IEC 60695-7-2

Edition 1.0 2011-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fire hazard testing –
Part 7-2: Toxicity of fire effluent – Summary and relevance of test methods

Essais relatifs aux risques du feu –
Partie 7-2: Toxicité des effluents du feu – Résumé et pertinence des méthodes d'essai

IEC 60695-7-2:2011

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIRE HAZARD TESTING –

Part 7-2: Toxicity of fire effluent – Summary and relevance of test methods

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 60695-7-2 has been prepared by IEC technical committee 89: Fire hazard testing.

This first edition of IEC 60695-7-2 cancels and replaces the first edition of Technical Report IEC/TR 60695-7-2 published in 2002. It constitutes a technical revision and now has the status of an International Standard.

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

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

– editorial changes throughout;
– expanded normative references;
– revised terms and definitions;

– modifications to “Repeatability and reproducibility” data throughout;
– modifications to “Relevance of test data” throughout;
– modifications to Clause 5;
– new Table 1 and Figure 1;
– introduction of ISO test method in new Subclause 6.6;
– introduction of test method from EN 50305 in new Subclause 6.8;
– revised Annex A and new Table A.1;
– expanded Bibliography.

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

FDIS	Report on voting
89/1059/FDIS	89/1073/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.

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

IEC 60695-7 consists of the following parts:

Part 7-1: Toxicity of fire effluent – General guidance

Part 7-2: Toxicity of fire effluent – Summary and relevance of test methods

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

Part 7-50: Toxicity of fire effluent – Estimation of toxic potency – Apparatus and test method

Part 7-51: Toxicity of fire effluent – Estimation of toxic potency – Calculation and interpretation of test results

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.

INTRODUCTION

The IEC 60695-7 series provides guidance to IEC product committees on the adoption and implementation of the recommendations of ISO/TC 92, for the minimization of toxic hazard from fires involving electrotechnical products.

Electrotechnical products, primarily as the objects of a fire, may contribute to the fire hazard due to release of toxic effluent, which may be a significant contributing factor to the overall fire hazard.

IEC product committees incorporating requirements for the assessment of toxic hazard from fire in product standards should note that toxic potency and other measurements of toxicity which are described in this international standard should not be used directly in product specifications. Data from toxic potency test methods should only be used as part of a toxic hazard assessment, in conjunction with other product-based reaction to fire data such as mass loss rate.

FIRE HAZARD TESTING –

Part 7-2: Toxicity of fire effluent – Summary and relevance of test methods

1 Scope

This part of IEC 60695 gives a brief summary of the test methods that are in common use in the assessment of acute toxic potency, and other toxicity tests. It includes special observations on their relevance to real fire scenarios and gives recommendations on their use.

It advises which tests provide toxic potency data that are relevant to real fire scenarios, and which are suitable for use in fire hazard assessment and fire safety engineering.

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 60695-7-1:2010, *Fire hazard testing – Part 7-1: Toxicity of fire effluent – General guidance*

IEC/TS 60695-7-3, *Fire hazard testing – Part 7-3: Toxicity of fire effluent – Use and interpretation of test results*

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

ISO/IEC 13943, *Fire safety – Vocabulary*

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

ISO 13344, *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 16312-1:2010, *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 16312-2:2007, *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 19703:2010, *Generation and analysis of toxic gases in fire – Calculation of species yields, equivalence ratios and combustion efficiency in experimental fires*

ISO 19706, *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 13943:2008, some of which are reproduced below for the user's convenience, as well as the following, apply.

3.1
acute toxicity
toxicity that causes rapidly occurring toxic effects

cf. **toxic potency** (3.45).

[ISO/IEC 13943:2008, definition 4.5]

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]

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
combustion efficiency
ratio of the amount of heat release in incomplete combustion to the theoretical heat of complete combustion

NOTE 1 Combustion efficiency can be calculated only for cases where complete combustion can be defined.

NOTE 2 Combustion efficiency is dimensionless and is usually expressed as a percentage.

[ISO/IEC 13943:2008, definition 4.47]

3.8
complete combustion
combustion in which all the combustion products are fully oxidized

NOTE 1 This means that, when the oxidizing agent is oxygen, all carbon is converted to carbon dioxide and all hydrogen is converted to water.

NOTE 2 If elements other than carbon, hydrogen and oxygen are present in the combustible material, those elements are converted to the most stable products in their standard states at 298 K.

[ISO/IEC 13943:2008, definition 4.50]

3.9
concentration
mass per unit volume

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

NOTE 2 For a toxic gas, concentration is usually expressed as a volume fraction at T = 298 K and P = 1 atm, with typical units of microlitres per litre (μL/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]

3.10
enclosure
⟨built environment⟩ volume defined by bounding surfaces, which may have one or more openings

[ISO/IEC 13943:2008, definition 4.77]

3.11
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 can 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]

3.12
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 For fire effluent, typical units are grams times minutes per cubic metre ($g \times min \times m^{-3}$).

NOTE 2 For a toxic gas, typical units are microlitres times minutes per litre ($\mu L \times min \times L^{-1}$) (at T = 298 K and P = 1 atm); see 'volume fraction' 3.49.

[ISO/IEC 13943:2008, definition 4.89]

3.13
exposure time
length of time for which people, animals or test specimens are exposed under specified conditions

[ISO/IEC 13943:2008, definition 4.90]

3.14
F factor
minimum concentration of a toxic gas irritant that is expected to seriously compromise the ability to escape from a fire

NOTE The concentration is usually expressed as a volume fraction at T = 298 K and P = 1 atm, in which case the typical units are microlitres per litre (μL/L), which is equivalent to cm^3/m^3 or 10^{-6}.

[ISO/IEC 13943:2008, definition 4.94]

3.15
fire
(general) process of combustion characterized by the emission of heat and fire effluent and usually accompanied by smoke, flame, glowing or a combination thereof

[ISO/IEC 13943:2008, definition 4.96]

3.16
fire effluent
totality of gases and aerosols, including suspended particles, created by combustion or pyrolysis in a fire

[ISO/IEC 13943:2008, definition 4.105]

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

[ISO/IEC 13943:2008, definition 4.112]

3.18
fire hazard assessment
evaluation of the possible causes of fire, the possibility and nature of subsequent fire growth, and the possible consequences of fire

3.19
fire plume
plume
buoyant gas stream and any materials transported within it, above a fire

[ISO/IEC 13943:2008, definition 4.118]

3.20
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

[ISO/IEC 13943:2008, definition 4.126]

3.21
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 13943:2008, definition 4.129]

3.22
fire test
test that measures behaviour of a fire or exposes an item to the effects of a fire

NOTE 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.

[ISO/IEC 13943:2008, definition 4.132]

3.23
flame retardance
property of a material whereby flaming combustion is slowed, terminated or prevented

NOTE 1 Flame retardance can be an inherent property of the basic material or it may be imparted by specific treatment.

NOTE 2 The degree of flame retardance exhibited by a material during testing can vary with the test conditions.

[ISO/IEC 13943:2008, definition 4.138]

3.24
flame retardant, noun
substance added, or a treatment applied, to a material in order to suppress or delay the appearance of a flame and/or reduce the flame-spread rate

NOTE The use of (a) flame retardant(s) does not necessarily suppress fire or terminate combustion.

[ISO/IEC 13943:2008, definition 4.139]

3.25
flame retarded
treated with a flame retardant

[ISO/IEC 13943:2008, definition 4.141]

3.26
flashover
(stage of fire) transition to a state of total surface involvement in a fire of combustible materials within an enclosure

[ISO/IEC 13943:2008, definition 4.156]

3.27
fractional effective concentration
FEC
ratio of the concentration of an irritant to that concentration expected to produce a specified effect on an exposed subject of average susceptibility

NOTE 1 As a concept, fractional effective concetration may refer to any effect, including incapacitation, lethality or other endpoints.

NOTE 2 When not used with reference to a specific irritant, the term "FEC" represents the summation of FEC values for all irritants in a fire-generated atmosphere.

NOTE 3 The FEC is dimensionless.

[ISO/IEC 13943:2008, definition 4.159]

3.28
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 As a concept, fractional effective dose may refer to any effect, including incapacitation, lethality or other endpoints.

NOTE 2 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 The FED is dimensionless.

[ISO/IEC 13943:2008, definition 4.160]

3.29
fully developed fire
state of total involvement of combustible materials in a fire

[ISO/IEC 13943:2008, definition 4.164]

3.30
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 (W × m^{-2}).

[ISO/IEC 13943:2008, definition 4.173]

3.31
ignition source
source of energy that initiates combustion

[ISO/IEC 13943:2008, definition 4.189]

3.32
incapacitation
state of physical inability to accomplish a specific task

NOTE An example of a specific task is to accomplish escape from a fire.

[ISO/IEC 13943:2008, definition 4.194]

3.33
lethal concentration 50
LC_{50}
concentration of a toxic gas or fire effluent, statistically calculated from concentration-response data, that causes death of 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 (g × m^{-3}).

NOTE 2 For a toxic gas, the typical units are microlitres per litre (µL/L) at T = 298 K and P = 1 atm; see ‘volume fraction’ 3.49.

[ISO/IEC 13943:2008, definition 4.207]