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**Fire hazard testing –
Part 5-1: Corrosion damage effects of fire effluent – General guidance**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIRE HAZARD TESTING –

**Part 5-1: Corrosion damage effects of fire effluent –
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.
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- 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 redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60695-5-1:2002. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60695-5-1 has been prepared by IEC technical committee 89: Fire hazard testing.

This third edition cancels and replaces the second edition, published in 2002, and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) References to IEC TS 60695-5-3 (withdrawn in 2014) have been removed.
- b) References to IEC 60695-1-1 are now to its replacements: IEC 60695-1-10 and IEC 60695-1-11.
- c) ISO/TR 9122-1 has been revised by ISO 19706.
- d) Table 1 has been updated.
- e) References to ISO 11907-2 and ISO 11907-3 have been removed.
- f) Terms and definitions have been updated.
- g) Text in 6.4 has been updated.
- h) Bibliographic references have been updated.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
89/1539/FDIS	89/1543/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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

In this standard, the following print types are used:

Arial **bold**: terms referred to in Clause 2

This standard is to be read in conjunction with IEC TS 60695-5-2.

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document 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 document using a colour printer.

INTRODUCTION

~~The risk of fire should be considered in any electrical circuit. With regard to this risk, the circuit and equipment design, the selection of components and the choice of materials should contribute towards reducing the likelihood of fire even in the event of foreseeable abnormal use, malfunction or failure. The practical aim should be to prevent ignition caused by electrical malfunction but, if ignition and fire occur, to control the fire preferably within the bounds of the enclosure of the electrotechnical product.~~

In the design of an electrotechnical product the risk of fire and the potential hazards associated with fire need to be considered. In this respect the objective of component, circuit and equipment design, as well as the choice of materials, is to reduce the risk of fire to a tolerable level even in the event of reasonably foreseeable (mis)use, malfunction or failure.

IEC 60695-1-10, IEC 60695-1-11, and IEC 60695-1-12 [1]¹ provide guidance on how this is to be accomplished.

Fires involving electrotechnical products can also be initiated from external non-electrical sources. Considerations of this nature are dealt with in an overall fire hazard assessment.

The aim of the IEC 60695 series is to save lives and property by reducing the number of fires or reducing the consequences of the fire. This can be accomplished by:

- trying to prevent ignition caused by an electrically energised component part and, in the event of ignition, to confine any resulting fire within the bounds of the enclosure of the electrotechnical product.
- trying to minimise flame spread beyond the product's enclosure and to minimise the harmful effects of **fire effluents** including heat, **smoke**, and toxic or corrosive combustion products.

All **fire effluent** is corrosive to some degree and the level of potential to corrode depends on the nature of the fire, the combination of combustible materials involved in the fire, the nature of the substrate under attack, and the temperature and relative humidity of the environment in which the **corrosion damage** is taking place. There is no evidence that **fire effluent** from electrotechnical products offers greater risk of **corrosion damage** than the **fire effluent** from other products such as furnishings, or building materials, ~~etc.~~

The performance of electrical and electronic components can be adversely affected by **corrosion damage** when subjected to **fire effluent**. A wide variety of combinations of small quantities of effluent gases, **smoke** particles, moisture and temperature may provide conditions for electrical component or system failures from breakage, overheating or shorting.

Evaluation of potential **corrosion damage** is particularly important for high value and safety-related electrotechnical products and installations.

Technical committees responsible for products will choose the test(s) and specify the level of severity.

The study of **corrosion damage** requires an interdisciplinary approach involving chemistry, electricity, physics, mechanical engineering, metallurgy and electrochemistry. In the preparation of this part of IEC 60695-5, all of the above have been considered.

IEC 60695-5-1 defines the scope of the guidance and indicates the field of application.

IEC TS 60695-5-2 provides a summary of test methods including relevance and usefulness.

¹ Numbers in square brackets refer to the bibliography.

~~IEC 60695-5-3 provides details of a small-scale test method for the measurement of leakage current and metal loss caused by fire effluent.~~

FIRE HAZARD TESTING –

Part 5-1: Corrosion damage effects of fire effluent – General guidance

1 Scope

This part of IEC 60695 provides guidance on the following:

- a) general aspects of **corrosion damage** test methods;
- b) methods of measurement of **corrosion damage**;
- c) consideration of test methods;
- d) relevance of **corrosion damage** data to hazard assessment.

This basic safety publication is primarily 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. It is not intended for use by manufacturers or certification bodies.

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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60695-1-1:1999, Fire hazard testing – Part 1-1: Guidance for assessing the fire hazard of electrotechnical products – General guidelines~~

~~IEC/TS 60695-5-2:2002, Fire hazard testing – Part 5-2: Corrosion damage effects of fire effluent – Summary and relevance of test methods~~

~~IEC/TS 60695-5-3, Fire hazard testing – Part 5-3: Corrosion damage effects of fire effluent – Leakage current and metal loss test method²~~

~~IEC 60754-1:1994, Test on gases evolved during combustion of materials from cables – Part 1: Determination of the amount of halogen acid gas~~

~~IEC 60754-2:1991, Test on gases evolved during combustion of electric cables – Part 2: Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity~~

~~IEC 60754-2, Amendment 1 (1997)~~

~~ISO/TR 9122-1:1989, Toxicity testing of fire effluents – Part 1: General~~

²~~To be published.~~

~~ISO 11907-2:1995, *Plastics – Smoke generation – Determination of the corrosivity of fire effluents – Part 2: Static method*~~

~~ISO 11907-3:1998, *Plastics – Smoke generation – Determination of the corrosivity of fire effluents – Part 3: Dynamic decomposition method using a travelling furnace*~~

~~ISO 11907-4:1998, *Plastics – Smoke generation – Determination of the corrosivity of fire effluents – Part 4: Dynamic decomposition method using a conical radiant heater*~~

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

~~ASTM D 2671 – 00, *Standard Test Methods for Heat-Shrinkable Tubing for Electrical Use*~~

IEC 60695-1-10, *Fire hazard testing – Part 1-10: Guidance for assessing the 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 TS 60695-5-2, *Fire hazard testing – Part 5-2: Corrosion damage effects 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 11907-1:2019, *Plastics – Smoke generation – Determination of the corrosivity of fire effluents – Part 1: General concepts and applicability*

ISO 13943:2017, *Fire safety – Vocabulary*

ISO 19706:2011, *Guidelines for assessing the fire threat to people*

INTERNATIONAL STANDARD

NORME INTERNATIONALE

HORIZONTAL PUBLICATION
PUBLICATION HORIZONTALE

**Fire hazard testing –
Part 5-1: Corrosion damage effects of fire effluent – General guidance**

**Essais relatifs aux risques du feu –
Partie 5-1: Effets des dommages de corrosion des effluents du feu –
Recommandations générales**

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FIRE HAZARD TESTING –**Part 5-1: Corrosion damage effects of fire effluent –
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IEC TS 60695-5-2 provides a summary of test methods including relevance and usefulness.

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Part 5-1: Corrosion damage effects of fire effluent – General guidance

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ISO 13943:2017, *Fire safety – Vocabulary*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

ESSAIS RELATIFS AUX RISQUES DU FEU –

Partie 5-1: Effets des dommages de corrosion des effluents du feu – Recommandations générales

AVANT-PROPOS

- 1) La Commission Électrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
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La Norme internationale IEC 60695-5-1 a été établie par le comité d'études 89 de l'IEC: Essais relatifs aux risques du feu.

Cette troisième édition annule et remplace la deuxième édition, parue en 2002 et constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) les références à l'IEC TS 60695-5-3 (supprimée en 2014) ont été supprimées;
- b) les références à l'IEC 60695-1-1 correspondent désormais aux normes suivantes: IEC 60695-1-10 et IEC 60695-1-11;
- c) l'ISO/TR 9122-1 a été révisée par l'ISO 19706;

- d) le Tableau 1 a été mis à jour;
- e) les références à l'ISO 11907-2 et à l'ISO 11907-3 ont été supprimées;
- f) les termes et définitions ont été mis à jour;
- g) le texte de 6.4 a été mis à jour;
- h) les références bibliographiques ont été mises à jour.

Le texte de cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
89/1539/FDIS	89/1543/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Le présent document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

Il a le statut d'une publication fondamentale de sécurité conformément au Guide IEC 104 et au Guide ISO/IEC 51.

Dans la présente norme, les caractères d'imprimerie suivants sont utilisés:

Arial **gras**: termes qui se réfèrent à l'Article 2

Cette norme doit être lue conjointement avec l'IEC TS 60695-5-2.

Une liste de toutes les parties de la série IEC 60695, publiées sous le titre général *Essais relatifs aux risques du feu*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu du présent document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

INTRODUCTION

Lors de la conception d'un quelconque produit électrotechnique, il est nécessaire de prendre en considération le risque d'incendie et les dangers potentiels liés au feu. À cet égard, la conception des composants, circuits et produits, ainsi que le choix des matériaux ont pour objectif de réduire à un niveau acceptable le risque d'incendie même en cas de mauvais usage raisonnablement prévisible, de dysfonctionnement ou de défaillance.

L'IEC 60695-1-10, l'IEC 60695-1-11 et l'IEC 60695-1-12 [1]¹ fournissent des recommandations relatives aux applications correspondantes.

Les feux impliquant des produits électrotechniques peuvent également être déclenchés par des sources externes non électriques. Ces éléments sont pris en considération lors de l'évaluation globale du danger d'incendie.

La série IEC 60695 a pour objet de sauver des vies et des biens en réduisant le nombre d'incendies ou en limitant leurs conséquences. Pour ce faire, il est possible:

- de tenter d'empêcher l'allumage provoqué par un composant mis sous tension et, en cas d'allumage, de circonscire l'incendie à l'intérieur des limites de l'enceinte du produit électrotechnique;
- de tenter de réduire le plus possible la propagation de flamme au-delà de l'enceinte du produit et les effets dommageables des **effluents du feu**, y compris la chaleur, la **fumée** et les produits de combustion toxiques ou corrosifs.

Tous les **effluents du feu** sont corrosifs à un certain degré et le niveau de leur potentiel de corrosion dépend de la nature du feu, de la combinaison des matériaux combustibles concernés par le feu, de la nature du substrat touché et de la température et de l'humidité relative de l'environnement dans lequel les **dommages de corrosion** se manifestent. Il n'est pas démontré que les **effluents du feu** des produits électrotechniques présentent un risque de **dommages de corrosion** plus important que ceux d'autres produits, tels que les matériaux d'ameublement ou de construction.

Les performances des composants électriques et électroniques peuvent être sérieusement affectées par les **dommages de corrosion** quand ils sont soumis aux **effluents du feu**. Une grande variété de combinaisons de faibles quantités d'effluents de gaz, de particules de **fumée**, d'humidité et de température sont autant d'éléments susceptibles de créer les conditions de la défaillance d'un composant électrique ou d'un système par rupture, surchauffe ou court-circuit.

Il est particulièrement important d'évaluer un **dommage** potentiel de **corrosion** pour les produits et les installations électrotechniques de prix élevé et liés à la sécurité.

Il incombe aux comités d'études responsables des produits de choisir l'essai ou les essais et de spécifier leur niveau de sévérité.

L'étude des **dommages de corrosion** exige une approche pluridisciplinaire qui englobe la chimie, l'électricité, la physique, l'ingénierie mécanique, la métallurgie et l'électrochimie. Toutes ces disciplines ont été prises en considération dans le cadre de l'élaboration de la présente partie de l'IEC 60695-5.

L'IEC 60695-5-1 définit le domaine d'application des recommandations et en indique les limites.

L'IEC 60695-5-2 présente un résumé des méthodes d'essai, y compris leur pertinence et leur utilité.

¹ Les chiffres entre crochets se réfèrent à la bibliographie.

ESSAIS RELATIFS AUX RISQUES DU FEU –

Partie 5-1: Effets des dommages de corrosion des effluents du feu – Recommandations générales

1 Domaine d'application

La présente partie de l'IEC 60695 fournit des recommandations concernant:

- a) les aspects généraux des méthodes d'essai des **dommages de corrosion**;
- b) les méthodes de mesure des **dommages de corrosion**;
- c) la prise en considération des méthodes d'essai;
- d) la pertinence des données concernant les **dommages de corrosion** pour l'estimation du danger.

La présente publication fondamentale de sécurité est essentiellement destinée à être utilisée par les comités d'études dans le cadre de l'élaboration de normes conformément aux principes établis dans le Guide IEC 104 et le Guide ISO/IEC 51. Elle n'est pas destinée à être utilisée par des fabricants ou des organismes de certification.

L'une des responsabilités d'un comité d'études consiste, le cas échéant, à utiliser les publications fondamentales de sécurité dans le cadre de l'élaboration de ses publications. Les exigences, les méthodes ou les conditions d'essai de la présente publication fondamentale de sécurité s'appliquent seulement si elles sont spécifiquement citées en référence ou incluses dans les publications correspondantes.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60695-1-10, *Essais relatifs aux risques du feu – Partie 1-10: Lignes directrices pour l'évaluation des risques du feu des produits électrotechniques – Lignes directrices générales*

IEC 60695-1-11, *Essais relatifs aux risques du feu – Partie 1-11: Lignes directrices pour l'évaluation du danger du feu des produits électrotechniques – Évaluation du danger du feu*

IEC TS 60695-5-2, *Fire hazard testing – Part 5-2: Corrosion damage effects of fire effluent – Summary and relevance of test methods* (disponible en anglais seulement)

IEC GUIDE 104, *The preparation of safety publications and the use of basic safety publications and group safety publications* (disponible en anglais seulement)

ISO/IEC Guide 51, *Aspects liés à la sécurité – Principes directeurs pour les inclure dans les normes*

ISO 11907-1:2019, *Plastiques – Production de fumées – Détermination de la corrosivité des effluents du feu – Partie 1: Concepts généraux et applicabilité*

ISO 13943:2017, *Sécurité au feu – Vocabulaire*

ISO 19706:2011, *Lignes directrices pour l'évaluation des dangers du feu pour les personnes*