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INTERNATIONAL STANDARD

NORME INTERNATIONALE

BASIC SAFETY PUBLICATION

PUBLICATION FONDAMENTALE DE SÉCURITÉ

Fire hazard testing – Part 1-11: Guidance for assessing the fire hazard of electrotechnical products – Fire hazard assessment

Essais relatifs aux risques du feu – Partie 1-11: Lignes directrices pour l'évaluation du danger du feu des produits électrotechniques – Evaluation du danger du feu

IEC 60695-1-11:2014-10(en-fr)

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FIRE HAZARD TESTING –

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FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60695-1-11 has been prepared by IEC technical committee 89: Fire hazard testing.

This second edition cancels and replaces the first edition of IEC 60695-1-11 published in 2010, and constitutes a technical revision.

The main changes with respect to the previous edition are:

a) Updated references;
b) Updated terms and definitions; and
c) Added Figure 5 – Description of range of products and circumstances of use; and
d) Updated Bibliography.

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

FDIS	Report on voting
89/1220/FDIS	89/1239/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.

It has the status of a basic safety publication in accordance with IEC Guide 104 and ISO/IEC Guide 51 [10] [1].

This standard is to be used in conjunction with IEC 60695-1-10.

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

Part 1 consists of the following parts:

Part 1-10: Guidance for assessing the fire hazard of electrotechnical products – General guidelines

Part 1-11: Guidance for assessing the fire hazard of electrotechnical products – Fire hazard assessment

Part 1-12: Guidance for assessing the fire hazard of electrotechnical products – Fire safety engineering[2]

Part 1-20: Guidance for assessing the fire hazard of electrotechnical products – Ignitability – General Guidance

Part 1-21: Guidance for assessing the fire hazard of electrotechnical products – Ignitability – Summary and relevance of test methods

Part 1-30: Guidance for assessing the fire hazard of electrotechnical products – Preselection testing process – General guidelines

Part 1-40: Guidance for assessing the fire hazard of electrotechnical products – Insulating liquids

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

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

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1 Figures in square brackets refer to the Bibliography.

2 To be published.

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 equipment design as well as the choice of materials is to reduce to acceptable levels the potential risks of fire even in the event of foreseeable abnormal use, malfunction or failure. This standard, together with its companion, IEC 60695-1-10, provides guidance on how this is to be accomplished.

The primary aims are 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.

Secondary aims include the minimisation of any flame spread beyond the product's enclosure and the minimisation of harmful effects of fire effluents including heat, smoke, and toxic or corrosive combustion products.

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.

Fire hazard assessment is used to identify the kinds of fire events (fire scenarios) which will be associated with the product, to establish how the measurable fire properties of the product are related to the outcome of those events, and to establish test methods and performance requirements for those properties which will either result in a tolerable fire outcome or eliminate the event altogether.

Annex A demonstrates a relatively simple fire hazard assessment process as applied to the toxic hazard from a burning material.

Annex B demonstrates a more complex fire hazard assessment process as applied to an electrotechnical product, rigid plastic conduit.

Attention is drawn to the principles in IEC Guide 104, and to the role of committees with horizontal safety functions and group safety functions.

FIRE HAZARD TESTING –

Part 1-11: Guidance for assessing the fire hazard of electrotechnical products – Fire hazard assessment

1 Scope

This part of IEC 60695 provides guidance for assessing the fire hazard of electrotechnical products and for the resulting development of fire hazard testing as related directly to harm to people, animals or property.

It outlines a hazard-based process to identify appropriate fire test methods and performance criteria for products. The principles of the methodology are to identify fire events (fire scenarios) which will be associated with the product, to establish how the measurable fire properties of the product are related to the possible occurrence and outcome of those events, and to establish test methods and performance requirements for those properties which will either result in a tolerable fire outcome or eliminate the event altogether.

It is intended as guidance to IEC committees, to be used with respect to their individual applications. The actual implementation of this document remains the responsibility of each product committee, according to the minimum acceptable fire safety in its application field and taking into account the feedback from experience.

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 [10].

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.

IEC 60695-1-10:2009, *Fire hazard testing – Part 1-10: Guidance for assessing the fire hazard of electrotechnical products – General guidelines*

IEC 60695-1-12, *Fire hazard testing – Part 1-12 Guidance for assessing the fire hazard of electrotechnical products – Fire safety engineering*[3]

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

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3 To be published.

IEC Guide 104:2010, *The preparation of safety publications and the use of basic safety publications and group safety publications*

ISO 13943:2008, *Fire safety – Vocabulary*

3 Terms and definitions

For the purposes of this document the following terms and definitions apply.

3.1
asphyxiant
toxicant that causes hypoxia, which can result in central nervous system depression or cardiovascular effects

Note 1 to entry: Loss of consciousness and ultimately death may occur.

[SOURCE: ISO 13943:2008, definition 4.17]

3.2
available safe escape time
ASET
time available for escape for an individual occupant, the calculated time interval between the time of ignition and the time at which conditions become such that the occupant is estimated to be incapacitated, i.e. unable to take effective action to escape to a safe refuge or place of safety

Note 1 to entry: The time of ignition can be known, e.g. in the case of a fire model or a fire test, or it may be assumed, e.g. it may be based upon an estimate working back from the time of detection. The basis on which the time of ignition is determined is always stated.

Note 2 to entry: This definition equates incapacitation with failure to escape. Other criteria for ASET are possible. If an alternate criterion is selected, it is necessary that it be stated.

Note 3 to entry: Each occupant can have a different value of ASET, depending on that occupant's personal characteristics.

[SOURCE: ISO 13943:2008, definition 4.20]

3.3
built environment
building or other structure

EXAMPLES off-shore platforms, civil engineering works, such as tunnels, bridges and mines; and means of transportation such as motor vehicles and marine vessels.

Note 1 to entry: ISO 6707-1 [11] contains a number of terms and definitions for concepts related to the built environment.

[SOURCE: ISO 13943:2008, definition 4.26]

3.4
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 13943:2008, definition 4.46]

3.5
combustion product
product of combustion
solid, liquid and gaseous material resulting from combustion

Note 1 to entry: Combustion products can include fire effluent, ash, char, clinker and/or soot.

[SOURCE: ISO 13943:2008, definition 4.48]

3.6
effective heat of combustion
heat released from a burning test specimen in a given time interval divided by the mass lost from the test specimen in the same time period

Note 1 to entry: It is the same as the net heat of combustion if all the test specimen is converted to volatile combustion products and if all the combustion products are fully oxidized.

Note 2 to entry: The typical units are $kJ \cdot g^{-1}$.

[SOURCE: ISO 13943:2008, definition 4.74]

3.7
end product
product that is ready for use without modification

Note 1 to entry: An end product can be a component of another end product.

[SOURCE: IEC 60695-4:2012, definition 3.2.7]

3.8
environment
conditions and surroundings that can influence the behaviour of an item or persons when exposed to fire

[SOURCE: ISO 13943:2008, definition 4.80]

3.9
escape
effective action taken to reach a safe refuge or place of safety

[SOURCE: ISO 13943:2008, definition 4.82]

3.10
exposure dose
measure of the maximum amount of a toxic gas or fire effluent that is available for inhalation, calculated by integration of the area under a concentration-time curve

Note 1 to entry: For fire effluent, typical units are grams times minutes per cubic metre ($g \cdot min \cdot m^{-3}$).

Note 2 to entry: For a toxic gas, typical units are microlitres times minutes per litre ($\mu L \cdot min \cdot L^{-1}$) (at T = 298 K and P = 1 atm).

[SOURCE: ISO 13943:2008, definition 4.89]

3.11
extinction area of smoke
product of the volume occupied by smoke and the extinction coefficient of the smoke

Note 1 to entry: It is a measure of the amount of smoke, and the typical units are square metres (m^2).

[SOURCE: ISO 13943:2008, definition 4.92]

3.12
fire
<general> process of combustion characterized by the emission of heat and fire effluent and usually accompanied by smoke, flame or glowing or a combination thereof

Note 1 to entry: In the English language the term "fire" is used to designate three concepts, two of which, fire (3.13) and fire (3.14), relate to specific types of self-supporting combustion with different meanings and two of them are designated using two different terms in both French and German.

[SOURCE: ISO 13943:2008, definition 4.96]

3.13
fire
<controlled> self-supporting combustion that has been deliberately arranged to provide useful effects and is limited in its extent in time and space

[SOURCE: ISO 13943:2008, definition 4.97]

3.14
fire
<uncontrolled> self-supporting combustion that has not been deliberately arranged to provide useful effects and is not limited in its extent in time and space

[SOURCE: ISO 13943:2008, definition 4.98]

3.15
fire effluent
totality of gases and aerosols, including suspended particles, created by combustion or pyrolysis in a fire

[SOURCE: ISO 13943:2008, definition 4.105]

3.16
fire growth
stage of fire (3.12) development during which the heat release rate and the temperature of the fire are increasing

[SOURCE: ISO 13943:2008, definition 4.111]

3.17
fire hazard
physical object or condition with a potential for an undesirable consequence from fire

[SOURCE: ISO 13943:2008, definition 4.112]

3.18
fire risk
probability of a fire (3.14) 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 13943:2008, definition 4.124]

3.19
fire safety engineering
application of engineering methods based on scientific principles to the development or assessment of designs in the built environment through the analysis of specific fire scenarios or through the quantification of risk for a group of fire scenarios

[SOURCE: ISO 13943:2008, definition 4.126]

3.20
fire scenario
qualitative description of the course of a fire (3.14) with respect to time, identifying key events that characterise the studied fire and differentiate it from other possible fires

Note 1 to entry: It typically defines the ignition and fire growth processes, the fully developed fire stage, the fire decay stage, and the environment and systems that will impact on the course of the fire.

[SOURCE: ISO 13943:2008, definition 4.129]

3.21
fire test
test that measures behaviour of a fire (3.12) or exposes an item to the effects of a fire (3.13)

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 13943:2008, definition 4.132]

3.22
flame front
boundary of flaming combustion at the surface of a material or propagating through a gaseous mixture

[SOURCE: ISO 13943:2008, definition 4.136]

3.23
flame spread
propagation of a flame front

[SOURCE: ISO 13943:2008, definition 4.142]

3.24
flashover
⟨stage of fire⟩ transition to a state of total surface involvement in a fire (3.14) of combustible materials within an enclosure

[SOURCE: ISO 13943:2008, definition 4.156]

3.25
fractional effective dose
FED
ratio of the exposure dose for an asphyxiant to that exposure dose of the asphyxiant expected to produce a specified effect on an exposed subject of average susceptibility

Note 1 to entry: As a concept, fractional effective dose may refer to any effect, including incapacitation, lethality or other endpoints.

Note 2 to entry: When not used with reference to a specific asphyxiant, the term *FED* represents the summation of *FED* values for all asphyxiants in a combustion atmosphere.

Note 3 to entry: The *FED* is dimensionless.

[SOURCE: ISO 13943:2008, definition 4.160]

3.26
heat release
thermal energy produced by combustion

Note 1 to entry: The typical units are joules (J).

[SOURCE: ISO 13943:2008, definition 4.176]

3.27
heat release rate
burning rate (deprecated)
rate of burning (deprecated)
rate of thermal energy production generated by combustion

Note 1 to entry: The typical units are watts (W).

[SOURCE: ISO 13943:2008, definition 4.177]

3.28
ignition
sustained ignition (deprecated)
<general> initiation of combustion

[SOURCE: ISO 13943:2008, definition 4.187]

3.29
ignition
sustained ignition (deprecated)
<flaming combustion> initiation of sustained flame

[SOURCE: ISO 13943:2008, definition 4.188]

3.30
incapacitation
state of physical inability to accomplish a specific task

Note 1 to entry: An example of a specific task is to accomplish escape from a fire.

[SOURCE: ISO 13943:2008, definition 4.194]

3.31
irritant, noun
⟨sensory/upper respiratory⟩ gas or aerosol that stimulates nerve receptors in the eyes, nose, mouth, throat and respiratory tract, causing varying degrees of discomfort and pain with the initiation of numerous physiological defence responses

Note 1 to entry: Physiological defence responses include reflex eye closure, tear production, coughing, and bronchoconstriction.

[SOURCE: ISO 13943:2008, definition 4.203]

3.32
mass loss rate
test specimen mass loss per unit time under specified conditions

Note 1 to entry: The typical units are grams per second ($g \cdot s^{-1}$).

[SOURCE: ISO 13943:2008, definition 4.224]

3.33
obscuration by smoke
reduction in the intensity of light due to its passage through smoke

Note 1 to entry: In practice, obscuration by smoke is usually measured as the transmittance, which is normally expressed as a percentage.

Note 2 to entry: Obscuration by smoke causes a reduction in visibility.

[SOURCE: ISO 13943:2008, definition 4.242]

3.34
qualitative fire test
fire test which is either:

a) a pass/fail test; or

b) a test which categorizes the behaviour of the test specimen by determining its position in a rank order of performance

3.35
quantitative fire test
fire test which takes into account the circumstances of product use in which the test conditions are based on, or are relatable to, the circumstances of use of the test specimen, and which measures a parameter or parameters, expressed in well defined terms and using rational scientific units, which can be used in the quantitative assessment of fire risk

3.36
radiant heat flux
power per unit area emitted, transferred or received in the form of heat radiation

Note 1 to entry: The typical units are kilowatts per square metre ($kW \cdot m^{-2}$).

[SOURCE: ISO 13943:2008, definition 4.269]

3.37
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 13943:2008, definition 4.272]

3.38
smoke
visible part of fire effluent

[SOURCE: ISO 13943:2008, definition 4.293]

3.39
specific extinction area of smoke
extinction area of smoke produced by a test specimen in a given time period divided by the mass lost from the test specimen in the same time period

Note 1 to entry: The typical units are square metres per gram ($m^2 \cdot g^{-1}$).

[SOURCE: ISO 13943:2008, definition 4.301]