



NSAI
Standards

Irish Standard
I.S. EN 60695-6-1:2005

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

I.S. EN 60695-6-1:2005

Incorporating amendments/corrigenda issued since publication:
 EN 60695-6-1:2005/A1:2010

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard – national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation - recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

<i>This document replaces:</i> EN 60695-6-1:2001	<i>This document is based on:</i> EN 60695-6-1:2005 EN 60695-6-1:2001	<i>Published:</i> 16 June, 2005 18 October, 2001
This document was published under the authority of the NSAI and comes into effect on: 29 July, 2005		ICS number: 13.220.99 29.020
NSAI 1 Swift Square, Northwood, Santry Dublin 9	T +353 1 807 3800 F +353 1 807 3838 E standards@nsai.ie W NSAI.ie	Sales: T +353 1 857 6730 F +353 1 857 6729 W standards.ie
Údarás um Chaighdeáin Náisiúnta na hÉireann		

English version

**Fire hazard testing -
Part 6-1: Smoke obscuration -
General guidance
(IEC 60695-6-1:2005/A1:2010)**

Essais relatifs aux risques du feu -
Partie 6-1: Opacité des fumées -
Lignes directrices générales
(CEI 60695-6-1:2005/A1:2010)

Prüfungen zur Beurteilung
der Brandgefahr -
Teil 6-1: Sichtminderung durch Rauch -
Allgemeiner Leitfaden
(IEC 60695-6-1:2005/A1:2010)

This amendment A1 modifies the European Standard EN 60695-6-1:2005; it was approved by CENELEC on 2010-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

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:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2011-06-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2013-09-01

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.

Replace Annex ZA of EN 60695-6-1:2005 by the following:

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
-	-	Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item	EN 13823	2002
IEC 60695-1-10	-	Fire hazard testing - Part 1-10: Guidance for assessing the fire hazard of electrotechnical products - General guidelines	EN 60695-1-10	-
IEC 60695-1-11	-	Fire hazard testing - Part 1-11: Guidance for assessing the fire hazard of electrotechnical products - Fire hazard assessment	EN 60695-1-11	-
IEC 60695-4	2005	Fire hazard testing - Part 4: Terminology concerning fire tests for electrotechnical products	EN 60695-4	2006
IEC 60695-6-2	-	Fire hazard testing - Part 6-2: Smoke obscuration - Summary and relevance of test methods	EN 60695-6-2	-
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	-	-
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	-	-

I.S. EN 60695-6-1:2005

EN 60695-6-1:2005/A1:2010

- 4 -

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO 5659-2	2006	Plastics - Smoke generation - Part 2: Determination of optical density by a single-chamber test	EN ISO 5659-2	2006
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	EN ISO 13943	2010
ISO 19706	2007	Guidelines for assessing the fire threat to people	-	-
NOTE ISO 9122-1:1989, <i>Toxicity testing of fire effluents – Part 1: General</i> , 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	-	-

EUROPEAN STANDARD

EN 60695-6-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

June 2005

ICS 13.220.99; 29.020

Supersedes EN 60695-6-1:2001

English version

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)

This European Standard was approved by CENELEC on 2005-05-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

I.S. EN 60695-6-1:2005

EN 60695-6-1:2005

- 2 -

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
at national level by publication of an identical
national standard or by endorsement (dop) 2006-02-01
- 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.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE Where an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60695-1-1	- ¹⁾	Fire hazard testing Part 1-1: Guidance for assessing the fire hazard of electrotechnical products - General guidelines	EN 60695-1-1	2000 ²⁾
IEC 60695-4	1993	Part 4: Terminology concerning fire tests	EN 60695-4	1995
A1	1995		-	-
A2	2001		-	-
IEC 60695-6-2	2001	Part 6-2: Smoke obscuration - Summary and relevance of test methods	-	-
IEC 60695-6-30	- ¹⁾	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	- ¹⁾	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/TR 9122-1	1989	Toxicity testing of fire effluents Part 1: General	-	-
ISO 5659-2	1994	Plastics - Smoke generation Part 2: Determination of capital density by a single-chamber test	EN ISO 5659-2	1998
ISO 13943	2000	Fire safety - Vocabulary	EN ISO 13943	2000
ISO/IEC Guide 51	1999	Safety aspects - Guidelines for their inclusion in standards	-	-

1) Undated reference.

2) Valid edition at date of issue.

This page is intentionally left BLANK.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references.....	7
3 Terms, definitions and symbols.....	8
3.1 Terms and definitions.....	8
3.2 Symbols.....	16
4 General aspects of smoke test methods.....	17
4.1 Fire scenarios and fire models.....	17
4.2 Factors affecting smoke production.....	21
5 Principles of smoke measurement.....	22
5.1 Bouguer's law.....	22
5.2 Extinction area.....	23
5.3 Log ₁₀ units.....	24
5.4 Light sources.....	24
5.5 Specific extinction area.....	24
5.6 Mass optical density.....	25
5.7 Visibility.....	26
6 Static and dynamic methods.....	26
6.1 Static methods.....	26
6.2 Dynamic methods.....	26
7 Test methods.....	28
7.1 Consideration of test methods.....	32
7.2 Selection of test specimen.....	32
8 Presentation of data.....	32
9 Relevance of data to hazard assessment.....	33
Annex A (informative) Calculation of visibility.....	35
Annex B (informative) Relationships between D_S and some other smoke parameters as measured in IEC 60695-6-30 and IEC 60695-6-31.....	37
Annex C (informative) Relationships between percent transmission, as measured in a "three metre cube" enclosure, and extinction area.....	40
Bibliography.....	42
Figure 1 – Chart of Different phases in the development of a fire within a compartment.....	20
Figure 2 – Attenuation of light by smoke.....	23
Figure 3 – Extinction area.....	23
Figure 4 – Dynamic smoke measurement.....	27
Figure 5 – Evaluation and consideration of smoke test methods.....	34
Figure 6 – Example SPR_{AV} versus t curve.....	31
Figure 7 – SMOGRA curve derived from Figure 6.....	31

Figure A.1 – Visibility (ω) versus extinction coefficient (k).....	35
Figure B.1 – Smoke parameters related to D_S as measured in IEC 60695-6-30 and IEC 60695-6-31.....	39
Figure C.1 – Extinction area (amount of smoke) related to percent transmission as measured in the "three metre cube".....	41
Table 1 – General classification of fires (ISO/TR 9122-1) Characteristics of fire stages (ISO 19706).....	18
Table B.1 – Conversion from D_S to some other smoke parameters as measured in IEC 60695-6-30 and IEC 60695-6-31.....	38
Table C.1 – Conversions from percent transmission, as measured in the "three metre cube" to amount of smoke (extinction area).....	40

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.
- 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.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This consolidated version of IEC 60695-6-1 consists of the second edition (2005) [documents 89/692/FDIS and 89/696/RVD] and its amendment 1 (2010) [documents 89/905/CDV and 89/946A/RVC]. It bears the edition number 2.1.

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience. A vertical line in the margin shows where the base publication has been modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through.

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

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

- 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.

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

This standard is to be used in conjunction with IEC 60695-6-2.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The IEC 60695-6 series, under the general heading *Fire hazard testing*, consists of the following parts

- Part 6-1: Smoke obscuration – General guidance
- Part 6-2: Smoke obscuration – Summary and relevance of test methods
- Part 6-30: Smoke obscuration – Guidance and test methods on the assessment of obscuration hazard of vision caused by smoke opacity from electrotechnical products involved in fires – Small scale static method - Determination of smoke opacity - Description of the apparatus
- Part 6-31: Smoke obscuration – Small-scale static test – Materials

The committee has decided that the contents of the base publication and its amendments 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.

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 publication using a colour printer.

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

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

~~IEC 60695-4:2001, Fire hazard testing – Part 4: Terminology concerning fire tests~~

~~IEC 60695-6-2:2001, Fire hazard testing – Part 6-2: Smoke obscuration – Summary and relevance of test methods~~

~~IEC 60695-6-30, 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, 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/TR 9122-1:1989, Toxicity testing of fire effluents – Part 1: General~~

~~ISO 5659-2:1994, Plastics – Smoke generation – Part 2: Determination of optical density by a single-chamber test~~

~~ISO/IEC 13943:2000, Fire safety – Vocabulary~~

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

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- [Looking for additional Standards? Visit Intertek Inform Infostore](#)
 - [Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation](#)
-