

# TECHNICAL SPECIFICATION



Fire hazard testing – **STANDARD PREVIEW**  
Part 1-14: Guidance on the different levels of power and energy related to  
the probability of ignition and fire in low voltage electrotechnical products  
(standards.iteh.ai)

IEC TS 60695-1-14:2017

<https://standards.iteh.ai/catalog/standards/sist/04ec3c54-583d-4fa7-a8da-51f036db3ce3/iec-ts-60695-1-14-2017>



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2017 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.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://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.

#### IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

#### IEC publications search - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

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 It also gives information on projects, replaced and withdrawn publications.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

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

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [csc@iec.ch](mailto:csc@iec.ch).

IEC STANDARD PREVIEW  
(standards.ch.ai)  
IEC TS 60695-1-14:2017  
51f036db3ce3/iec-ts-60695-1-14-2017

# TECHNICAL SPECIFICATION



---

**Fire hazard testing –**  
**Part 1-14: Guidance on the different levels of power and energy related to**  
**the probability of ignition and fire in low voltage electrotechnical products**

<https://standards.iteh.ai/catalog/standards/sist/04ec3c54-583d-4fa7-a8da-51f036db3ce3/iec-ts-60695-1-14-2017>

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

ICS 13.220.40, 29.020

ISBN 978-2-8322-4921-5

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	3
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms and definitions .....	8
4 Electrical energy as a cause of ignition.....	9
5 Empirical safety values of electrical power and energy .....	10
5.1 Different levels of power and electrical energy sources .....	10
5.2 Electrical power and energy source that is unlikely to cause ignition (Class 1).....	10
5.3 Electrical power and energy source that may cause ignition (Class 2).....	11
5.4 Electrical power and energy source that is likely to cause ignition (Class 3).....	12
5.5 Graphical overview of the classification.....	13
Bibliography.....	15
Figure 1 – Illustration of power/time limits related to fire and ignition .....	13
Figure 2 – Illustration of energy limits related to fire and ignition.....	14

**iTeh STANDARD PREVIEW**  
(standards.iteh.ai)

IEC TS 60695-1-14:2017  
<https://standards.iteh.ai/catalog/standards/sist/04ec3c54-583d-4fa7-a8da-51f036db3ce3/iec-ts-60695-1-14-2017>

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## FIRE HAZARD TESTING –

**Part 1-14: Guidance on the different levels of power and energy related to the probability of ignition and fire in low voltage electrotechnical products**

## 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.  
<https://standards.iteh.ai/catalog/standards/sist/04ec3c54-583d-4fa7-a8da-3280a3c60c1c/iec-60695-1-14-2017>
- 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.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 60695-1-14, which is a technical specification, has been prepared by IEC technical committee 89: Fire hazard testing.

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

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
89/1334/DTS	89/1363/RVDTS

Full information on the voting for the approval of this technical specification 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.

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

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

Part 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 1-14: Guidance on the different levels of power and energy related to the probability of ignition and fire in low voltage electrotechnical products (this document)
- Part 1-20: Guidance for assessing the fire hazard of electrotechnical products – Ignitability – General guidance
- Part 1-21: Guidance for assessing the fire hazard of electrotechnical products – Ignitability – Summary and relevance of test methods
- 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

In this standard, the following print types or formats are used:

- requirements proper and normative annexes: in roman type;
- compliance statements and test specifications: *italic type*;
- notes/explanatory matter: in smaller roman type;
- normative conditions within tables: in smaller roman type;
- terms defined in Clause 3: **bold type**.

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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

**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.**

## **iTeh STANDARD PREVIEW** **(standards.iteh.ai)**

[IEC TS 60695-1-14:2017](https://standards.iteh.ai/catalog/standards/sist/04ec3c54-583d-4fa7-a8da-51f036db3ce3/iec-ts-60695-1-14-2017)

<https://standards.iteh.ai/catalog/standards/sist/04ec3c54-583d-4fa7-a8da-51f036db3ce3/iec-ts-60695-1-14-2017>

## INTRODUCTION

In the design of any 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 provide guidance on how this is to be accomplished.

Fires involving electrotechnical products can 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 of standards 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;
- 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.

This technical specification provides guidance to Product Committees on the power levels and amounts of energy that are likely to cause **ignition** and fire. It also provides guidance to Product Committees on the **fire hazard safeguards** that might be necessary to protect against the probability of **ignition**.

The probability of fire is highly dependent on the specific fire scenario within the electrotechnical product itself. Therefore, product committees are ultimately responsible for deciding what **fire hazard safeguards** are appropriate for their products.

This document was created due to a need (IEC technical committee 66) for guidance on electrical energy levels in relation to **ignition** and fire. The preparation of this TS is based on based on electrical energy 141 levels developed by TC 108, responsible for safety of audio, video and ICT equipment.



## FIRE HAZARD TESTING –

### Part 1-14: Guidance on the different levels of power and energy related to the probability of ignition and fire in low voltage electrotechnical products

#### 1 Scope

This part of IEC 60695, which is a technical specification, provides guidance about the levels of power and energy that could cause **ignition** and fire in a low voltage electrotechnical product. It can be used by Product Committees to determine what **fire hazard safeguards** might be used, based on the electrical energy that could be dissipated as heat.

This document deals with products used in normal atmospheres commonly available in the home and does not deal with special locations such as those in explosive atmospheres. It is intended as guidance to IEC committees, and is intended to be used with respect to their individual applications.

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.

<https://standards.iteh.ai/catalog/standards/sist/04ec3c54-583d-4fa7-a8da-51f036db3ce3/iec-ts-60695-1-14-2017>

#### 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, *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 60695-4:2012, *Fire hazard testing - Part 4: Terminology concerning fire tests for electrotechnical products*

IEC 62368-1:2014, *Audio/video, information and communication technology equipment - Part 1: Safety requirements*

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 13943:2008, *Fire safety – Vocabulary*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60695-4:2012 and ISO 13943:2008 (some of which are reproduced below) and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

#### 3.1

##### **fire hazard**

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

[SOURCE: ISO 13943:2008, 4.1.12]

#### 3.2

##### **fire hazard safeguard**

part or system or instruction specifically provided to reduce the likelihood of **ignition** or spread of fire

Note 1 to entry: A **fire hazard safeguard** is often also called a protection method.

Note 2 to entry: Examples include current limiters, distances to or from **ignition** sources, materials with flame retardant properties.

#### 3.3

##### **ignition**

DEPRECATED: sustained ignition  
(general) initiation of combustion

[SOURCE: ISO 13943:2008, 4.1.87]

#### 3.4

##### **low voltage equipment**

set of electrical devices or electrical equipment necessary to perform a specific task such as generation, transmission, distribution, utilisation of electric energy and with a supply or output voltage not exceeding 1 000 V for alternating current and 1 500 V for direct current

Note 1 to entry: Examples of low voltage equipment are electric power generator, electrical switchgear and controlgear assemblies, electrical wiring systems, air conditioning units.

[SOURCE: IEC Guide 116:2010, 3.1]

#### 3.5

##### **permanently connected equipment**

equipment that can only be electrically connected to or disconnected from the mains by the use of a tool

[SOURCE: IEC 62368-1:2014, 3.3.3.4]

#### 3.6

##### **pluggable equipment type A**

equipment that is intended for connection to the mains via a non-industrial plug and socket-outlet or via a non-industrial appliance coupler, or both

Note 1 to entry: Examples are plugs and socket-outlets covered by standards such as IEC TR 60083 and IEC 60320-1.

[SOURCE: IEC 62368-1:2014, 3.3.3.5]

### 3.7

#### **pluggable equipment type B**

equipment that is intended for connection to the mains via an industrial plug and socket-outlet or via an industrial appliance coupler, or both

Note 1 to entry: Examples are plugs and socket-outlets covered by standards such as IEC 60309-1.

[SOURCE: IEC 62368-1:2014, 3.3.3.6]

### 3.8

#### **potential ignition source**

location where electrical energy can cause **ignition**

[SOURCE: IEC 62368-1:2014, 3.3.9.1]

## 4 Electrical energy as a cause of ignition

If a fault occurs, the energy used in a low voltage electrotechnical product may be converted to heat. This could be due to arcing or due to resistive heating.

An arc is a high-temperature luminous electric discharge across a gap. Temperatures within an arc can be in the range of several thousand degrees depending on circumstances including current, voltage drop, and the materials involved. In spite of the very high temperatures in an arc path, arcs may not be effective **ignition** sources for many fuel materials. In most cases, the arcing is so brief and localized that solid fuels cannot be ignited or can be difficult to ignite. However, fuels with a high surface-area-to-mass ratio, may be ignited when in contact with the arc.

In the case of resistive heating, the thermal energy,  $E$ , produced by in a direct current circuit is given by:

<https://standards.iteh.ai/catalog/standards/sist/04ec3c54-583d-4fa7-a8da-51f036db3ce3/iec-ts-60695-1-14-2017>

$$E = P \times t = I \times V \times t \quad (1)$$

where

$P$  is the power (energy per unit time)

$t$  is the time

$I$  is the current passing through the resistance

$V$  is the voltage drop across the resistance

For example if  $V = 12$  volts and  $I = 2$  amp, and the current flows for 5 seconds, then  $P = 24$  watts and  $E = 120$  joules.

In an alternating current circuit:

$$E = P_{\text{avg}} \times t = I_{\text{rms}} \times V_{\text{rms}} \times \cos \theta \times t \quad (2)$$

where

$P_{\text{avg}}$  is the average power over one complete a.c. cycle

$I_{\text{rms}}$  is the root mean square current passing through the resistance

$V_{\text{rms}}$  is the root mean square voltage drop across the resistance

$\theta$  is the phase difference between current and voltage