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Fire hazard testing – Part 6-1: Smoke obscuration – General guidance

INTERNATIONAL
ELECTROTECHNICAL
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIRE HAZARD TESTING –

Part 6-1: Smoke obscuration –
General guidance

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.
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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 60695-6-1:2005+AMD1:2010 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.

International Standard IEC 60695-6-1 has been prepared by IEC technical committee 89: Fire hazard testing.

This third edition cancels and replaces the second edition of IEC 60695-6-1 published in 2005 and Amendment 1:2010. It constitutes a technical revision.

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

- References to IEC TS 60695-6-30 (withdrawn in 2016) have been removed.
- References to IEC TS 60695-6-31 (withdrawn in 2016) have been removed.
- References to ISO 5659-2 have been inserted.
- The scope contains some additional text.
- Terms and definitions have been updated.
- Subclause 3.2 has been updated.
- Subclause 7.1 has been updated.

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

Draft	Report on voting
89/1472/CDV	89/1504/RVC

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.

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 60695-6-2.

In this standard, the following print types are used:

- *italic font: terms defined in Clause 3.*

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

IEC 60695-6 consists of the following parts:

Part 6-1: Smoke obscuration – General guidance

Part 6-2: Smoke obscuration – Summary and relevance of test methods

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.

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

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INTRODUCTION

~~The risk of fire needs to be considered in any electrical circuit, and the objective of component, circuit and equipment design, as well as the choice of material, is to reduce the likelihood of fire, even in the event of foreseeable abnormal use, malfunction or failure.~~

~~Electrotechnical products, primarily victims of a fire, may nevertheless contribute to the fire.~~

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 the risk of fire to a tolerable level even in the event of reasonably foreseeable (mis)use, malfunction or failure.

IEC 60695-1-10, IEC 60695-1-11, and IEC 60695-1-12 [1]¹ provide guidance on how this is to be accomplished.

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

The aim of the IEC 60695 series 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.

One of the contributing hazards is the release of *smoke*, which may cause loss of vision and/or disorientation which could impede escape from the building or fire fighting.

Smoke particles reduce the *visibility* due to light absorption and scattering. Consequently, people may experience difficulties in finding exit signs, doors and windows. *Visibility* is often determined as the distance at which an object is no longer visible. It depends on many factors, but close relationships have been established between *visibility* and the measurements of the *extinction coefficient of smoke* – see Annex A.

The production of *smoke* and its optical properties can be measured as well as other fire properties, such as heat release, flame spread, and the production of toxic gas and corrosive effluent. This document serves as a guidance document and focuses on obscuration of light by *smoke*.

¹ Numbers in square brackets refer to the bibliography.

FIRE HAZARD TESTING –

Part 6-1: Smoke obscuration – General guidance

1 Scope

This part of IEC 60695 gives guidance on:

- a) the optical measurement of *obscuration of smoke*;
- b) general aspects of optical *smoke* test methods;
- c) consideration of test methods;
- d) expression of *smoke* test data;
- e) the relevance of optical *smoke* data to hazard assessment.

This basic safety publication focusing on safety guidance 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 60695-1-10, *Fire hazard testing – Part 1-10: Guidance for assessing the fire hazard of electrotechnical products – General guidelines*

IEC 60695-1-11², *Fire hazard testing – Part 1-11: Guidance for assessing the fire hazard of electrotechnical products – Fire hazard assessment*

IEC 60695-4:~~2005~~, *Fire hazard testing – Part 4: Terminology concerning fire tests for electrotechnical products*

IEC 60695-6-2³, *Fire hazard testing – Part 6-2: Smoke obscuration – Summary and relevance of test methods*

~~IEC 60695-6-30:1996, Fire hazard testing – Part 6: Guidance and test methods on the assessment of obscuration hazard of vision caused by smoke opacity from electrotechnical products involved in fires – Section 30: Small-scale static method – Determination of smoke opacity – Description of the apparatus~~

~~IEC 60695-6-31:1999, Fire hazard testing – Part 6-31: Smoke obscuration – Small-scale static test – Materials~~

² ~~To be published.~~

³ ~~To be published.~~

IEC Guide 104:~~1997~~, *The preparation of safety publications and the use of basic safety publications and group safety publications*

ISO/IEC Guide 51:~~1999~~, *Safety aspects – Guidelines for *their* inclusion in standards*

~~ISO 5659-2:2006, *Plastics – Smoke generation – Part 2: Determination of optical density by a single-chamber test*~~

~~ISO 5660-2:2002, *Reaction to fire tests – Heat release, smoke production and mass loss rate – Part 2: Smoke production rate (dynamic measurement)*~~

ISO 13943:~~2008~~2017, *Fire safety – Vocabulary*

~~ISO 19706:2007, *Guidelines for assessing the fire threat to people*~~

~~NOTE ISO 9122-1:1989, *Toxicity testing of fire effluents – Part 1: General*, has been withdrawn and replaced by ISO 19706:2007.~~

~~ASTM E 1354:2008, *Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter*~~

~~EN 13823:2002, *Reaction to fire tests for building products – Building products, excluding floorings, exposed to thermal attack by a single burning item*~~

INTERNATIONAL STANDARD

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HORIZONTAL PUBLICATION
PUBLICATION HORIZONTALE

**Fire hazard testing –
Part 6-1: Smoke obscuration – General guidance**

**Essais relatifs aux risques du feu –
Partie 6-1: Obscurcissement dû à la fumée – Recommandations générales**

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FIRE HAZARD TESTING –**Part 6-1: Smoke obscuration –
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FIRE HAZARD TESTING –

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

IEC 60695-6-2, *Fire hazard testing – Part 6-2: Smoke obscuration – Summary and relevance of 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 13943:2017, *Fire safety – Vocabulary*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

ESSAIS RELATIFS AUX RISQUES DU FEU –

Partie 6-1: Obscurcissement dû à la fumée – Recommandations générales

AVANT-PROPOS

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La Norme internationale IEC 60695-6-1 a été établie par le comité d'études 89 de l'IEC: Essais relatifs aux risques du feu.

Cette troisième édition annule et remplace la deuxième édition de l'IEC 60695-6-1 parue en 2005 et l'Amendement 1:2010. Elle constitue une révision technique.

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

- Les références à l'IEC TS 60695-6-30 (annulée en 2016) ont été supprimées.
- Les références à l'IEC TS 60695-6-31 (annulée en 2016) ont été supprimées.
- Des références à l'ISO 5659-2 ont été ajoutées.
- Le domaine d'application contient du texte supplémentaire.

- Les termes et définitions ont été mis à jour.
- Le paragraphe 3.2 a été mis à jour.
- Le paragraphe 7.1 a été mis à jour.

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

Projet	Rapport de vote
89/1472/CDV	89/1504/RVC

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.

Elle a le statut de publication fondamentale de sécurité, conformément au Guide IEC 104 et au Guide ISO/IEC 51.

Cette Norme internationale doit être utilisée conjointement avec l'IEC 60695-6-2.

Dans cette norme, les caractères suivants sont utilisés:

- *italique: termes définis à l'Article 3.*

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.

L'IEC 60695-6 est constituée des parties suivantes:

Partie 6-1: Opacité des fumées – Recommandations générales

Partie 6-2: Opacité des fumées – Résumé et pertinence des méthodes d'essais

Ce 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.

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

INTRODUCTION

Lors de la conception d'un produit électrotechnique, il est nécessaire d'envisager le risque d'incendie et les dangers potentiels associés au feu. Dans cette perspective, l'objectif lors de la conception des composants, des circuits et des équipements ainsi que le choix des matériaux est de réduire le risque d'incendie à un niveau tolérable dans le cas d'une (mauvaise) utilisation, d'un mauvais fonctionnement ou d'une défaillance raisonnablement prévisible.

L'IEC 60695-1-10, l'IEC 60695-1-11 et l'IEC 60695-1-12 [1]¹ fournissent des recommandations pour atteindre cet objectif.

Les incendies impliquant des produits électrotechniques peuvent également être déclenchés par des sources externes non électriques. Les considérations de cette nature sont traitées dans une évaluation globale du danger d'incendie.

La série IEC 60695 a pour objectif de sauver des vies humaines et de protéger les biens matériels en réduisant le nombre d'incendies ou les conséquences de l'incendie. Pour ce faire, il est possible de:

- tenter de prévenir l'allumage provoqué par un composant sous tension électrique et, en cas d'allumage, de confiner tout incendie en résultant dans les limites de l'enveloppe du produit électrotechnique.
- tenter de réduire le plus possible la propagation des flammes au-delà de l'enveloppe du produit et de réduire le plus possible les effets dangereux des effluents du feu comprenant la chaleur, la *fumée*, ainsi que les produits de combustion toxiques ou corrosifs.

L'un des dangers impliqués est le dégagement de *fumée*, qui peut entraîner une perte de vision et/ou une désorientation pouvant entraver l'évacuation des immeubles ou la lutte contre l'incendie.

Les particules de *fumée* réduisent la *visibilité* du fait de l'absorption de la lumière et de sa diffusion. En conséquence, les personnes peuvent avoir des difficultés à trouver les signaux de sortie, les portes et les fenêtres. La *visibilité* est souvent définie comme étant la distance à partir de laquelle un objet n'est plus visible. Elle dépend de nombreux facteurs, mais des relations étroites ont été établies entre la *visibilité* et les mesurages du *coefficient d'extinction de la fumée* – voir l'Annexe A.

Le dégagement de *fumée* et ses propriétés optiques peuvent être mesurés avec d'autres propriétés du feu telles que le dégagement de chaleur, la propagation des flammes et la production de gaz toxiques et d'effluents corrosifs. Le présent document fournit des recommandations et traite de l'obscurcissement de la lumière par la *fumée*.

¹ Les nombres entre crochets se réfèrent à la bibliographie.

ESSAIS RELATIFS AUX RISQUES DU FEU –

Partie 6-1: Obscurcissement dû à la fumée – Recommandations générales

1 Domaine d'application

La présente partie de l'IEC 60695 fournit des recommandations relatives:

- a) au mesurage optique de l'*obscurcissement de la lumière par la fumée*;
- b) aux aspects généraux des méthodes d'essais optiques de la *fumée*;
- c) aux considérations concernant les méthodes d'essai;
- d) à l'expression des résultats d'essais de *fumée*;
- e) à la pertinence des résultats des mesurages optiques de la *fumée* pour l'évaluation du danger.

La présente publication fondamentale de sécurité portant sur des recommandations de sécurité est avant tout 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 104 de l'IEC et dans 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 60695-1-10, *Essais relatifs aux risques du feu – Partie 1-10: Lignes directrices pour l'évaluation des risques du feu des produits électrotechniques – Lignes directrices générales*

IEC 60695-1-11, *Essais relatifs aux risques du feu – Partie 1-11: Lignes directrices pour l'évaluation du danger du feu des produits électrotechniques – Évaluation du danger du feu*

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

IEC 60695-6-2, *Essais relatifs aux risques du feu – Partie 6-2: Opacité des fumées – Résumé et pertinence des méthodes d'essais*

Guide IEC 104, *The preparation of safety publications and the use of basic safety publications and group safety publications* (disponible en anglais seulement)

ISO/IEC Guide 51, *Aspects liés à la sécurité – Principes directeurs pour les inclure dans les normes*

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