

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



BASIC SAFETY PUBLICATION

PUBLICATION FONDAMENTALE DE SÉCURITÉ

Fire hazard testing – **STANDARD PREVIEW**  
Part 11-20: Test flames – 500 W flame test method  
(standards.iteh.ai)

Essais relatifs aux risques du feu –  
Partie 11-20: Flammes d'essai – Méthode d'essai à la flamme de 500 W

IEC 60695-11-20:2015  
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## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references.....	8
3 Terms and definitions .....	9
4 Principle .....	12
5 Significance of the fire tests .....	13
5.1 General.....	13
5.2 Limitations on the use of test results.....	13
5.3 Physical properties that can effect burning behaviour.....	13
5.4 Shrinkage and distortion.....	13
5.5 Effects of test specimen conditioning .....	13
6 Apparatus.....	13
6.1 Laboratory fumehood/chamber .....	13
6.2 Laboratory burner .....	14
6.3 Support stand .....	14
6.4 Timing device.....	14
6.5 Measuring scale.....	14
6.6 Conditioning chamber.....	14
6.7 Micrometer.....	14
6.8 Desiccator chamber .....	14
6.9 Air-circulating oven .....	14
6.10 Cotton pads .....	14
6.11 Burner mounting block.....	15
7 Test specimens .....	15
7.1 Test specimen preparation .....	15
7.2 Bar test specimens.....	15
7.3 Plate test specimens .....	15
7.4 Testing materials – ranges in formulations .....	15
7.4.1 General .....	15
7.4.2 Density, melt flows and filler/reinforcement.....	16
7.4.3 Colour (bar test specimens only) .....	16
7.5 Thickness measurements .....	16
8 Test procedure .....	17
8.1 Conditioning.....	17
8.1.1 General .....	17
8.1.2 Conditioning of specimens in conditioning chamber (“As Received”).....	17
8.1.3 Conditioning of specimens in air-circulating oven.....	17
8.1.4 Conditioning of the cotton pad .....	17
8.1.5 Test conditions .....	17
8.2 Test procedure – bar test specimens .....	18
8.2.1 Test specimen setup .....	18
8.2.2 Flame setup.....	18
8.2.3 Flame application and observations.....	18
8.2.4 Criteria for retest.....	19
8.3 Test procedure – plate shaped test specimens.....	19

8.3.1	Support stand .....	19
8.3.2	Flame setup .....	19
8.3.3	Flame application and observations .....	19
8.3.4	Criteria for retest .....	19
8.4	Classification .....	20
8.5	Test report .....	20
Annex A (normative)	Detailed requirements for the flame application point .....	26
A.1	Dynamic deformation .....	26
A.2	J-shape or twisting deformation .....	26
A.3	Curling deformation .....	26
A.4	Severe deformation .....	26
Bibliography	.....	31
Figure 1	– Vertical burning test for bar test specimen .....	21
Figure 2	– Horizontal burning test for plates .....	22
Figure 3	– Burner mounting block – Example .....	22
Figure 4	– Test specimens .....	23
Figure 5	– Examples of flame application .....	24
Figure 6	– 5V specimen gauge (Example) .....	25
Figure A.1	– Flame application points for a specimen which deforms dynamically .....	27
Figure A.2	– Flame application point for twisted and J-shaped specimens .....	28
Figure A.3	– Flame application point for a curled specimen .....	29
Figure A.4	– Flame application point when there is severe deformation .....	30
Table 1	– Thickness tolerances .....	17
Table 2	– 5V burning classification .....	20

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International Standard IEC 60695-11-20 has been prepared by IEC technical committee 89: Fire hazard testing.

The text of this standard is based on the following documents:

FDIS	Report on voting
89/1241/FDIS	89/1250/RVD

Full information on the voting for the approval of this 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.

This second edition cancels and replaces the first edition of IEC 60695-11-20 published in 1999. This edition constitutes a technical revision.

The main changes with respect to the first edition are listed below:

- The Part title has been modified to the singular – 500 W flame test method.
- Editorial changes have been made throughout the document for the purpose of aligning IEC 60695-11-10 with IEC 60695-11-20.
- The Introduction has been modified to clarify the description of the test method.
- The Scope has been modified for clarification.
- All occurrences of the term “fixture” have been deleted from the document.
- Preferred thickness values have been added to 7.2 and 7.3.
- 7.4.4: ‘Thickness measurement’ is now numbered 7.5 to which a new Table 1 – Thickness tolerances has been added.
- New Subclause 8.1.4 ‘Conditioning of the cotton pad’ has been added.
- 8.2.3 clarifies the application of the test flame to distorted specimens
- Explanatory notes have been added to Figures 5 and 6.
- The Bibliography has been updated and references added.

It has the status of a basic safety publication in accordance with IEC Guide 104 and ISO/IEC Guide 51.

This International Standard is to be used in conjunction with IEC 60695-11-3.

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

Part 11 consists of the following parts:

- Part 11-2: Test flames – 1 kW nominal pre-mixed flame – Apparatus, confirmatory test arrangement and guidance
- Part 11-3: Test flames – 500 W flames – Apparatus and confirmational test methods
- Part 11-4: Test flames – 50 W flame – Apparatus and confirmational test method
- Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance
- Part 11-10: Test flames – 50 W horizontal and vertical flame test methods
- Part 11-11: Test flames – Determination of the characteristic heat flux for ignition from a non-contacting flame source
- Part 11-20: Test flames – 500 W flame test methods
- Part 11-30: Test flames – History and development from 1979 to 1999
- Part 11-40: Test flames – Confirmatory tests – Guidance

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.

The contents of the corrigendum of January 2016 have been included in this copy.

**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.**

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## INTRODUCTION

In the design of an 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 equipment design as well as the choice of materials is to reduce to a tolerable level of risk of fire even in the event of reasonably foreseeable (mis)use, malfunction or failure. Fires involving electrotechnical products can also be initiated from external non-electrical sources. Considerations of this nature are dealt with in the overall fire hazard assessment.

The aim of the IEC 60695 series of standards is to save lives and property by reducing the number of fires or reducing the consequences of the fire. This can be accomplished by:

- trying to prevent ignition caused by an electrically energised component part and, in the event of ignition, to confine any resulting fire within the bounds of the enclosure of the electrotechnical product.
- trying to minimise flame spread beyond the product's enclosure and to minimise the harmful effects of fire effluents including heat, smoke, and toxic or corrosive combustion products.

This part of IEC 60695 describes a test method which consists of two small-scale fire test procedures carried out on materials used in electrotechnical equipment. A 500 W test flame is used as an ignition source. The test method described provides classifications which may be used for quality assurance, the pre-selection of component materials of products, or to verify the required minimum flammability classification of materials used in end products.

### iTeh STANDARD PREVIEW

This test method should not 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 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.

<https://standards.iteh.ai/catalog/standards/sist/9613132d-eca7-4719-b3d1-9c02b55f2e005-iec-60695-11-20:2015>

This international standard 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 international standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

## FIRE HAZARD TESTING –

### Part 11-20: Test flames – 500 W flame test method

#### 1 Scope

This part of IEC 60695 describes a test method consisting of two small-scale laboratory test procedures which is intended to compare the burning behaviour of different materials used in electrotechnical products. Vertically oriented bar specimens or horizontally oriented plate test specimens are exposed to a small flame ignition source with a nominal thermal power of 500 W. The test method uses two test specimen configurations to classify material performance. Rectangular bar-shaped test specimens are used to assess ignitability and burning behaviour, and square plate test specimens are used to assess the resistance of the test specimen to burn-through, as defined in 8.3.3. This test method only applies to materials that have been classified as V-0 or V-1 according to IEC 60695-11-10.

This test method is only applicable to solid and cellular materials that have an apparent density of more than 250 kg/m<sup>3</sup>, determined in accordance with ISO 845. The method does not apply to materials that shrink away from the applied flame without igniting due to their thinness.

The test method described provides classifications which may be used for quality assurance, the pre-selection of component materials of products, or to verify the required minimum flammability classification of materials used in end products. If used for pre-selection, then positive results shall be obtained at a test specimen thickness which equals the smallest thickness used in the product application.

The results obtained provide some information about the behaviour of materials in service, but cannot by themselves assure safe performance in service.

NOTE 1 Guidance on pre-selection is given in IEC 60695-1-30 [3]<sup>1</sup>.

NOTE 2 Test results are influenced by material additives, e.g. pigments, fillers, and fire retardants, and properties such as the direction of anisotropy and the molecular mass.

This basic safety publication is intended for use by technical committees in the preparation of standards 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, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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<sup>1</sup> Numbers in square brackets refer to the bibliography.

IEC 60695-4:2012, *Fire hazard testing – Part 4: Terminology concerning fire tests for electrotechnical products*

IEC 60695-11-3, *Fire hazard testing – Part 11-3: Test flames – 500 W flames – Apparatus and confirmational test methods*

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

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 their inclusion in standards*

ISO/IEC 13943:2008, *Fire Safety – Vocabulary*

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

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

ISO 294:1996 (all parts), *Plastics – Injection moulding of test specimens of thermoplastic materials*

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

ISO 845, *Cellular plastics and rubbers – Determination of apparent density*

ISO 16012, *Plastics – Determination of linear dimensions of test specimens*

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### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 13943:2008 and IEC 60695-4:2005, some of which are reproduced below for the user's convenience, as well as the following apply.

#### 3.1

##### **afterflame**

flame that persists after the ignition source has been removed

[SOURCE: ISO/IEC 13943:2008, definition 4.6]

#### 3.2

##### **afterflame time**

length of time for which an afterflame persists under specified test conditions

Note 1 to entry: Designated in this standard by the parameter  $t_1$ .

[SOURCE: ISO/IEC 13943:2008, definition 4.7]

#### 3.3

##### **afterglow**

persistence of glowing combustion after both removal of the ignition source and the cessation of any flaming combustion

[SOURCE: ISO/IEC 13943:2008, definition 4.8]

### 3.4

#### **afterglow time**

length of time which an afterglow persists under specified test conditions

Note 1 to entry: Designated in this standard by the parameter  $t_2$ .

[SOURCE: ISO/IEC 13943:2008, definition 4.9]

### 3.5

#### **As Received**

test specimen state after a specified period of preconditioning at laboratory ambient conditions

### 3.6

**burn**, intransitive verb  
undergo combustion

[SOURCE: ISO/IEC 13943:2008, definition 4.28]

### 3.7

#### **burning behaviour**

⟨fire tests⟩ response of a test specimen, when it burns under specified conditions, to examination of reaction to fire or fire resistance

[SOURCE: ISO/IEC 13943:2008, definition 4.32]

### 3.8

#### **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]

### 3.9

#### **draught-free environment**

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

Note 1 to entry: A qualitative example is a space in which a wax candle flame remains essentially undisturbed. Quantitative examples are small-scale fire tests in which a maximum air speed of  $0,1 \text{ m} \times \text{s}^{-1}$  or  $0,2 \text{ m} \times \text{s}^{-1}$  is sometimes specified.

[SOURCE: ISO/IEC 13943:2008, definition 4.70]

### 3.10

#### **enclosure**

⟨electrotechnical⟩ external casing protecting the electrical and mechanical parts of apparatus

Note 1 to entry: The term excludes cables.

[SOURCE: ISO/IEC 13943:2008, definition 4.78]

### 3.11

#### **fire hazard**

physical object or condition with a potential for an undesirable consequence from fire

[SOURCE: ISO/IEC 13943:2008, definition 4.112]

**3.12****fire hazard assessment**

evaluation of the possible causes of fire, the possibility and nature of subsequent fire growth, and the possible consequences of fire

[SOURCE: IEC 60695-4:2012, definition 3.2.10]

**3.13****fire retardant**

substance added, or a treatment applied, to a material in order to delay ignition or to reduce the rate of combustion

Note 1 to entry: The use of a fire retardant does not necessarily suppress fire or terminate combustion.

[SOURCE: ISO/IEC 13943:2008, definition 4.123]

**3.14****fire risk**

probability of a fire combined with a quantified measure of its consequence

Note 1 to entry: It is often calculated as the product of probability and consequence.

[SOURCE: ISO/IEC 13943:2008, definition 4.124]

**3.15****fire test**

test that measures behaviour of a fire or exposes an item to the effects of a fire

Note 1 to entry: The results of a fire test can be used to quantify fire severity or determine the fire resistance or reaction to fire of the test specimen.

[SOURCE: ISO/IEC 13943:2008, definition 4.132]

**3.16****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]

**3.17****flame**, verb

produce flame

[SOURCE: ISO/IEC 13943:2008, definition 4.134]

**3.18****flame spread**

propagation of a flame front

[SOURCE: ISO/IEC 13943:2008, definition 4.142]

**3.19****flammability**

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

[SOURCE: ISO/IEC 13943:2008, definition 4.151]

### 3.20

#### **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]

### 3.21

#### **ignition**

sustained ignition (deprecated)  
 〈general〉 initiation of combustion

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

### 3.22

#### **ignition**

sustained ignition (deprecated)  
 〈flaming combustion〉 initiation of sustained flame

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

### 3.23

#### **molten drip**, noun

falling droplet of material that 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]

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### 3.24

#### **preselection**

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

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

### 3.25

#### **reaction to fire**

response of a test specimen when it is exposed to fire under specified conditions in a fire test

Note 1 to entry: Fire resistance is regarded as a special case and is not normally considered as a reaction to fire property.

[SOURCE: ISO/IEC 13943:2008, definition 4.272]

### 3.26

#### **small-scale fire test**

fire test performed on a test specimen of small dimensions

Note 1 to entry: A fire test performed on a test specimen of which the maximum dimension is less than 1 m is usually called a small-scale fire test.

[SOURCE: ISO/IEC 13943:2008, definition 4.292]

## 4 Principle

This test method is only applicable to solid and cellular materials that have an apparent density of more than 250 kg/m<sup>3</sup>, determined in accordance with ISO 845. The method does

not apply to materials that shrink away from the applied flame without igniting due to their thinness.

This test method requires the use of two test specimen configurations to classify the material performance. Rectangular bar-shaped test specimens (see 7.2) are used to assess ignitability and burning behaviour, while square plate test specimens (see 7.3) are used to assess the resistance of the test specimen to burn-through.

## 5 Significance of the fire tests

### 5.1 General

Fire tests made on a material under the conditions specified can be of considerable value when comparing the relative burning behaviour of different materials, controlling manufacturing processes, or assessing any change in burning characteristics. The results obtained from these fire test methods are dependent on the shape and orientation of the test specimen, the environment surrounding the test specimen, and on the conditions of ignition.

NOTE The results obtained with this method and with the horizontal burning (HB) and vertical burning (V) tests specified in IEC 60695-11-10 are not equivalent. The test flame for this test method is 500 W, whereas the test flame for IEC 60695-11-10 is 50 W.

### 5.2 Limitations on the use of test results

Results obtained in accordance with this standard shall not be used alone to describe or appraise the fire hazard presented by a particular material or shape under actual fire conditions. Assessment for fire hazard requires consideration of such factors as fuel contribution, intensity of burning (rate of heat release), products of combustion and environmental factors, including the nature of the ignition source, the orientation of exposed material and ventilation conditions.

[IEC 60695-11-20:2015](https://standards.iteh.ai/catalog/standards/sist/9613132d-cca7-4719-b3d1-0c0428351517/iec-60695-11-20-2015)

[https://standards.iteh.ai/catalog/standards/sist/9613132d-cca7-4719-b3d1-](https://standards.iteh.ai/catalog/standards/sist/9613132d-cca7-4719-b3d1-0c0428351517/iec-60695-11-20-2015)

### 5.3 Physical properties that can effect burning behaviour

Burning behaviour, as measured by this test method, is affected by such factors as density, any anisotropy of the material and the thickness of the test specimen.

### 5.4 Shrinkage and distortion

Certain materials may shrink from (due to their thinness) or be distorted by the applied flame without igniting. If valid results at the thickness under test cannot be obtained, these materials at that specific tested thickness are not suitable for evaluation by these test methods.

### 5.5 Effects of test specimen conditioning

The burning behaviour of some plastic materials may change with time. It is accordingly advisable to make tests before and after conditioning using an appropriate procedure. The preferred oven conditioning is  $168 \text{ h} \pm 2 \text{ h}$  at  $70 \text{ °C} \pm 2 \text{ °C}$ . However, other conditioning times and temperatures may be used by agreement between the interested parties, and if used, shall be noted in the test report.

## 6 Apparatus

### 6.1 Laboratory fumehood/chamber

The laboratory fumehood/chamber shall have an inside volume of at least  $0,5 \text{ m}^3$ . The chamber shall permit observation of tests in progress and shall provide a draught-free environment, whilst allowing normal thermal circulation of air past the test specimen during burning. The inside surfaces of the chamber shall be of a dark colour. When a light meter, facing towards the rear of the chamber, is positioned in place of the test specimen, the