

BS EN 60695-7-3:2011



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Fire hazard testing

Part 7-3: Toxicity of fire effluent —
Use and interpretation of test results

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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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English version

**Fire hazard testing -
Part 7-3: Toxicity of fire effluent -
Use and interpretation of test results
(IEC 60695-7-3:2011)**

Essais relatifs aux risques du feu -
Partie 7-3: Toxicité des effluents du feu -
Utilisation et interprétation des résultats
d'essai
(CEI 60695-7-3:2011)

Prüfungen zur Beurteilung der
Brandgefahr -
Teil 7-3: Toxizität von Rauch und/oder
Brandgasen -
Anwendung und Beurteilung von
Prüfergebnissen
(IEC 60695-7-3:2011)

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 89/1058/FDIS, future edition 1 of IEC 60695-7-3, prepared by IEC/TC 89 "Fire hazard testing" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60695-7-3:2011.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2012-07-04
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2014-10-04

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Endorsement notice

The text of the International Standard IEC 60695-7-3:2011 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60695-6-1:2005 NOTE Harmonized as EN 60695-6-1:2005 (not modified).

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>
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 60695-7-1	-	Fire hazard testing - Part 7-1: Toxicity of fire effluent - General guidance	EN 60695-7-1	-
IEC 60695-7-2	-	Fire hazard testing - Part 7-2: Toxicity of fire effluent - Summary and relevance of test methods	EN 60695-7-2	-
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 13344	2004	Estimation of the lethal toxic potency of fire effluents	-	-
ISO 13571	2007	Life-threatening components of fire - Guidelines for the estimation of time available for escape using fire data	-	-
ISO 13943	2008	Fire safety - Vocabulary	EN ISO 13943	2010
ISO 16312-1	-	Guidance for assessing the validity of physical- fire models for obtaining fire effluent toxicity data for fire hazard and risk assessment - Part 1: Criteria		-
ISO/TR 16312-2	-	Guidance for assessing the validity of physical- fire models for obtaining fire effluent toxicity data for fire hazard and risk assessment - Part 2: Evaluation of individual physical fire models		-
ISO 19701	-	Methods for sampling and analysis of fire effluents	-	-
ISO 19702	-	Toxicity testing of fire effluents - Guidance for analysis of gases and vapours in fire effluents using FTIR gas analysis		-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO 19706	-	Guidelines for assessing the fire threat to people	-	-

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INTRODUCTION

Electrotechnical products sometimes become involved in fires. However, except for certain specific cases (e.g. power generating stations, mass transit tunnels, computer suites), electrotechnical products are not normally present in sufficient quantities to form the major source of toxic hazard. For example, in domestic dwellings and places of public assembly, electrotechnical products are usually a very minor source of fire effluent compared with, for example, furnishings.

It should be noted that the IEC 60695-7 series of publications is subject to the ongoing evolution of fire safety philosophy within ISO/TC 92.

The guidance in this international standard is consistent with the principles of fire safety developed by ISO TC 92 SC 3 on toxic hazards in fire, as described in ISO 13344, ISO 13571, ISO 16312-1, ISO 16312-2, ISO 19701, ISO 19702 and ISO 19706. General guidance for the fire hazard assessment of electrotechnical products is given in IEC 60695-1-10 and IEC 60695-1-11.

In 1989, the following views were expressed in ISO/TR 9122-1.

"Small-scale toxic potency tests as we know them today are inappropriate for regulatory purposes. They cannot provide rank orderings of materials with respect to their propensity to produce toxic atmospheres in fires. All currently available tests are limited because of their inability to replicate the dynamics of fire growth which determine the time/concentration profiles of the effluent in full-scale fires, and the response of electrotechnical products, not just materials. This is a crucial limitation because the toxic effects of combustion effluent are now known to depend much more on the rates and conditions of combustion than on the chemical constitution of the burning materials."

Because of these limitations IEC TC 89 has developed IEC 60695-7-50 and ISO subsequently developed ISO/TS 19700 [1]¹. Both these standards use the same apparatus. It is a practical small-scale apparatus which is used to measure toxic potency and which, by virtue of its ability to model defined stages of a fire, yields toxic potency data suitable for use, with appropriate additional data, in a full hazard assessment. Both methods use variations in air flow and temperature to give different physical fire models, but the ISO test method additionally uses the equivalence ratio as a key parameter.

The evidence from fires and fire casualties, when taken with data from experimental fire and combustion toxicity studies, suggests that chemical species with unusually high toxicity are not important (see Clause 7). Carbon monoxide is by far the most significant agent contributing to toxic hazard. Other agents of major significance are hydrogen cyanide, carbon dioxide and irritants. There are also other important, non-toxic, threats to life such as the effects of heat, radiant energy, depletion of oxygen and smoke obscuration, all of which are discussed in ISO 13571. General guidance on smoke obscuration is provided in IEC 60695-6-1.

IEC TC89 recognizes that effective mitigation of toxic hazard from electrotechnical products is best accomplished by tests and regulations leading to improved resistance to ignition and to reduced rates of fire growth, thus limiting the level of exposure to fire effluent and facilitating escape.

¹ Figures in square brackets refer to the bibliography.

FIRE HAZARD TESTING –

Part 7-3: Toxicity of fire effluent – Use and interpretation of test results

1 Scope

This part of IEC 60695 concerns laboratory tests used to measure the toxic components of the fire effluent from either electrotechnical products or materials used in electrotechnical products. It provides guidance on the use and interpretation of results from such tests. It discusses currently available approaches to toxic hazard assessment consistent with the approach of ISO TC 92 SC 3, as set out in ISO 13344, ISO 13571, ISO 16312-1, ISO 16312-2, ISO 19701, ISO 19702 and ISO 19706. It also provides guidance on the use of toxic potency data in fire hazard assessment and on principles which underlie the use of combustibility and toxicological information in fire hazard assessment.

The methods described are applicable to data concerning both the incapacitating effects and the lethal effects of fire effluents.

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 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 fire hazard of electrotechnical products – General guidelines*

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

IEC 60695-7-1, *Fire hazard testing – Part 7-1: Toxicity of fire effluent – General guidance*

IEC 60695-7-2, *Fire hazard testing – Part 7-2: Toxicity of fire effluent – 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/IEC 13943:2008, *Fire safety – Vocabulary*

ISO 13344:2004, *Estimation of the lethal toxic potency of fire effluents*

ISO 13571:2007, *Life-threatening components of fire – Guidelines for the estimation of time available for escape using fire data*

ISO 16312-1, *Guidance for assessing the validity of physical fire models for obtaining fire effluent toxicity data for fire hazard and risk assessment – Part 1: Criteria*

ISO/TR 16312-2, *Guidance for assessing the validity of physical fire models for obtaining fire effluent toxicity data for fire hazard and risk assessment – Part 2: Evaluation of individual physical fire models*

ISO 19701, *Methods for sampling and analysis of fire effluents*

ISO 19702, *Toxicity testing of fire effluents – Guidance for analysis of gases and vapours in fire effluents using FTIR gas analysis*

ISO 19706², *Guidelines for assessing the fire threat to people*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 13943, some of which are reproduced below for the user's convenience, apply.

3.1

asphyxiant

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

NOTE Loss of consciousness and ultimately death can occur.

[ISO/IEC 13943:2008, definition 4.17]

3.2

burn, intransitive verb

undergo combustion

[ISO/IEC 13943:2008, definition 4.28]

3.3

burn, transitive verb

cause combustion

[ISO/IEC 13943:2008, definition 4.29]

3.4

combustible, adjective

capable of being ignited and burned

[ISO/IEC 13943:2008, definition 4.43]

3.5

combustible, noun

item capable of combustion

[ISO/IEC 13943:2008, definition 4.44]

² ISO 9122-1: *Toxicity testing of fire effluents – Part 1: General* has been withdrawn and replaced by ISO 19706.

3.6

combustion

exothermic reaction of a substance with an oxidizing agent

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

[ISO/IEC 13943:2008, definition 4.46]

3.7

concentration

mass per unit volume

NOTE 1 For a fire effluent, the typical units are grams per cubic metre ($\text{g} \times \text{m}^{-3}$).

NOTE 2 For a toxic gas, concentration is usually expressed as a volume fraction at $T = 298 \text{ K}$ and $P = 1 \text{ atm}$, with typical units of microlitres per litre ($\mu\text{L/L}$), which is equivalent to cm^3/m^3 or 10^{-6} .

NOTE 3 The concentration of a gas at a temperature, T , and a pressure, P can be calculated from its volume fraction (assuming ideal gas behaviour) by multiplying the volume fraction by the density of the gas at that temperature and pressure.

[ISO/IEC 13943:2008, definition 4.52]

3.8

effective concentration 50

EC_{50}

concentration of a toxic gas or fire effluent, statistically calculated from concentration-response data, that causes a specified effect in 50 % of a population of a given species within a specified exposure time and post-exposure time

NOTE 1 For fire effluent, typical units are grams per cubic metre ($\text{g} \times \text{m}^{-3}$).

NOTE 2 For a toxic gas, typical units are microlitres per litre ($\mu\text{L/L}$) (at $T = 298 \text{ K}$ and $P = 1 \text{ atm}$); see volume fraction.

NOTE 3 The observed effect is usually a behavioural response, incapacitation, or death. The EC_{50} for incapacitation is termed the IC_{50} . The EC_{50} for lethality is termed the LC_{50} .

[ISO/IEC 13943:2008, definition 4.72]

3.9

effective exposure dose 50

ECt_{50}

product of EC_{50} and the exposure time over which it was determined

NOTE 1 For fire effluent, typical units are grams times minutes per cubic metre ($\text{g} \times \text{min} \times \text{m}^{-3}$).

NOTE 2 For a toxic gas, typical units are microlitres times minutes per litre ($\mu\text{L} \times \text{min} \times \text{L}^{-1}$) (at $T = 298 \text{ K}$ and $P = 1 \text{ atm}$); see volume fraction.

NOTE 3 ECt_{50} is a measure of toxic potency

[ISO/IEC 13943:2008, definition 4.73]

3.10

equivalence ratio

fuel/air ratio divided by the fuel/air ratio required for a stoichiometric mixture

NOTE 1 Standard, dry air contains 20,95 % oxygen by volume. In practice, the oxygen concentration in entrained air may vary and calculation of the equivalence ratio to a standard, dry air basis is required.

NOTE 2 The equivalence ratio is dimensionless.

[ISO/IEC 13943:2008, definition 4.81]