

Fire hazard testing

Part 6-1: Smoke obscuration — General guidance

ICS 13.220.99; 29.020

National foreword

This British Standard is the UK implementation of EN 60695-6-1:2005+A1:2010. It is identical with IEC 60695-6-1:2005, incorporating amendment 1:2010. It supersedes BS EN 60695-6-1:2005 which will be withdrawn on 1 September 2013.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by **A1** **A1**.

The UK participation in its preparation was entrusted to Technical Committee GEL/89, Fire hazard testing.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Fire hazard testing
Part 6-1: Smoke obscuration –
General guidance
(IEC 60695-6-1:2005)

Essais relatifs aux risques du feu
Partie 6-1: Opacité des fumées –
Lignes directrices générales
(CEI 60695-6-1:2005)

Prüfungen zur Beurteilung
der Brandgefahr
Teil 6-1: Sichtminderung durch Rauch -
Allgemeiner Leitfaden
(IEC 60695-6-1:2005)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 89/692/FDIS, future edition 2 of IEC 60695-6-1, prepared by IEC TC 89, Fire hazard testing, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60695-6-1 on 2005-05-01.

This European Standard supersedes EN 60695-6-1:2001.

The main changes with respect to EN 60695-6-1:2001 are:

- modified title;
- updated normative references;
- expanded terms and definitions;
- numerous editorial changes of a technical nature throughout the publication;
- a flowchart has been added for the evaluation and consideration of smoke test methods.

This European Standard is to be used in conjunction with IEC/TS 60695-6-2.

The following dates were fixed:

- latest date by which the EN has to be implemented
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- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2008-05-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60695-6-1:2005 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A1

The text of document 89/905/CDV, future amendment 1 to IEC 60695-6-1:2005, prepared by IEC TC 89, Fire hazard testing, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60695-6-1:2005 on 2010-09-01.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

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Endorsement notice

The text of amendment 1:2010 to the International Standard IEC 60695-6-1:2005 was approved by CENELEC as an amendment to the European Standard without any modification.

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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. 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 part of IEC 60695-6 serves as a guidance document and focuses on obscuration of light by smoke.

FIRE HAZARD TESTING –

Part 6-1: Smoke obscuration – General guidance

1 Scope

This part of IEC 60695 gives guidance on:

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

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

- A1** The following referenced documents are indispensable for the application 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 60695-1-11¹, *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 60695-6-22, *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*

¹ To be published.

² To be published.

[A1] IEC 60695-6-31:1999, *Fire hazard testing – Part 6-31: Smoke obscuration – Small-scale static test – Materials*

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 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, *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* **[A1]**

3 Terms, definitions and symbols

3.1 Terms and definitions

[A1] For the purposes of this document, the terms and definitions given in ISO/IEC 13943, some of which are reproduced below for the uses' convenience, as well as the following apply.

3.1.1

combustion

exothermic reaction of a substance with an oxidizing agent

NOTE Combustion generally emits fire effluent accompanied by flames and/or glowing.

[ISO/IEC 13943, definition 4.46]

3.1.2

extinction area of smoke

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

NOTE It is a measure of the amount of smoke, and the typical units are square metres (m²).

[ISO /IEC 13943, definition 4.92]

3.1.3

extinction coefficient

natural logarithm of the ratio of incident light intensity to transmitted light intensity, per unit light path length

NOTE Typical units are reciprocal metres (m⁻¹). **[A1]**

 [ISO/IEC 13943, definition 4.93]

3.1.4

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 In the English language the term "fire" is used to designate three concepts, two of which, fire (3.1.5) and fire (3.1.6), 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.

[ISO/IEC 13943, definition 4.96]

3.1.5

fire

⟨controlled⟩ self-supporting combustion that has been deliberately arranged to provide useful effects and is limited in its extent in time and space

[ISO/IEC 13943, definition 4.97]

3.1.6

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

[ISO/IEC 13943, definition 4.98]

3.1.7

fire effluent

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

[ISO/IEC 13943, definition 4.105]

3.1.8

fire hazard

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

[ISO/IEC 13943, definition 4.112]

3.1.9

fire model

fire simulation

calculation method that describes a system or process related to fire development, including fire dynamics and the effects of fire

[ISO/IEC 13943, definition 4.116]

3.1.10

fire scenario

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

NOTE It typically defines the ignition and fire growth processes, the fully developed fire stage, the fire decay stage, and the environment and systems that impact on the course of the fire.

[ISO/IEC 13943, definition 4.129] 

A1 3.1.11

flashover

⟨stage of fire⟩ transition to a state of total surface involvement in a fire of combustible materials within an enclosure

[ISO/IEC 13943, definition 4.156]

3.1.12

heat flux

amount of thermal energy emitted, transmitted or received per unit area and per unit time

NOTE The typical units are watts per square metre ($\text{W}\cdot\text{m}^{-2}$).

[ISO/IEC 13943, definition 4.173]

3.1.13

ignition

sustained ignition (deprecated)

⟨general⟩ initiation of combustion

[ISO/IEC 13943, definition 4.187]

3.1.14

ignition

sustained ignition (deprecated)

⟨flaming combustion⟩ initiation of sustained flame

[ISO/IEC 13943, definition 4.188]

3.1.15

large-scale fire test

fire test, that cannot be carried out in a typical laboratory chamber, performed on a test specimen of large dimensions

NOTE A fire test performed on a test specimen of which the maximum dimension is greater than 3 m is usually called a large-scale fire test.

[ISO/IEC 13943, definition 4.205]

3.1.16

mass optical density of smoke

optical density of smoke multiplied by a factor, $V/(\Delta m L)$, where V is the volume of the test chamber, Δm is the mass lost from the test specimen, and L is the light path length

NOTE The typical units are square metres per gram ($\text{m}^2\cdot\text{g}^{-1}$).

[ISO/IEC 13943, definition 4.225]

3.1.17

obscuration by smoke

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

cf. **extinction area of smoke** (3.1.2) and **specific extinction area of smoke** (3.1.26).

NOTE 1 In practice, obscuration by smoke is usually measured as the transmittance, which is normally expressed as a percentage.

NOTE 2 Obscuration by smoke causes a reduction in visibility.

[ISO/IEC 13943, definition 4.242] **A1**