.

If the three test specimens withstand the test criteria as defined in 10.1, the test shall be repeated with three new test specimens at a test temperature preferably 50 °C (60 °C for 900 °C) higher.

Repeat the tests with three new test specimens each time and reduce the interval of test temperatures to 25 °C (30 °C for 960 °C) in the final approach to determine the maximum test temperature at which all three test specimens withstand the test criteria as defined in 10.1.

However, there is no need to go to the higher temperature if it has already been determined that at least one of the three test specimens will not withstand the test criteria as defined in 10.1.

NOTE The minimum test temperature is 550 °C. The maximum test temperature is 960 °C.

9 Observations and measurements

9.1 Initial observations

After identifying and visually inspecting the test specimens, the following shall be recorded:

a) a description of the tested material, including thickness, colour, type and manufacturer;

b) a description of the method for the preparation of the test specimens, if available;

c) the direction of any anisotropy, if known, relative to the dimensions of the test specimen; and

d) the pre-test conditioning of the test specimens and wrapping tissue.

9.2 Test observations

During the time of application of the glow-wire, t_{APP} (30 s ± 1 s), and during a further period of 30 s, time of observation, t_{OBS}, the test specimen and the wrapping tissue placed below it shall be observed and the following shall be recorded:

a) whether there is no ignition; or, if there is ignition, the time of ignition, t_I for the test specimen;

b) the time of extinguishment, t_E;

c) based on the recording of measured values t_I and t_E, the calculated value for t_R shall be recorded as well;

d) the test temperatures from Clause 8;

e) whether the test specimen is totally consumed;

f) whether there is any ignition of the wrapping tissue placed underneath the test specimen; and

g) additional observations that may be agreed to by both parties.

10 Evaluation of test results

10.1 Test criteria

The test specimen is considered to have achieved the severity level of a specific test temperature of T °C, if

a) there is no ignition, or

b) all of the following situations apply when ignition has occurred:

   1) flames or glowing combustion of the test specimen extinguish within 30 s after removal of the glow-wire (t_{OBS}), i.e. $t_R \leq 30$ s;

   2) the test specimen is not totally consumed; and

3) the wrapping tissue placed underneath the test specimen does not ignite.

10.2 Glow-wire flammability index

The GWFI is the highest temperature at which three test specimens at the relevant thickness withstand the test as defined in 10.1.

In those cases where the material under test did not ignite during the determination of the GWIT (see IEC 60695-2-13) at the highest temperature taken from Table 1, the GWFI test procedure need not be conducted. The GWFI for this material will be 960 °C at the relevant thickness.

The GWFI shall be reported in the following manner:

for example, for a test specimen of 3,0 mm thickness and a GWFI temperature of 850 °C:

GWFI: 850 / 3,0

In case of different GWFIs per thickness, these GWFIs shall be reported per thickness.

In those cases where the GWFI is to be utilized over a range of thicknesses, it may be appropriate to consider the GWFI at the minimum and maximum thickness and the other preferred thicknesses in the range.

The GWFI representative for a range of thicknesses shall be reported in the following manner, for example, for a range of thicknesses of 0,75 mm up to 3,0 mm and a GWFI temperature of 850 °C:

GWFI: 850 / 0,75 – 3,0

11 Test report

The test report shall include the following information:

a) a reference to IEC 60695-2-12;
b) the test temperatures from 8.3;
c) the observations and measurements from Clause 9; and
d) the GWFI from 10.2.

Bibliography

[1] IEC 60695-1-10, *Fire hazard testing – Part 1-10: Guidance for assessing the fire hazard of electrotechnical products – General guidelines*

[2] IEC 60695-1-11, *Fire hazard testing – Part 1-11: Guidance for assessing the fire hazard of electrotechnical products – Fire hazard assessment*

[3] IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

[4] IEC 60695-1-30, *Fire hazard testing – Part 1-30: Guidance for assessing the fire hazard of electrotechnical products – Preselection testing process – General guidelines*

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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ESSAIS RELATIFS AUX RISQUES DU FEU –

Partie 2-12: Essais au fil incandescent/chauffant – Méthode d'essai d'indice d'inflammabilité au fil incandescent (GWFI) pour matériaux

AVANT-PROPOS

1) La Commission Électrotechnique 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. À 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.

L'IEC 60695-2-12 a été établie par le comité d'études 89 de l'IEC: Essais relatifs aux risques du feu. Il s'agit d'une Norme internationale.

Cette troisième édition annule et remplace la deuxième édition parue en 2010 et l'Amendement 1:2014. Cette édition constitue une révision technique.

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

a) ajout à l'Article 3 de nouveaux termes et définitions, ayant rapport aux moments et durées, applicables à la méthode d'essai.

Le texte cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
89/1537/FDIS	89/1545/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Le présent document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

Il a le statut d'une publication fondamentale de sécurité conformément au Guide IEC 104.

Cette norme doit être utilisée conjointement avec l'IEC 60695-2-10.

Une liste de toutes les parties de la série IEC 60695, publiées sous le titre général *Essais relatifs aux risques du feu*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu du présent document 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 au document recherché. À cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

INTRODUCTION

Lors de la conception d'un quelconque produit électrotechnique, il est nécessaire de prendre en considération le risque d'incendie et les dangers potentiels associés au feu. À cet égard, la conception des composants, circuits et produits, ainsi que le choix des matériaux, ont pour objectifs de réduire à des niveaux acceptables les risques potentiels d'incendie dans les conditions de fonctionnement normal, d'utilisation anormale raisonnablement prévisible, de dysfonctionnement et/ou d'une défaillance. L'IEC 60695-1-10 [1][1] a été élaborée, avec sa norme associée, l'IEC 60695-1-11 [2], afin de fournir des recommandations sur les méthodes de réalisation correspondantes.

L'IEC 60695-1-10 et l'IEC 60695-1-11 ont pour principaux objectifs de fournir des recommandations relatives aux éléments suivants:

a) éviter l'allumage provoqué par un composant sous tension électrique; et

b) confiner le feu résultant dans les limites de l'enceinte du produit électrotechnique en cas d'allumage.

Les objectifs secondaires de l'IEC 60695-1-10 et de l'IEC 60695-1-11 comprennent la réduction à un niveau minimal de toute propagation de flamme au-delà de l'enceinte du produit et la réduction à un niveau minimal des effets nuisibles des effluents du feu tels que la chaleur, la fumée, la toxicité et/ou la corrosivité.

Les feux impliquant des produits électrotechniques peuvent également être déclenchés par des sources externes non électriques. Ces éléments sont pris en considération lors de l'évaluation du danger d'incendie.

Dans le matériel électrotechnique, les parties métalliques surchauffées peuvent jouer le rôle de sources d'allumage. Dans les essais au fil incandescent, un fil incandescent est utilisé pour simuler la source d'allumage.

L'IEC 60695-2-10 décrit un appareillage d'essai et la méthode commune d'essai au fil incandescent, l'IEC 60695-2-11 [3] décrit un essai d'inflammabilité au fil incandescent pour les produits finis et l'IEC 60695-2-13 décrit une méthode d'essai de température d'allumage au fil incandescent (GWIT) pour matériaux.

Le présent document décrit un essai d'indice d'inflammabilité au fil incandescent pour matériaux. Il est destiné à être utilisé pour mesurer, décrire et classer les propriétés des matériaux en réponse à la chaleur produite par contact avec un fil chauffé électriquement dans des conditions de laboratoire contrôlées. Il peut être utile pour l'évaluation de matériaux destinés à être utilisés dans des produits pouvant être exposés à une contrainte thermique excessive telle qu'un courant de défaut traversant un fil, une surcharge de composants et/ou de mauvaises connexions. Il n'est pas destiné à être utilisé uniquement pour décrire ou évaluer le danger d'incendie ou le risque d'incendie de matériaux, de produits ou d'assemblages dans des conditions réelles de feu. Cependant, les résultats de cet essai peuvent servir d'éléments pour une évaluation du danger d'incendie qui prend en compte tous les facteurs appropriés à une utilisation finale particulière.

Le présent document peut concerner des matériaux, opérations et matériels dangereux. Il n'a pas pour objet de traiter tous les problèmes de sécurité associés à son utilisation. Il incombe à l'utilisateur du présent document d'établir les bonnes pratiques appropriées en termes de sécurité et de santé et de déterminer l'applicabilité des limites réglementaires avant usage.

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1 Les chiffres entre crochets se réfèrent à la bibliographie.

ESSAIS RELATIFS AUX RISQUES DU FEU –

Partie 2-12: Essais au fil incandescent/chauffant – Méthode d'essai d'indice d'inflammabilité au fil incandescent (GWFI) pour matériaux

1 Domaine d'application

La présente partie de l'IEC 60695 décrit les informations détaillées de l'essai au fil incandescent destiné à être appliqué à des éprouvettes d'essai de matériaux isolants électriques solides ou autres matériaux solides pour les essais d'inflammabilité dans le but de déterminer l'indice d'inflammabilité au fil incandescent (GWFI, *glow-wire flammability index*).

Le GWFI est la température la plus élevée, déterminée durant cette procédure normalisée, à laquelle le matériau en essai ne s'enflamme pas ou s'il s'enflamme, s'éteint dans les 30 s qui suivent le retrait du fil incandescent et n'est pas entièrement consumé et des gouttes en fusion, s'il y a lieu, n'enflamment pas le papier mousseline.

Cette méthode d'essai est un essai de matériaux exécuté sur une série d'éprouvettes d'essai normalisées. Les données obtenues, ainsi que les données issues de la méthode d'essai de température d'allumabilité au fil incandescent (GWIT, *glow-wire ignition temperature*) pour matériaux, IEC 60695-2-13, peuvent alors être utilisées dans un processus de présélection conformément à l'IEC 60695-1-30 [4] pour estimer l'aptitude des matériaux à satisfaire aux exigences de l'IEC 60695-2-11.

NOTE En tant que résultat de l'exécution d'une évaluation du danger d'incendie, une série appropriée d'essais de présélection d'inflammabilité et d'allumabilité peut permettre un allègement des essais sur le produit final.

La présente publication fondamentale de sécurité, fondée sur la ou les méthodes d'essai de sécurité, est essentiellement destinée à être utilisée par les comités d'études dans le cadre de l'élaboration de publications de sécurité conformément aux principes établis dans le Guide IEC 104 et le Guide ISO/IEC 51.

L'une des responsabilités d'un comité d'études consiste, le cas échéant, à utiliser les publications fondamentales de sécurité dans le cadre de l'élaboration de ses publications.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils 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 60695-2-10, *Essais relatifs aux risques du feu – Partie 2-10: Essais au fil incandescent/chauffant – Appareillage et méthode commune d'essai*

IEC 60695-2-13, *Essais relatifs aux risques du feu – Partie 2-13: Essais au fil incandescent/chauffant – Méthode d'essai de température d'allumabilité au fil incandescent (GWIT) pour matériaux*

IEC 60695-4:2021, *Essais relatifs aux risques du feu – Partie 4: Terminologie relative aux essais au feu pour les produits électrotechniques*

ISO 291:2008, *Plastiques – Atmosphères normales de conditionnement et d'essai*

ISO 293, *Plastiques – Moulage par compression des éprouvettes en matières thermoplastiques*

ISO 294 (toutes les parties), *Plastiques – Moulage par injection des éprouvettes de matériaux thermoplastiques*

ISO 295, *Plastiques – Moulage par compression des éprouvettes de matériaux thermodurcissables*

ISO 13943:2017, *Sécurité au feu – Vocabulaire*

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions de l'ISO 13943:2017 et de l'IEC 60695-4:2012, certains étant repris ci-dessous pour des raisons de commodité de l'utilisateur, puis ceux de l'IEC 60695-2-10 relatifs aux moments et aux durées, 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
combustion
réaction exothermique d'une substance avec un comburant

Note 1 à l'article: Cette combustion émet généralement des effluents du feu accompagnés de flammes et/ou d'incandescence.

[SOURCE: ISO 13943:2017, 3.55]

3.2
flamme, nom
propagation subsonique, auto-entretenue et rapide de la combustion dans un milieu gazeux, généralement accompagnée d'une émission de lumière

[SOURCE: ISO 13943:2017, 3.159]

3.3
événement d'inflammation
inflammation persistante et/ou combustion incandescente

3.4
inflammabilité
aptitude d'un matériau ou d'un produit à brûler avec flamme dans des conditions spécifiées

[SOURCE: ISO 13943:2017, 3.178]

3.5
incandescence, nom
émission de lumière produite par la chaleur

[SOURCE: ISO 13943:2017, 3.196]