IEC 60695-1-12

Edition 2.0 2026-09

# INTERNATIONAL STANDARD

BASIC SAFETY PUBLICATION

HORIZONTAL PUBLICATION

**Fire hazard testing -**
**Part 1-12: Guidance for assessing the fire hazard of electrotechnical products - Fire safety engineering**

ICS 13.220.40; 29.020

ISBN 978-2-8327-1519-2

IEC 60695-1-12:2026-09(en)

# CONTENTS

FOREWORD ..... 2
INTRODUCTION ..... 4
1 Scope ..... 6
2 Normative references ..... 6
3 Terms and definitions ..... 6
4 The fire safety engineering process ..... 7
4.1 General ..... 7
4.2 Fire safety engineering calculations ..... 8
4.3 Validity of methods ..... 9
5 Benefits of fire safety engineering ..... 9
6 Objectives of fire safety engineering ..... 10
6.1 General ..... 10
6.2 Safety of life ..... 10
6.3 Conservation of property ..... 10
6.4 Continuity of operation ..... 10
6.5 Protection of the natural environment ..... 11
6.6 Preservation of heritage ..... 11
7 Functional requirements ..... 11
8 Performance criteria ..... 11
8.1 General ..... 11
8.2 Explicit performance criteria ..... 11
8.3 Implicit performance criteria ..... 12
9 Design fire scenarios and design fires ..... 12
9.1 Design fire scenarios ..... 12
9.2 Design fires ..... 13
10 Data for fire safety engineering ..... 13
11 Tests on electrotechnical products ..... 14
11.1 General ..... 14
11.2 Condition for evaluation in fire tests ..... 14
11.3 Test selection and/or development ..... 14
12 Evaluation of electrotechnical products ..... 15
12.1 As the source of ignition of a fire ..... 15
12.2 As the victim of a fire ..... 16
Annex A (informative) An example of application of Fire Safety Engineering (FSE) Method for prediction of flammability of materials in microgravity environment ..... 17
A.1 Background ..... 17
A.2 Method of application of Fire Safety Engineering (FSE) to predict the flammability of materials in microgravity environment ..... 17
A.3 Details of the application of FSE ..... 17
Bibliography ..... 18

Figure 1 – FSE process – Design, implementation and management ..... 8

Table 1 – Examples of design fire scenario ..... 12
Table 2 – Common ignition phenomena encountered in electrotechnical products ..... 15

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

# Fire hazard testing - Part 1-12: Guidance for assessing the fire hazard of electrotechnical products - Fire safety engineering

## 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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60695-1-12 has been prepared by IEC technical committee 89: Fire hazard testing. It is an International Standard.

This document has been given the status of a horizontal document in accordance with the ISO/IEC Directives, Part 1. It has the status of a basic safety publication in accordance with IEC Guide 104 and ISO/IEC Guide 51.

This second edition cancels and replaces the first edition published in 2015. This edition constitutes a technical revision.

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

a) whole text is renewed to contain the most recent technologies of fire safety engineering mainly developed by ISO/TC92 Fire safety SC4 Fire safety engineering.

b) Annex A is changed to show example of application of FSE in an international standard.

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

| Draft | Report on voting |
|---|---|
| 89/1631/CDV | 89/1670/RVC |

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 has been drafted in accordance with the 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/reference. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

IEC 60695-1 consists of the following parts:

Part 1-10: Guidance for assessing the fire hazard of electrotechnical products - General guidelines

Part 1-11: Guidance for assessing the fire hazard of electrotechnical products - Fire hazard assessment

Part 1-12: Guidance for assessing the fire hazard of electrotechnical products - Fire safety engineering

Part 1-30: Guidance for assessing the fire hazard of electrotechnical products - Preselection testing process - General guidelines

Part 1-40: Guidance for assessing the fire hazard of electrotechnical products - Insulating liquids.

This document is to be used in conjunction with IEC 60695-1-10 and IEC 60695-1-11.

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, or
– revised.

# INTRODUCTION

## Fire safety engineering

Fire safety engineering (FSE) is the 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.

Typical objectives of FSE are:

a) to protect life safety,

b) to protect property,

c) to maintain the continuity of operations,

d) to protect the natural environment, and

e) to preserve heritage.

The analysis of FSE is usually based on calculations that use input data obtained principally from quantitative fire tests as described in IEC 60695-1-11.

Fire safety engineering (FSE) is a discipline increasingly being used in support of performance-based national fire safety regulations in many states and regional jurisdictions throughout the world. ISO 23932-1 [1] [1], developed by ISO TC 92/SC 4, outlines the fundamental methodologies and uses of FSE. Further detailed aspects of FSE are covered in ISO 16730-1 [2], ISO 16732-1 [3], ISO 16733-1 [4], ISO 24678-2 [5], ISO 24678-3 [6], ISO 24678-4 [7] and ISO/TR 16738 [8].

In addition to performance-based regulations, many nations are also using FSE to supplement prescriptive regulations by applying FSE principles to specific design aspects, where reduced costs, alternative practices, improved performance and improved safety are the objectives.

The International Maritime Organization (IMO) is using FSE and the ISO standards mentioned above to develop fire safety designs for ships as described in IMO MSC/Circ.1002[27]. These are considered to bring an improvement in the design of electrotechnical products.

There are handbooks, guides and literatures which give information with regards to FSE. See Bibliography [28], [29], [30], [31], [32], [33], [34], [35], [36], [37], [38].

## Qualitative and quantitative fire tests

Many standardized qualitative fire test methods give information on the performance of a material or end product as measured in the test. Such information usually is not related to a real fire scenario or real installation practices. These qualitative fire test methods result in a "pass" or "fail" and/or a product or material ranking. They play an important role in prescriptive regulations, and the results of a qualitative test can be used indirectly in fire hazard assessment of electrotechnical products, but they are not suitable for directly supporting performance-based design.

Most standardized test methods developed by IEC TC 89 for electrotechnical products are of the qualitative type. It is agreed within ISO TC 92 and IEC TC 89 that this type of fire test will continue to be maintained and, where necessary, developed. It is recognized that, even if the use of these standards is in prescriptive codes, product data from many of these standards can be potentially adaptable for fire safety engineering purposes.

---

[1] Numbers in square brackets refer to the Bibliography.

In contrast, quantitative fire tests are increasingly being developed and used, and these provide data that can be inputs to fire safety engineering calculations.

Various ISO standards [14] to [23] for quantitative fire tests have been developed by ISO TC 92/SC 1, *Fire safety - Initiation and growth of fire*, some of which can be used to assess the performance of electrotechnical products, and referred to in the series of IEC 60695, e.g. IEC TS 60695-5-2 [9], IEC 60695-6-2 [10], IEC 60695-7-2 [11], IEC 60695-8-2 [12] and IEC 60695-9-2 [13].

## 1 Scope

This part of IEC 60695 specifies methodologies of fire safety engineering for electrotechnical products by providing:

– an explanation of the principles and uses of fire safety engineering;
– guidance on the use of fire safety engineering in the design of electrotechnical products;
– fire safety engineering terminology, and concepts;
– an indication of properties, data and tests needed for input into fire safety engineering assessment; and
– informative references.

This document is intended to provide guidance for product committees on fire safety engineering methods and performance-based tests for use in performance-based designs and fire hazard assessments of electrotechnical materials, assemblies, products and systems. More detailed information on fire safety engineering is contained in ISO 23932-1 [1].

NOTE Further detailed aspects of FSE are covered in ISO 16730-1 [2], ISO 16732-1 [3], ISO 16733-1 [4], ISO 24678-2 [5], ISO 24678-3 [6], ISO 24678-4 [7] and ISO/TR 16738 [8].

This basic safety publication focusing on safety guidance is primarily intended for use by committees in the preparation of safety publications in accordance with the principles laid down in IEC Guide 104 [39] and ISO/IEC Guide 51 [40]

One of the responsibilities of a committee is, wherever applicable, to make use of basic safety publications in the preparation of its publications.

This document has the status of a horizontal publication in accordance with IEC Guide 108 [43].

## 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 60695-1-10:2016, *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 60695-4:2021, *Fire hazard testing - Part 4: Terminology concerning fire tests for electrotechnical products*

ISO 13943:2017, *Fire safety - Vocabulary*

# Bibliography

[1] ISO 23932-1:2018, *Fire safety engineering - General principles - Part 1: General*

[2] ISO 16730-1:2015, *Fire safety engineering - Procedures and requirements for verification and validation of calculation methods - Part 1: General*

[3] ISO 16732-1:2012, *Fire safety engineering - Fire risk assessment - Part 1: General*

[4] ISO 16733-1:2024, *Fire safety engineering - Selection of design fire scenarios and design fires - Part 1: Selection of design fire scenarios*

[5] ISO 24678-2:2022, *Fire safety engineering - Requirements governing algebraic formulae - Part 2: Fire plume*

[6] ISO 24678-3:2022, *Fire safety engineering - Requirements governing algebraic formulae - Part 3: Ceiling jet flows*

[7] ISO 24678-4:2023, *Fire safety engineering - Requirements governing algebraic formulae - Part 4: Smoke layers*

[8] ISO/TR 16738, *Fire-safety engineering - Technical information on methods for evaluating behaviour and movement of people*

[9] IEC TS 60695-5-2, *Fire hazard testing - Part 5-2: Corrosion damage effects of fire effluent - Summary and relevance of test methods*

[10] IEC 60695-6-2, *Fire hazard testing - Part 6-2: Smoke obscuration - Summary and relevance of test methods*

[11] IEC 60695-7-2, *Fire hazard testing - Part 7-2: Toxicity of fire effluent - Summary and relevance of test methods*

[12] IEC 60695-8-2, *Fire hazard testing - Part 8-2: Heat release - Summary and relevance of test methods*

[13] IEC 60695-9-2, *Fire hazard testing - Part 9-2: Surface spread of flame - Summary and relevance of test methods*

[14] ISO 5658-2, *Reaction to fire tests - Spread of flame - Part 2: Lateral spread on building and transport products in vertical configuration*

[15] ISO 5660-1:2015, *Reaction-to-fire tests - Heat release, smoke production and mass loss rate - Part 1: Heat release rate (cone calorimeter method) and smoke production rate (dynamic measurement)*

[16] ISO 9239-1:2025, *Reaction to fire tests for floorings - Part 1: Determination of the burning behaviour using a radiant heat source*

[17] ISO 9705-1, *Reaction to fire tests - Room corner test for wall and ceiling lining products - Part 1: Test method for a small room configuration*

[18] ISO 12136, *Reaction to fire tests - Measurement of material properties using a fire propagation apparatus*

[19] ISO 13784-1, *Reaction to fire test for sandwich panel building systems - Part 1: Small room test*

[20] ISO 13784-2:2020, *Reaction-to-fire tests for sandwich panel building systems - Part 2: Test method for large rooms*

[21] ISO 13785-1:2002, *Reaction-to-fire tests for façades - Part 1: Intermediate-scale test*

[22] ISO 13785-2:2002, *Reaction-to-fire tests for façades - Part 2: Large-scale test*

[23] ISO 14696:2009, *Reaction-to-fire tests - Determination of fire and thermal parameters of materials, products and assemblies using an intermediate-scale calorimeter (ICAL)*

[24] ISO/TR 17252, *Fire tests - Applicability of reaction to fire tests to fire modelling and fire safety*

[25] ISO/TS 22269, *Reaction to fire tests - Fire growth - Full scale test for stair and stair coverings*

[26] ISO 24473:2008, *Fire tests - Open calorimetry - Measurement of the rate of production of heat and combustion products for fires of up to 40 MW*

[27] IMO MSC/Circ.1002, *Guidelines on alternative design and arrangement for fire safety*

[28] *Simulation of critical evacuation conditions for a fire scenario involving cables and comparison of two different cables*, Patrick van Hees, Daniel Nilsson and Emil Berggren, Department of Fire Safety Engineering and System Safety Lund University, Sweden, Report 3147, Lund 2010

[29] *Assessment of the impact of computed and measured fire environments on building evacuation using bench and real scale test data*, Robinson JE, Hull TR, Stec AA, Galea ER, Mahalingam A, Jia F, Patel MK, Persson H & Journeaux T, Interflam Conf. Proc., London 1027 2007

[30] *The SFPE Engineering Guide to Performance-Based Fire Protection Analysis and Design of Buildings*, 2nd Edition, Society of Fire Protection Engineers and National Fire Protection Association, Boston, MA, 2007

[31] *SFPE Handbook of Fire Protection Engineering*, 4th Edition, PJ DiNenno, ed., The Society of Fire Protection Engineers and National Fire Protection Association, Boston, MA, 2008

[32] *Fire Protection Handbook*, 20th Edition, National Fire Protection Association, Quincy, MA 2008

[33] *Introduction to Performance-Based Fire Safety*, Custer, RLP and Meacham, BJ, Society of Fire Protection Engineers, USA, 1997

[34] NFPA 550, *Guide to the Fire Safety Concepts Tree*, National Fire Protection Association, 2007

[35] *An Introduction to Fire Dynamics*, 2nd Edition, Drysdale, D, 1998

[36] *The Ignition Handbook: Principles and Applications to Fire Safety Engineering, Fire Investigation, Risk Management and Forensic Science*, Babrauskas, V, Fire Science Publishers, Issaquah WA, 2003

[37] *Fire behaviour of plastic parts in electrical appliances - standards versus required fire safety objectives*, Babrauskas, V and Simonson, M, Fire & Materials, 31, 83-96, 2007

[38] *Assessing the fire performance of electric cables (FIPEC)*, SJ Grayson, P Van Hees, AM Green, H Breulet, U Vercellotti, First published: 12 April 2001

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

[40] ISO/IEC Guide 51, *Safety aspects - Guidelines for inclusion in standards*

[41] Shuhei Takahashi, *Evaluation of the flammability of solid materials for space habitats using ground test*; The 76th Suga Academic Seminar for Weathering Technologies 2024

[42] ISO 4589-4, *Plastics - Determination of burning behaviour by oxygen index - Part 4: High gas velocity tests*

[43] IEC Guide 108, *Guidelines for ensuring the coherence of IEC publications - Horizontal functions, horizontal publications and their application*

_____