

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**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2011 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

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**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX



ICS 13.220.40; 29.020

ISBN 978-2-88912-628-6

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references.....	8
3 Terms and definitions.....	9
4 Role of small-scale toxicity tests.....	16
4.1 General.....	16
4.2 Toxic potency.....	16
4.3 Fractional effective dose (<i>FED</i>) and toxic hazard.....	17
4.4 Fractional effective concentration (<i>FEC</i>).....	18
4.5 Generic toxic potencies.....	18
5 General aspects of small-scale toxicity tests.....	18
5.1 General.....	18
5.2 Physical fire models.....	18
5.3 Fire stages in a compartment fire.....	21
5.4 Methods of analysis.....	21
5.4.1 Chemical analysis based methods.....	22
5.4.2 Methods based on animal exposure.....	22
6 Summary of published chemical analysis based test methods.....	22
6.1 General.....	22
6.2 UK Ministry of Defence – Defence Standard (DS).....	23
6.2.1 Summary.....	23
6.2.2 Purpose and principle.....	23
6.2.3 Test specimen.....	23
6.2.4 Test method.....	23
6.2.5 Repeatability and reproducibility.....	24
6.2.6 Relevance of test data and special observations.....	24
6.2.7 Reference document.....	25
6.3 Airbus industry.....	25
6.3.1 Summary.....	25
6.3.2 Purpose and principle.....	25
6.3.3 Test specimen.....	25
6.3.4 Test method.....	25
6.3.5 Repeatability and reproducibility.....	26
6.3.6 Relevance of test data and special observations.....	26
6.3.7 Reference documents.....	26
6.4 Comitato Elettrotecnico Italiano (CEI).....	26
6.4.1 Summary.....	26
6.4.2 Purpose and principle.....	26
6.4.3 Test specimen.....	26
6.4.4 Test method.....	26
6.4.5 Repeatability and reproducibility.....	26
6.4.6 Relevance of test data and special observations.....	27
6.4.7 Reference documents.....	27
6.5 Norme Française (NF).....	27
6.5.1 Summary.....	27

6.5.2	Purpose and principle	27
6.5.3	Test specimen	27
6.5.4	Test method	27
6.5.5	Repeatability and reproducibility	28
6.5.6	Relevance of test data and special observations	28
6.5.7	Reference documents	28
6.6	International Electrotechnical Commission (IEC)	28
6.6.1	Summary	28
6.6.2	Purpose and principle	28
6.6.3	Test specimen	29
6.6.4	Test method	29
6.6.5	Sampling of effluent	29
6.6.6	Repeatability and reproducibility	30
6.6.7	Relevance of test data and special observations	30
6.6.8	Reference documents	30
6.7	International Standards Organization (ISO)	30
6.7.1	Summary	30
6.7.2	Purpose and principle	30
6.7.3	Test specimen	30
6.7.4	Test method	30
6.7.5	Repeatability and reproducibility	31
6.7.6	Relevance of test data and special observations	31
6.7.7	Reference documents	31
6.8	International Maritime Organization (IMO)	31
6.8.1	Summary	31
6.8.2	Purpose and principle	31
6.8.3	Test specimen	31
6.8.4	Test method	31
6.8.5	Repeatability and reproducibility	32
6.8.6	Relevance of test data and special observations	32
6.8.7	Reference documents	32
6.9	Toxicity test for rolling stock cables	32
6.9.1	Summary	32
6.9.2	Purpose and principle	33
6.9.3	Test specimen	33
6.9.4	Test method	33
6.9.5	Repeatability and reproducibility	34
6.9.6	Relevance of test data and special observations	34
6.9.7	Reference document	34
7	Summary of published test methods relating to animal exposure	34
7.1	Deutsches Institut für Normung (DIN)	34
7.1.1	Summary	34
7.1.2	Purpose and principle	35
7.1.3	Test specimen	35
7.1.4	Test method	35
7.1.5	Repeatability and reproducibility	35
7.1.6	Relevance of test data and special observations	35
7.1.7	Reference documents	36

7.2	National Bureau of Standards (NBS)	36
7.2.1	Summary	36
7.2.2	Purpose and principle	36
7.2.3	Test specimen	36
7.2.4	Test method	36
7.2.5	Repeatability and reproducibility	37
7.2.6	Relevance of test data and special observations	37
7.2.7	Reference documents	37
7.3	National Institute of Standards and Technology (NIST)	37
7.3.1	Summary	37
7.3.2	Purpose and principle	38
7.3.3	Test specimen	38
7.3.4	Test method	38
7.3.5	Repeatability and reproducibility	39
7.3.6	Relevance of test data and special observations	39
7.3.7	Reference documents	39
7.4	University of Pittsburgh (Upitt)	39
7.4.1	Summary	39
7.4.2	Purpose and principle	39
7.4.3	Test specimen	39
7.4.4	Test method	40
7.4.5	Repeatability and reproducibility	40
7.4.6	Relevance of test data and special observations	40
7.4.7	Reference documents	40
7.5	Japanese fire toxicity test for building components	41
7.5.1	Summary	41
7.5.2	Purpose and principle	41
7.5.3	Test specimen	41
7.5.4	Test method	41
7.5.5	Repeatability and reproducibility	41
7.5.6	Relevance of test data and special observations	41
7.5.7	Reference documents	42
	Annex A (informative) Overview of toxicity test methods	43
	Bibliography	45

Figure 1	Different phases in the development of a fire within a compartment	21
----------	--	----

Table 1	Characteristics of fire types (ISO 19706)	20
---------	---	----

Table 2	C_f values taken from DS 02-713 for various gases	24
---------	---	----

Table 3	Volume fraction limits for gas components	25
---------	---	----

Table 4	Decomposition conditions	29
---------	--------------------------	----

Table 5	Decomposition conditions	30
---------	--------------------------	----

Table 6	Volume fraction limits for gas component	32
---------	--	----

Table 7	CC_z values taken from EN 50305	34
---------	-----------------------------------	----

Table A.1	Overview of toxicity test methods	43
-----------	-----------------------------------	----

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.
- 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.

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.

Withdrawing