IEC 60695-10-3

Edition 2.0 2016-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

BASIC SAFETY PUBLICATION

PUBLICATION FONDAMENTALE DE SÉCURITÉ

Fire hazard testing –
Part 10-3: Abnormal heat – Mould stress relief distortion test

Essais relatifs aux risques du feu –
Partie 10-3: Chaleur anormale – Essai de déformation par réduction des contraintes de moulage

IEC 60695-10-3:2016-09(en-fr)

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ICS 13.220.40; 29.020 ISBN 978-2-8322-3559-1

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIRE HAZARD TESTING –

Part 10-3: Abnormal heat – Mould stress relief distortion test

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.
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International Standard IEC 60695-10-3 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
89/1328/FDIS	89/1337/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 second edition of IEC 60695-10-3 cancels and replaces the first edition issued in 2002. It constitutes a technical revision.

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

a) Updated references;

b) Updated equipment;

c) Added terms and definitions; and

d) Added Bibliography.

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.

The IEC 60695-10 series, under the general title *Fire hazard testing*, consists of the following parts:

- *Part 10-2: Abnormal heat – Ball pressure test*
- *Part 10-3: Abnormal heat – Mould stress relief distortion test*

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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.

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. The IEC 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 [1][1] and IEC 60695-1-11 [2] 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 that simulates the effects caused by relief of the residual process-induced stress, frozen in a moulded polymeric assembly of an end product, when the end product or a part of it is exposed to conditioning at the maximum allowable operating temperature. The test method is intended to be used to evaluate whether the product after conditioning continues to meet the requirements of the relevant product specification. It is 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 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 part of IEC 60695 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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1 Numbers in square brackets refer to the bibliography.

FIRE HAZARD TESTING –

Part 10-3: Abnormal heat – Mould stress relief distortion test

1 Scope

This part of IEC 60695 specifies a mould stress relief distortion test. It is applicable to electrotechnical equipment including parts made from polymeric materials.

This test method is intended to evaluate the effects caused by relief of the residual process-induced stress, set in a moulded polymeric assembly of an end product. This stress relief occurs when the sample (energized or not), is exposed to conditioning at a defined temperature for a defined period of time. The test specimen is considered to have satisfactorily withstood the test if, after conditioning to room temperature, it meets defined test criteria.

This basic safety publication is primarily 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. It is not intended for use by manufacturers or certification bodies.

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 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 60050 (all parts), *International Electrotechnical Vocabulary* (available at: http://www.electropedia.org)

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

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

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 13943:2008, *Fire safety – Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13943:2008 and IEC 60695-4:2012, some of which are reproduced below for the user's convenience, 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
creepage distance
shortest distance along the surface of a solid insulating material between two conductive parts

[SOURCE: IEC 60050-151:2001, 151-15-50]

3.2
enclosure
<electrotechnical> external casing protecting the electrical and mechanical parts of apparatus

Note 1 to entry: The term excludes cables.

[SOURCE: ISO 13943:2008, 4.78]

3.3
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, 3.2.7]

4 General description of the test

A test specimen is exposed to a specified temperature for a specified duration. The test temperature and the test duration shall be specified in the relevant product specification. The test duration shall not be less than 7 h. The test specimen is then examined to determine compliance with the requirements in the relevant product specification.

5 Test apparatus

5.1 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.

In addition, the heating oven shall return to the specified temperature (± 2 °C) within 5 min and without any overshoot exceeding 5 °C after the heating oven door is closed after inserting the test specimen.

5.2 Temperature measuring equipment

The temperature shall be measured using equipment with an accuracy of 1 % or better. It is preferred to measure the temperature by a thermocouple type K or J inserted in the test specimen support.

6 Test specimens

The test specimen shall be as defined in the relevant product specification. It is preferred that the specimen should be a complete end product. Unless otherwise specified in the relevant product specification, three test specimens are tested.

7 Conditioning

Unless otherwise required by the relevant product specification, the test specimens shall be stored for at least 24 h immediately prior to testing in a laboratory atmosphere having a temperature between 15 °C and 35 °C and a relative humidity of 75 % or less.

8 Test procedure

8.1 General

The procedure described in 8.2 is appropriate for parts exposed to uniform maximum operating temperatures in the end use application. The procedure described in 8.3 may be more appropriate if an enclosure or part has variations in temperature at different locations on the part or is too large to be placed into the heating oven. For example, an enclosure for a hair dryer may have elevated temperatures near the heating element whilst the area around the power cord strain relief may only see room temperature. The procedure described in 8.3 accommodates the differences in temperature by operating the equipment within the heating oven.

8.2 Parts exposed to uniform maximum operating temperatures

Unless otherwise specified in the relevant product specification, conduct the test in a heating oven, with the product mounted in accordance with the manufacturer's instructions, and at a temperature defined in either a) or b) below:

a) the test temperature shall be the ambient temperature plus the maximum allowable temperature rise of the part under consideration as defined in the relevant product specification, or

b) the test temperature shall be the maximum operating temperature of the part under consideration as defined in the relevant product specification.

NOTE 1 In the case of hand-held equipment, it has been found useful that the product be supported by a mechanical clamp in at least one representative orientation.

Unless otherwise specified in the relevant product specification, the test temperature shall not be less than 70 °C.

In some cases the product committee may choose to increase the test temperature by a safety margin. This will be appropriate if no safety margins have been included for operating temperatures or temperature rise in the relevant product specification.

NOTE 2 A typical safety margin could be 10 K.

8.3 Parts exposed to variations in operating temperatures

Alternatively to 8.2, conduct the test in a heating oven equipped with means for energizing the end product. The circulation of air within the heating oven shall simulate actual end use conditions. Unless otherwise specified in the relevant product specification, the air temperature within the heating oven, as measured at the supporting surface of the end product, shall be maintained at a temperature 10 K higher than the maximum allowable ambient temperature for which the end product is designed to operate, but not less than 60 °C. Unless otherwise specified in the relevant product specification, the end product is operated continuously at 106 % or 94 % of normal rated voltage, whichever results in higher temperatures.

8.4 Test setup

For whichever test procedure is chosen (8.2 or 8.3), let the heating oven reach the desired test temperature, and place each test specimen in the heating oven. Hand-held equipment is to be supported by a mechanical clamp in at least one representative orientation. The test specimens are conditioned in the heating ovens for a duration specified in the relevant product specification, or the time sufficient to reach thermal equilibrium, but not less than 7 h. A longer conditioning duration may be selected for parts of a large mass or if initial tests indicate the potential for further relaxation.

After cooling to room temperature, examine the test specimen for shrinkage, warpage, or other distortions that may affect compliance with the requirements in the relevant product specification.

NOTE The test duration specified in 8.4 is generally sufficient to determine if the release of moulding stresses would be detrimental. For parts of a large mass, or in cases where initial tests indicate the potential for further relaxation, it has been found useful to select a longer test duration.

9 Test criteria

The test specimen is considered to have satisfactorily withstood the test if, after cooling to room temperature, it continues to meet the requirements of the relevant product specification and does not exhibit any significant shrinkage, warpage, or other distortion i.e.:

a) creepage distances do not fall below minimum acceptable values;

b) clearance distances do not fall below minimum acceptable values;

c) there are no changes that would make any hazardous part accessible; or

d) there are no changes that would produce any other condition that might increase the risk of fire from the equipment.

10 Information to be given in the relevant product specification

The relevant product specification shall specify, where necessary, the following details:

a) the test temperature;

b) whether or not a safety margin of 10 K shall be applied (see 8.2 and 8.3);

c) a description of the test specimen (see Clause 6);

d) the number of test specimens to be tested if other than 3 (see Clause 6);

e) any conditioning required other than specified in Clause 7;

f) which test procedure is to be used (see Clause 8);

g) whether the test specimen shall be energized during the test; if yes, what per cent of the normal rated voltage shall be applied (see 8.3);

h) the test duration (see 8.4);