

INTERNATIONAL STANDARD

NORME INTERNATIONALE

BASIC SAFETY PUBLICATION

PUBLICATION FONDAMENTALE DE SÉCURITÉ

Fire hazard testing – **STANDARD PREVIEW**
Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignition
(standards.iteh.ai)
temperature (GWIT) test method for materials

IEC 60695-2-13:2010
Essais relatifs aux risques du feu –
Partie 2-13: Essais au fil incandescent/chauffant – Méthode d'essai de
température d'allumabilité au fil incandescent (GWIT) pour matériaux





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2010 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 It also gives information on projects, withdrawn and replaced publications.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.

[IEC 60695-2-13.2010](mailto:IEC.60695-2-13.2010@iec.ch)

- 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



IEC 60695-2-13

Edition 2.0 2010-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

BASIC SAFETY PUBLICATION

PUBLICATION FONDAMENTALE DE SÉCURITÉ

Fire hazard testing – Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignition temperature (GWIT) test method for materials

Essais relatifs aux risques du feu – Partie 2-13: Essais au fil incandescent/chauffant – Méthode d'essai de température d'allumabilité au fil incandescent (GWIT) pour matériaux

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

M

ICS 13.220.40; 29.020

ISBN 978-2-88912-216-5

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	7
4 Test specimens	8
4.1 Test specimen preparation.....	8
4.2 Test specimen dimensions.....	8
4.3 Testing ranges in formulations	8
4.3.1 General	8
4.3.2 Density, melt flow, and filler/reinforcement	8
4.3.3 Colour	9
5 Apparatus.....	9
6 Temperature measuring system verification	9
7 Conditioning and test conditions.....	9
7.1 Conditioning of test specimens	9
7.2 Testing conditions.....	9
8 Test procedure	9
8.1 General	9
8.2 Initial test temperatures.....	9
8.3 Test temperatures	10
9 Observations and measurements	10
9.1 General	10
9.2 Initial observations.....	10
9.3 Test observations	11
10 Evaluation of test results.....	11
10.1 Test criteria	11
10.2 Glow-wire ignition temperature.....	11
11 Test report.....	12
Bibliography	13
Table 1 – Initial test temperatures	10

iTeh STANDARD PREVIEW

(standards.iteh.ai)

IEC 60695-2-13:2010

[https://standards.iteh.ai/catalog/standards/sist/8acde4d3-01b2-4355-b2e5-](https://standards.iteh.ai/catalog/standards/sist/8acde4d3-01b2-4355-b2e5-d7dccc5e3112/iec-60695-2-13-2010)

[d7dccc5e3112/iec-60695-2-13-2010](https://standards.iteh.ai/catalog/standards/sist/8acde4d3-01b2-4355-b2e5-d7dccc5e3112/iec-60695-2-13-2010)

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIRE HAZARD TESTING –

**Part 2-13: Glowing/hot-wire based test methods –
Glow-wire ignition temperature (GWIT) test method for materials**

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.
<http://www.internationalstandardsite.com/standards/iec/iec60695-2-13-2010>
- 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 60695-2-13 has been prepared by technical committee 89: Fire hazard testing.

This second edition of IEC 60695-2-13 cancels and replaces the first edition published in 2000. It also constitutes a technical revision.

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

This standard is to be used in conjunction with IEC 60695-2-10.

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

- modified title;
- addition of an Introduction;
- clarification of Scope;

- expansion of Clause 2: Normative references;
- expansion of Clause 3;
- revision of Clause 4 to alignment with the IEC 60695-11 series to introduce guidance on test programs for material variations;
- clarification of Clause 8: Conditioning (now Clause 7);
- deletion of Clause 9: Initial measurement;
- expansion of Clause 10: Test procedures (now Clause 8);
- expansion of Clause 11: Observation and measurement (now Clause 9);
- clarification of Clause 12: Evaluation of test results (now Clause 10);
- expansion of Clause 13: Test report (now Clause 11).

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

FDIS	Report on voting
89/1018/FDIS	89/1035/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 IEC 60695 series, under the general title *Fire hazard testing* can be found on the IEC web site. **(standards.iteh.ai)**

Part 2 consists of the following parts:

- Part 2-10: [IEC 60695-2-13:2010](http://standards.iteh.ai/catalog/standards/sist/891018/fdis/iec-60695-2-13-2010) Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure
- Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products
- Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability index (GWFI) test method for materials
- Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignition temperature (GWIT) test method for materials

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.

The contents of the corrigendum of February 2012 have been included in this copy.

INTRODUCTION

In electrotechnical equipment, overheated metal parts can act as ignition sources. In glow-wire tests an electrically heated wire is used to simulate such an ignition source.

IEC 60695-2-10 describes a glow-wire test apparatus and common test procedure, IEC 60695-2-11 describes a glow-wire flammability test for end products, and IEC 60695-2-12 describes a glow-wire flammability index test method for materials.

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 product design, as well as the choice of materials, is to reduce to acceptable levels the potential risks of fire during normal operating conditions, reasonable foreseeable abnormal use, malfunction and/or failure. IEC/TC 89 has developed IEC 60695-1-10, together with its companion, IEC 60695-1-11, to provide guidance on how this is to be accomplished.

The primary aims of IEC 60695-1-10 and IEC 60695-1-11 are to provide guidance on how:

- a) to prevent ignition caused by an electrically energized component part, and
- b) to confine any resulting fire within the bounds of the enclosure of the electrotechnical product in the event of ignition.

Secondary aims of IEC 60695-1-10 and IEC 60695-1-11 include the minimization of any flame spread beyond the product's enclosure and the minimization of the harmful effects of fire effluents such as heat, smoke, toxicity and/or corrosivity.

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

This part of IEC 60695 describes a glow-wire ignition temperature test method for materials. It should be used to measure, describe, and rank the properties of materials in response to heat caused by contact with an electrically heated wire under controlled laboratory conditions. This may be useful for the evaluation of materials for use in products that may be exposed to excess thermal stress such as a fault current flowing through a wire, overloading of components, and/or bad connections. It should not be used to solely describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment which takes into account all of the factors pertinent to a fire hazard assessment of a particular end use.

This International Standard may involve hazardous materials, operations, and equipment. It does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

FIRE HAZARD TESTING –

Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignition temperature (GWIT) test method for materials

1 Scope

This part of IEC 60695 specifies the details of the glow-wire test to be applied to test specimens of solid electrical insulating materials or other solid materials for ignitability testing to determine the glow-wire ignition temperature (GWIT).

The GWIT is the temperature which is 25 K (or 30 K) higher than the maximum test temperature, determined during this standardized procedure, at which the tested material

- a) does not ignite, or
- b) if sustained and continuous flaming combustion does not occur for a time longer than 5 s for any single flame event and the specimen is not totally consumed.

This test is a materials test carried out on a series of standard test specimens. The data obtained, along with data from the glow-wire flammability index (GWFI) test method for materials, IEC 60695-2-12, can then be used in a preselection process in accordance with IEC 60695-1-30 to judge the ability of materials to meet the requirements of IEC 60695-2-11.

NOTE As an outcome of conducting a fire hazard assessment, an appropriate series of preselection flammability and ignition tests may allow a reduction of end product testing.

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 60695-1-30:2008, *Fire hazard testing – Part 1.30: Guidance for assessing the fire hazard of electrotechnical products – Preselection testing process – General guidelines*

IEC 60695-2-10:2000, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-11:2000, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

IEC 60695-2-12, *Fire hazard testing – Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability index (GWFI) test method for materials*

IEC Guide 104:1997, *The preparation of safety publications and the use of basic safety publications and group safety publications*

ISO/IEC Guide 51:1999, *Safety aspects – Guidelines for inclusion in standards*

ISO/IEC 13943:2008, *Fire safety – Vocabulary*

ISO 291:2008, *Plastics – Standard atmospheres for conditioning and testing*

ISO 293:2004, *Plastics – Compression moulding of test specimens of thermoplastic materials*

ISO 294 (all parts), *Plastics – Injection moulding of test specimens of thermoplastic materials*

ISO 295:2004, *Plastics – Compression moulding of test specimens of thermosetting materials*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 13943, some of which are reproduced below for the user's convenience, as well as the following apply.

3.1

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]

3.2

flame, noun

rapid, self-sustaining, sub-sonic propagation of combustion in a gaseous medium, usually with emission of light

[ISO/IEC 13943: 2008, definition 4.133]

3.3

flammability

ability of a material or product to burn with a flame under specified conditions

[ISO/IEC 13943: 2008, definition 4.151]

3.4

glowing, noun

luminosity caused by heat

[ISO/IEC 13943:2008, definition 4.168]

3.5

glowing combustion

combustion of a material in the solid phase without flame but with emission of light from the combustion zone

[ISO/IEC 13943:2008, definition 4.169]

3.6

ignitability

ease of ignition

measure of the ease with which a test specimen can be ignited under specified conditions

[ISO/IEC 13943:2008, definition 4.182]

3.7

ignition

sustained ignition (deprecated)
<general> initiation of combustion

[ISO/IEC 13943:2008, definition 4.187]

3.8

ignition

sustained ignition (deprecated)
<flaming combustion> initiation of sustained flame

[ISO/IEC 13943:2008, definition 4.188]

3.9

preselection

process of assessing and choosing candidate materials, components or sub-assemblies for making an end-product

[IEC 60695-1-30:2008, definition 3.2]

4 Test specimens

4.1 Test specimen preparation

Test specimens shall be fabricated using the appropriate ISO method, e.g. casting and injection moulding in accordance with the ISO 294 series, compression moulding in accordance with ISO 293 or ISO 295, or transfer moulding to the necessary shape. Where this is not possible, the test specimen shall be cut and/or sliced from a representative sample of the material (for example, produced using the same fabrication process as would be used to mould a part of a product).

After any fabrication or cutting operation, care shall be taken to remove all dust and any particles from the surface; cut edges shall be fine sanded to a smooth finish.

4.2 Test specimen dimensions

The dimensions of the planar sections of the test specimens shall be at least 60 mm in length and 60 mm in width (measured inside the clamping areas) and shall be provided in all thicknesses under consideration. The preferred values include 0,1 mm ± 0,02 mm, 0,2 mm ± 0,02 mm, 0,4 mm ± 0,05 mm, 0,75 mm ± 0,1 mm, 1,5 mm ± 0,15 mm, 3,0 mm ± 0,2 mm, or 6,0 mm ± 0,4 mm.

NOTE A set of 15 test specimens per thickness will, in general, be adequate to concurrently establish the GWIT and the GWF1 (See IEC 60695-2-12).

4.3 Testing ranges in formulations

4.3.1 General

The results of tests carried out on test specimen sets of different colour, thickness, density, molecular mass, anisotropic type/direction, additives, fillers, and/or reinforcements can vary. When agreed between involved parties, the test programs outlined in 4.3.2 and 4.3.3 may be employed in order to evaluate these variations.

4.3.2 Density, melt flow, and filler/reinforcement

Test specimens covering all combinations of minimum and maximum levels of density, melt flows and filler/reinforcement content may be provided and considered representative of the range if the test results yield the same GWIT. If the test results do not yield the same GWIT for all test specimens representing the range, evaluation shall be limited to the materials with the

specific levels of density, melt flows and filler/reinforcement tested. In addition, test specimens with intermediate density, melt flows, and filler/reinforcement content shall be tested to determine the representative range for each GWIT determination. However, as an alternative, the least favourable performance of the specific levels of density, melt flows and filler/reinforcement tested may be considered representative of intermediate levels without additional testing.

4.3.3 Colour

When evaluating a range of colours, test specimens that

- a) contain no colouring,
- b) contain the highest level of organic pigments/colorants/dyes and/or carbon black,
- c) contain the highest level of inorganic pigments, and
- d) contain pigments/colorants/dyes which are known to adversely affect flammability characteristics

are considered representative of the colour range if the test results yield the same GWIT.

5 Apparatus

The description of the test apparatus is specified in Clause 5 of IEC 60695-2-10. The reference to a specified layer does not apply.

iTeh STANDARD PREVIEW

6 Temperature measuring system verification

(standards.iteh.ai)

The method of verification of the temperature measuring system is specified in 6.2 of IEC 60695-2-10.

[IEC 60695-2-13:2010](https://standards.iteh.ai/catalog/standards/sist/8acde4d3-01b2-4355-b2e5-d7dcec5e3f12/iec-60695-2-13-2010)

<https://standards.iteh.ai/catalog/standards/sist/8acde4d3-01b2-4355-b2e5-d7dcec5e3f12/iec-60695-2-13-2010>

7 Conditioning and test conditions

7.1 Conditioning of test specimens

The test specimens shall be conditioned for a minimum of 48 h at $23\text{ °C} \pm 2\text{ °C}$ and at a relative humidity between 40 % and 60 %. Once removed from the conditioning atmosphere, the test specimens shall be tested within 4 h (see ISO 291, Clause 6, Table 2, Class 2).

7.2 Testing conditions

The test specimens shall be tested in a laboratory atmosphere having a temperature of $25\text{ °C} \pm 10\text{ °C}$ and at a relative humidity between 45 % and 75 %.

8 Test procedure

8.1 General

The test specimens shall be identified and examined visually.

The general test procedure shall be as specified in Clause 8 of IEC 60695-2-10.

8.2 Initial test temperatures

The glow-wire is heated to one of the initial test temperatures specified in Table 1, which is considered to be just high enough to cause ignition. If unknown, the initial test temperature shall not exceed 650 °C .

Table 1 – Initial test temperatures

Initial test temperature °C	Tolerances K
500	±10
550	±10
600	±10
650	±10
700	±10
750	±10
800	±15
850	±15
900	±15
960	±15

8.3 Test temperatures

A set of three test specimens shall be prepared for testing at a chosen test temperature.

If one of the three test specimens fails to withstand the test criteria as defined in 10.1, the test shall be repeated with three new test specimens at a test temperature preferably 50 K (60 K for 960 °C) lower.

If the three test specimens withstands the test criteria as defined in 10.1, the test shall be repeated with three new test specimens at a test temperature preferably 50 K (60 K for 900 °C) higher.

Repeat the tests with three new test specimens each time and reduce the interval of test temperatures to 25 K (30 K for 960 °C) in the final approach to determine the maximum test temperature at which all three test specimen withstand the test criteria as defined in 10.1.

However, there is no need to go to the higher temperature if it has already been determined that at least one of the three test specimen will not withstand the test criteria as defined in 10.1.

NOTE 1 The minimum test temperature is 500 °C and the maximum test temperature is 960 °C.

NOTE 2 It is recommended to start with a temperature of 650 °C.

9 Observations and measurements

9.1 General

The following observations and measurements shall be recorded.

9.2 Initial observations

After identifying and visually inspecting the test specimens, the following items shall be recorded: