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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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BASIC SAFETY PUBLICATION

PUBLICATION FONDAMENTALE DE SÉCURITÉ

Fire hazard testing – Part 10-2: Abnormal heat – Ball pressure test method

Essais relatifs aux risques du feu – Partie 10-2: Chaleurs anormales – Essai à la bille

IEC 60695-10-2:2014-02(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIRE HAZARD TESTING –

Part 10-2: Abnormal heat – Ball pressure test method

FOREWORD

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International Standard IEC 60695-10-2 has been prepared by IEC technical committee 89: Fire hazard testing.

This third edition cancels and replaces the second edition of IEC 60695-10-2 published in 2003. It constitutes a technical revision.

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

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

– The addition of an introduction introduces the user to the basic guidance documents published by TC 89
– Addition of a reference to IEC Guide 104 and ISO/IEC Guide 51 in the Scope
– Additional relevant Terms and Definitions in new Clause 3

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– 5.2: Additional requirements to the test specimen support at the suggestion of IECEE-CTL to improve reproducibility
– 5.3: Clarification of heating oven requirements at the suggestion of IECEE-CTL to improve reproducibility
– 5.4: Specification of minimum resolution consistent with method requirements for optical measurement instrument
– New Test Procedure in in Clauses 6 and 8 which introduces separate methods for End Product proof testing (Method A) and material performance testing (Method B)
– Updated Clause 11 Test Report to be consistent with other IEC 60695 documents.

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

FDIS	Report on voting
89/1203/FDIS	89/1210/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.

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

In the design of any electrotechnical product, the risk of abnormal heat and the potential hazards associated with abnormal heat 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 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 hazard assessment.

This part of IEC 60695 describes a test method where the softening and accelerated material flow under load of a polymeric material is evaluated using a weighted ball-bearing in a heating oven. It should be used to measure, describe, and rank a property of a material in response to elevated temperatures 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. It should also be used for the evaluation of materials used in end products. It should not be used to solely describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual abnormal conditions. However, results of this test method may be used as elements of a fire hazard assessment which takes into account all of the factors 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 standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

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FIRE HAZARD TESTING –

Part 10-2: Abnormal heat – Ball pressure test method

1 Scope

This part of IEC 60695 specifies the ball pressure test as a method for evaluating the softening temperature and accelerated material flow under load of polymeric materials and parts of end products in their ability to resist abnormal heat. It is applicable to the materials used in electrotechnical equipment, subassemblies and components, and to solid electrical insulating materials except ceramics.

NOTE The Ball Pressure test method is not appropriate for certain elastomers, foamed materials, and other materials that tend to be soft at room temperature. Product Committees are encouraged to evaluate these materials using other methods such as IEC 60695-10-3.

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 60216-4-1, *Electrical insulating materials – Thermal endurance properties – Part 4-1: Ageing ovens – Single-chamber ovens*

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

ISO 3290-1, *Rolling bearings – Balls – Part 1: Steel balls*

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 inclusion in standards*

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

ISO 294 (All Parts), *Plastics – Injection moulding of test specimens of thermoplastic materials*

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

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 13943:2008, one of which is reproduced below for the users' convenience, as well as the following apply.

3.1
abnormal heat
<electrotechnical> heat that is additional to that resulting from use under normal conditions, up to and including that which causes a fire

[SOURCE: ISO/IEC 13943:2008, definition 4.1]

3.2
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]

3.3
proof test
any predetermined and specified test required of an end product to verify its suitability for its intended purpose

4 General description of the test method

To measure and to verify the dimension d of the indentation left by a steel ball applied on a test specimen with a specified force and at a specified temperature.

5 Apparatus

5.1 Loading device

The loading device shall consist of a 5 mm ± 0,05 mm diameter pressure ball (a finished steel ball for rolling bearings in accordance with ISO 3290-1) attached to a system of weights designed to apply a downward force equivalent to a 20 N ± 0,2 N load including the mass of the pressure ball.

An example of a typical loading device is shown in Figure 1.

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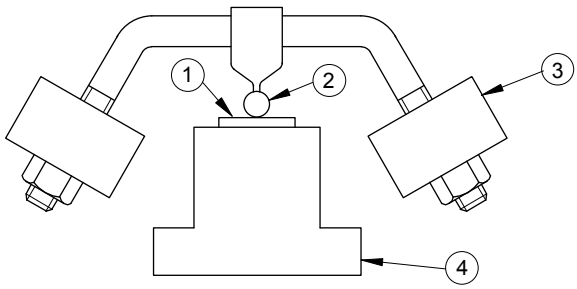


IEC 0314/14

Key

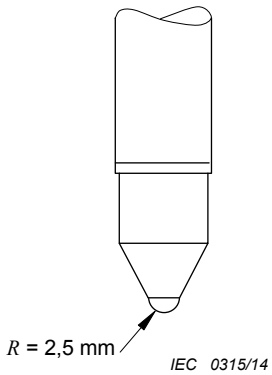
1 Test specimen

2 Pressure ball

3 Weight

4 Test specimen support

Figure 1a



IEC 0315/14

Figure 1b

Figure 1 – Loading device (example)

5.2 Test specimen support

The test specimen support shall be such that

a) it rigidly supports the test specimen in a horizontal position;

b) it has sufficient strength to support the loading device;

c) it has a smooth flat surface;

d) it has sufficiently large mass to prevent a significant reduction in temperature of the apparatus during the installation and removal of the test specimen from the heating oven.

NOTE It has been found useful to mount a separate thermocouple in the centre of the test specimen support approximately 3 mm below the surface to check that the temperature of the test specimen support does not significantly deviate from the test temperature.

5.3 Heating oven

The heating oven shall be a single chamber type in accordance with IEC 60216-4-1 with regard to temperature differences, fluctuation, and variations appropriate to the test temperature.

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In addition, the heating oven shall be capable of returning to the set temperature in accordance with the requirements in 8.3 after the heating oven door is closed after inserting the test specimen.

5.4 Optical measuring instrument

The optical measuring instrument shall have an optical magnification of at least 10 × and shall incorporate a calibrated reticule or cross-travel measuring table with a resolution of not more than 0,1 mm. A lighting device can be used to illuminate the surface where the pressure ball was applied.

5.5 Temperature measuring equipment

The temperature shall be measured using equipment with a accuracy of ± 2 K below 100 °C and ± 3 % at 100 °C and above. It is preferable to measure the temperature by a thermocouple type K or J inserted in the test specimen support.

6 Test specimens

6.1 End product test method

A test specimen is cut from the end product in such a way that a piece at least 2,5 mm thick with approximately parallel upper and lower surfaces is obtained. If necessary, the thickness may be attained by stacking two or more sections so long as there is no noticeable movement between the surfaces prior to testing. If it is not possible to cut a test specimen with parallel surfaces, care shall be taken to support the area of the test specimen directly under the pressure ball. The test specimen shall be a square with a minimum of 10 mm sides or a circle with a diameter of at least 10 mm.

If it is impracticable to use a test specimen from the end product, then a plaque of identical material may be used as the test specimen as described in 6.2.

NOTE Three test specimens may be necessary.

6.2 Material Test method

6.2.1 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.

6.2.2 Test specimen dimensions

The dimensions of the planar sections of the test specimens shall be at least 10 mm in length and 10 mm in width, or a circle with a diameter of at least 10 mm and shall be provided in a thickness of 3,0 mm ± 0,5 mm.

NOTE 15 test specimens may be necessary.

7 Conditioning

The test specimen shall be stored for at least 24 h in an atmosphere having a temperature between 15 °C and 35 °C and a relative humidity between 45 % and 75 %.

NOTE For materials, the mechanical characteristics of which are significantly affected by moisture content or temperature, a more precise conditioning may be specified.

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