

# INTERNATIONAL STANDARD



BASIC SAFETY PUBLICATION

**Fire hazard testing –  
Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test  
method for end-products (GWEPT)**

IEC 60695-2-11:2014

<https://standards.iteh.ai/catalog/standards/iec/35736e31-509b-4d54-ad2d-31165d401831/iec-60695-2-11-2014>



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## CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references .....	6
3 Terms and definitions .....	6
4 <del>Description of test considerations and test specimen selection</del> Test specimens.....	9
4.1 General.....	9
4.2 Complete end product.....	9
4.3 Partial end product (alternative).....	9
4.4 Test considerations and limitations associated with the specimen configuration.....	9
5 <del>Description of the</del> Test apparatus .....	10
<del>6 Severities .....</del>	<del>11</del>
<del>76 Verification of the temperature measuring system .....</del>	<del>11</del>
<del>87 Conditioning .....</del>	<del>11</del>
7.1 Conditioning of test specimens.....	11
7.2 Conditioning of specified layers .....	11
7.3 Testing conditions.....	11
<del>9 Initial measurement .....</del>	<del>11</del>
<del>108 Test procedure .....</del>	<del>11</del>
8.1 General.....	12
8.2 Test temperatures.....	12
8.3 Number of test specimens.....	12
<del>149 Observations and measurements.....</del>	<del>12</del>
<del>1210 Evaluation of test results .....</del>	<del>13</del>
11 Test report.....	13
<del>1312 Information to be given in the relevant specification product standard.....</del>	<del>14</del>
Annex A (informative) <del>Guidance for glow wire test</del> Suggested GWEPT temperatures.....	16
Bibliography.....	17
Figure 1 – Small parts.....	10
Figure A.1 – Suggested GWEPT temperatures .....	16
Table 1 <del>Test severities</del> .....	11
Table 1 – Test temperatures .....	12
Table A.1 <del>Guidance for glow wire test</del> .....	15

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIRE HAZARD TESTING –**

**Part 2-11: Glowing/hot-wire based test methods –  
Glow-wire flammability test method for end-products (GWEPT)**

FOREWORD

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International Standard IEC 60695-2-11 has been prepared by IEC technical committee 89: Fire hazard testing.

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

FDIS	Report on voting
89/1197/FDIS	89/1206/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.

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.

This second edition of IEC 60695-2-11 cancels and replaces the first edition of IEC 60695-2-11 published in 2000. It constitutes a technical revision.

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

- The Introduction has been added to provide background and how it relates to the Scope.
- The Scope has been modified for greater clarity and reference to basic safety publications.
- Numerous terms and definitions relevant to this Standard have been added to Clause 3.
- The application of “small parts” and “insignificant mass” have been introduced and clarified.
- The different types of specimens, how to specify them, and limitations of the test method have been further clarified in Clause 4.
- Clarified in Clause 5 the distance to specified layer when unknown.
- The information from Clause 6 has been moved into the test procedure in Clause 8.
- The conditioning of the specified layer and the laboratory ambient test conditions were clarified in Clause 7.
- Measurement of the maximum flame height was removed from Clause 9.
- The reference to this test as “GWEPT” was introduced along with an applicable title change.
- Annex A has been revised to reflect current practice by prominent product committees.

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.

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## INTRODUCTION

The purpose of this Introduction is to provide background regarding the basic guidance that prompted the preparation of this International Standard and how it relates to the Scope.

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 within the design of component, circuit, and product design, as well as the choice of the 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 Technical Committee 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 these documents include the minimization of any flame spread beyond the product's enclosure and the minimization of 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 hazard assessment.

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

IEC 60695-2-10 describes a glow-wire test apparatus and common test procedure, IEC 60695-2-12 describes a glow-wire flammability index (GWFI) test method for materials, and IEC 60695-2-13 describes a glow-wire ignition temperature (GWIT) test method for materials.

This standard is used to assess the reaction of end products to heat caused by contact with an electrically heated wire under controlled laboratory conditions. This may be useful for the evaluation of end products that may be exposed to excess thermal stress such as a fault current flowing through a wire, overloading of components, and/or poor electrical connections. It should not be used to solely describe or appraise the fire hazard or fire risk of products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire hazard assessment which takes into account all of the factors which are pertinent to 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 international standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

## FIRE HAZARD TESTING –

### Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products (GWEPT)

#### 1 Scope

This part of IEC 60695 specifies ~~the details of the glow-wire test to be applied to end-products for fire hazard testing~~ a test method on an end product. It is intended to simulate the effects of thermal stresses produced by an electrically heated source to represent a fire hazard.

~~For the purpose of this standard, end-product means electrotechnical equipment, its subassemblies, and components.~~

This test method is used to check that, under defined test conditions, an end product exposed to an electrically heated source has either a limited ability to ignite or, if it ignites, a limited ability to propagate flame. However, the fire hazard analysis, the flammability aspects and the flame spreading to other products are not covered by the present standard.

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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

~~IEC 60695-2-2:1991, Fire hazard testing – Part 2: Test methods – Section 2: Needle-flame test~~

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

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

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

#### 3 Terms and definitions

For the purpose of this ~~part of IEC 60695 document, the definitions given in ISO/IEC 13943, as well as~~ the following terms and definitions apply.



**3.1**

**burn**, intransitive verb  
undergo combustion

[SOURCE: ISO/IEC 13943:2008, definition 4.28]

**3.2**

**combustible**, adjective  
capable of being ignited and burned

[SOURCE: ISO/IEC 13943:2008, definition 4.43]

**3.3**

**combustion**  
exothermic reaction of a substance with an oxidizing agent

Note 1 to entry: Combustion generally emits fire effluent accompanied by flames and/or glowing.

[SOURCE: ISO/IEC 13943:2008, definition 4.46]

**3.4**

**enclosure**  
(electrotechnical) external casing protecting the electrical and mechanical parts of apparatus

Note 1 to entry: The term excludes cables.

[SOURCE: ISO/IEC 13943:2008, definition 4.78]

**3.5**

**end product**  
product that is ready for use without modification

Note 1 to entry: An end product can be a component of another end product.

[SOURCE: IEC 60695-4:2012, definition 3.2.7]

**3.6**

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

[SOURCE: ISO/IEC 13943:2008, definition 4.112]

**3.7**

**fire hazard assessment**  
evaluation of the possible causes of fire, the possibility and nature of subsequent fire growth, and the possible consequences of fire

[SOURCE: IEC 60695-4:2012, definition 3.2.10]

**3.8**

**fire risk**  
probability of a fire combined with a quantified measure of its consequence

Note 1 to entry: It is often calculated as the product of probability and consequence.

[SOURCE: ISO/IEC 13943:2008, definition 4.124]

**3.9  
flame**

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

[SOURCE: ISO/IEC 13943:2008, definition 4.133]

**3.10  
flame spread**

propagation of a flame front

[SOURCE: ISO/IEC 13943:2008, definition 4.142]

**3.11  
flammability**

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

[SOURCE: ISO/IEC 13943:2008, definition 4.151]

**3.12  
glowing**, adjective

emitting light without flame from the combustion of a material in the solid phase

**3.13  
ignition**

sustained ignition (deprecated)  
(general) initiation of combustion

[SOURCE: ISO/IEC 13943:2008, definition 4.187]

**3.14  
insignificant mass**

insufficient combustible material to constitute a fire hazard

Note 1 to entry: A default value is 2 g, but product TCs may assign a different value appropriate to the product type and scale.

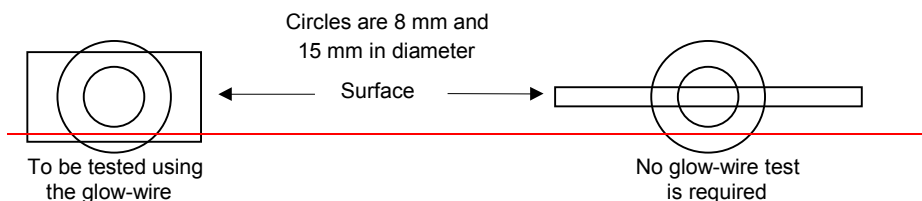
[SOURCE: IEC 60695-4:2012, definition 3.2.16]

~~**3.1**~~

~~**3.15  
small parts**~~

~~parts, where each surface lies completely within a circle of 15 mm diameter or where some of the surface lies outside the 15 mm diameter circle but in such a way that it is not possible to place a circle of 8 mm diameter on any of this remaining surface~~

~~NOTE—When checking a surface, projections on the surface and holes which are not greater than 2 mm on the largest dimensions are disregarded.~~



part with a dimension less than the minimum specified for the relevant test method

[SOURCE: IEC 60695-4:2012, definition 3.2.25]

## **4 Description of test considerations and test specimen selection**

### **Test specimens**

#### **4.1 General**

It is not necessary to test end products or parts of end products which have insignificant mass. Additionally, this test method is not suitable for testing small parts (see 4.4).

#### **4.2 Complete end product**

~~If possible, It is preferred that the test specimen should be a complete end product, as opposed to a partial end product (see 4.3). The test specimen shall be chosen so that the conditions of the test will not be significantly different from those occurring in normal use with regard to shape, ventilation, effect of thermal stresses, and, possibly eventually, of flames occurring in, or the effects of burning or glowing particles falling in the vicinity of, from the test specimen.~~

#### **4.3 Partial end product (alternative)**

If the test cannot be made on a complete end product, ~~or then,~~ unless otherwise specified by the relevant ~~specification~~ product standard, it is acceptable to

- a) cut a piece containing the part under examination from ~~it~~ a complete and assembled end product, or
- b) cut an aperture in the complete end product to allow the glow-wire access, or
- c) remove the part under examination in its entirety and test it separately.

Technical committees should define in their relevant ~~specifications~~ product standards what may be removed to achieve access. ~~So far as possible, these product standards should strive to replicate actual service locations and conditions.~~

#### **4.4 Test considerations and limitations associated with the specimen configuration**

~~When cutting an opening for access purposes, a small aperture may affect the results by leading to the ignition of the surroundings, by and/or reducing the temperature of the tip of the glow-wire or by restricting the availability of oxygen, whereas too large an aperture may permit more oxygen than would normally be available. The opening should be large enough to supply an adequate supply of air for combustion.~~

If, during the test, any part of the equipment containing the test specimen is ignited by extraneous heat from the glow-wire ~~and so~~ which in turn influences the thermal conditions at the test specimen, the test shall be invalid.

~~The test is carried out to ensure that, under defined conditions, the glow-wire does not cause ignition of parts, and that a part, if ignited, has a limited duration of burning without spreading fire by flames or by burning or glowing particles falling from the test specimen.~~

~~If the test specimen emits flames during the application of the glow-wire, the fire hazard created may necessitate further tests using other ignition sources such as the needle flame applied to those parts which are reached by the emitted flames.~~

The glow-wire flammability test method for end products shall not be used for testing small parts ~~for which reference may need to be made to other test methods, for example, the needle flame test in IEC 60695-2-2.~~ This is because such parts cannot be effectively

supported to avoid heat losses (see IEC 60695-2-10), and they are not able to accommodate the penetration of the glow-wire.

The following are considered to be small parts:

- a) where each surface lies completely within a circle of 15 mm in diameter; or
- b) where it is not possible to fit a circle of 8 mm in diameter completely on at least one of the surfaces while, at least one part dimension is > 15 mm.

See Figure 1.

When checking a surface,

- a) projections on the surface are disregarded and
- b) holes or recesses which are not greater than 2 mm in any dimension are disregarded.

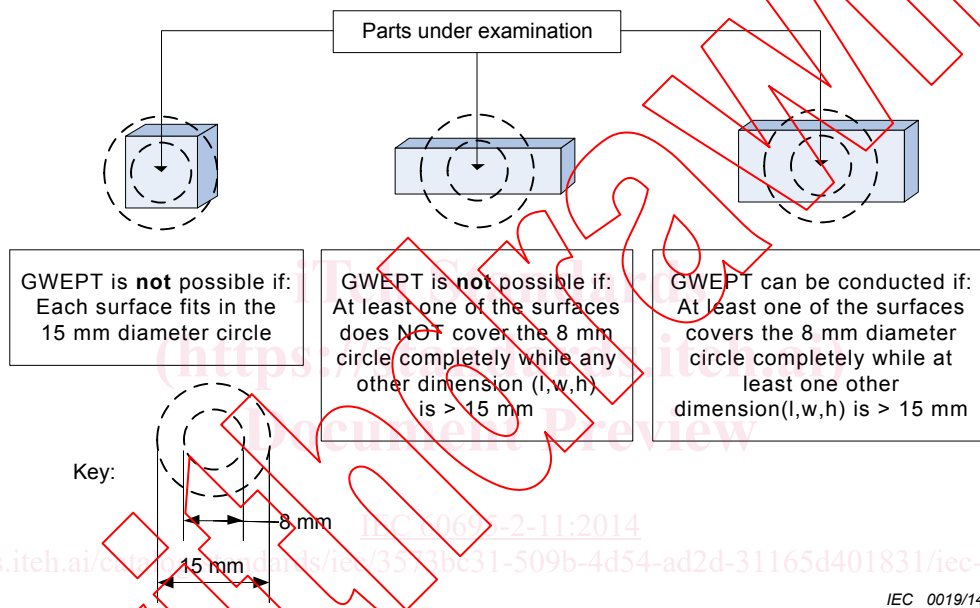


Figure 1 – Small parts

## 5 Description of the Test apparatus

The ~~description of the~~ test apparatus is ~~given specified~~ in ~~clause 5 of~~ IEC 60695-2-10.

To evaluate the possibility of the spread of fire, for example by burning or glowing particles falling from the test specimen, a specified layer as described in ~~5.3 of~~ IEC 60695-2-10, or the material or components normally surrounding or situated underneath the test specimen, are placed underneath the test specimen. The distance between the test specimen and the specified layer representing the surrounding material or components, shall be equal to ~~those when the test specimen is mounted in the electrotechnical product that which occurs in end use~~. If the test specimen is a component such that surrounding materials and distances are unknown, then the wrapping tissue / wooden board specified layer described in IEC 60695-2-10 shall be placed 200 mm ± 5 mm below the glow wire point of contact.

If the test specimen is a complete free-standing equipment, it is placed in its normal position of use on the specified layer as described in ~~clause 5.3 of~~ IEC 60695-2-10 extending for at least 100 mm outside the base of the equipment in all directions.

If the test specimen is a complete wall-mounted equipment, it is fixed in its normal position of use 200 mm ± 5 mm above the specified layer as described in ~~5.3 of~~ IEC 60695-2-10.

## **6—Severities**

The test temperature shall be chosen from the following values of table 1.

**Table 1—Test severities**

Preferred test temperatures	Tolerances
°C	K
550	±10
650	±10
750	±10
850	±15
960	±15

If required by the relevant specification, other test temperatures may be used.

NOTE—See annex A for guidance.

## **76 Verification of the temperature measuring system**

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

## **87 Conditioning**

### **7.1 Conditioning of test specimens**

If not otherwise specified in the relevant specification product standard, the test specimen and the specified layer to be used is specimens shall be conditioned for 24 h in an atmosphere having a temperature between 15 °C and 35 °C and a relative humidity between 45 % and 75 %.

### **7.2 Conditioning of specified layers**

If the wrapping tissue / wooden board specified layer is used, the conditioning shall be carried out according to IEC 60695-2-10. If the material or components normally surrounding or situated underneath the test specimen is used, the material or components shall be conditioned in the same way as the test specimen (see 7.1).

### **7.3 Testing conditions**

The test specimens shall be tested in a laboratory atmosphere having a temperature between 15 °C and 35 °C and a relative humidity less than or equal to 75 %. Testing shall be completed within 30 minutes after the specimen is removed from the conditions specified in 7.1.

## **9—Initial measurements**

The test specimen shall be examined visually and, when specified in the relevant specification, the mechanical/electrical parameters measured.

## **108 Test procedure**

See clause 8 of IEC 60695-2-10.

## 8.1 General

40.1—In addition to ~~clause 8 of the common test procedure specified in~~ IEC 60695-2-10, if not otherwise specified, the test specimen shall be so arranged that the tip of the glow-wire is applied to the part of the surface of the test specimen which is likely to be subjected to thermal stresses in normal use. The glow-wire shall be maintained as close to the horizontal as is practicable.

In cases where the test shall be made at more than one point on the same test specimen, care shall be taken that any deterioration caused by previous tests will not affect the result of the test to be made.

In cases where the areas subjected to thermal stresses during normal use of the equipment are not specified in detail, the tip of the glow-wire is applied at a place where the section is thinnest, but ~~preferably if possible~~ not less than 15 mm from the upper edge of the test specimen.

Clamping the test specimen onto the test apparatus shall not introduce excessive internal mechanical stresses in the test specimen during the test.

## 8.2 Test temperatures

The glow-wire is heated to the test temperature specified in the relevant product standard. This temperature should preferably be one of the temperatures shown in Table 1.

Table 1 – Test temperatures

Test temperatures °C	Tolerances °C
550	± 10
600	± 10
650	± 10
700	± 10
750	± 10
800	± 15
850	± 15
900	± 15
960	± 15

When selecting test temperatures, product committees should consider Figure A.1 which gives suggested glow-wire end product test (GWEPT) temperatures.

## 8.3 Number of test specimens

40.2—If not otherwise specified by the relevant ~~specification~~ product standard, the test is made on one test specimen.

## 419 Observations and measurements

During the time of application of the glow-wire,  $t_{aA}$  (30 s ± 1 s), and during a further period of 30 s, the test specimen, the parts surrounding the test specimen and the specified layer placed below it shall be observed and the following shall be reported: