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Environmental testing –

Part 3-11:
Supporting documentation and guidance –
Calculation of uncertainty of conditions
in climatic test chambers

Essais d'environnement –

Partie 3-11:
Documentation d'accompagnement et guide –
Calcul de l'incertitude des conditions
en chambres d'essais climatiques

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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 60068-3-11 has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test.

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

FDIS	Report on voting
104/409/FDIS	104/415/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 parts in the IEC 60068 series, under the general title *Environmental testing* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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- withdrawn,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.

INTRODUCTION

This part of IEC 60068 provides guidance for analysing uncertainties of temperature and humidity in climatic test chambers. It has been written for technicians, engineers and managers in environmental testing, and for anyone who needs to understand the results of environmental tests.

The performance of climatic test chambers is a key concern in environmental test engineering. To comply with any test specification, the performance of the chamber needs to be characterized to decide whether the generated conditions fall within the specified limits. This characterization can be a difficult task, and the analysis of uncertainties in chamber performance is often surrounded by confusion. This publication is intended to ease that process.

In what follows, the concept of uncertainty of measurement is introduced first and then the significance of tolerance discussed. Aspects of humidity and temperature measurement are considered, followed by methods for determining and combining uncertainties. The cases of both calibrating an empty chamber and of measuring conditions in a loaded chamber are considered. Finally, detailed guidance and worked examples are given for analysing results to give estimates of uncertainty in the measured performance.

ENVIRONMENTAL TESTING –

Part 3-11: Supporting documentation and guidance – Calculation of uncertainty of conditions in climatic test chambers

1 Scope

This part of IEC 60068 demonstrates how to estimate the uncertainty of steady-state temperature and humidity conditions in temperature and humidity chambers. Since this is inextricably linked to the methods of measurement, these are also described.

This standard is equally applicable to all environmental enclosures, including rooms or laboratories. The methods used apply both to temperature chambers and combined temperature and humidity chambers.

This standard is meant to help everyone using climatic test chambers. Those already familiar with uncertainty of measurement will find it useful for guidance on typical sources of uncertainty and how they should be quantified and combined. It is also intended to assist the first-time or occasional user who has little or no knowledge of the subject.

To discuss uncertainty, it is important first to understand what is being measured or characterized. The calibration or characterization of the performance of a chamber is concerned with the humidity and temperature of the air in the chamber, as experienced by the item under test, at a given set point. This should not be confused with characterizing or calibrating the chamber sensor, which is a separate matter.

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 60068-3-5: *Environmental testing – Part 3-5: Supporting documentation and guidance – Confirmation of the performance of temperature chambers*

IEC 60068-3-6: *Environmental testing – Part 3-6: Supporting documentation and guidance – Confirmation of the performance of temperature/humidity chambers*

ISO 3534-1:2006, *Statistics – Vocabulary and symbols – Part 1: General statistical terms and terms used in probability*

ISO 3534-2:2006, *Statistics – Vocabulary and symbols – Part 2:Applied statistics*

*International Vocabulary of basic and general standard terms in metrology. I*SO, Geneva, Switzerland 1993 (ISBN 92-67-10175-1) – VIM

Guide to the expression of uncertainty in measurement. ISO, Geneva, Switzerland 1993. (ISBN 92-67-10188-9) – GUM

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
calibration authority
laboratory or other organization that performs calibrations and is itself accredited by the appropriate national accreditation body

3.2
climatic test chamber
enclosure
chamber or enclosed space where the internal temperature or temperature and humidity can be controlled within specified limits

3.3
combined standard uncertainty
standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or covariances of these other quantities weighted according to how the measurement result varies with changes in these quantities

See also GUM.

3.4
correction
value added algebraically to the result of a measurement to compensate determinable systematic error

See also VIM.

3.5
confidence level
value of probability associated with a confidence interval

NOTE The confidence level is the likelihood that the “true value” lies within the stated range of uncertainty usually expressed as a percentage, e.g. 95 %.

See also ISO 3534-1.

3.6
coverage factor
numerical factor to multiply the combined standard uncertainty to obtain an expanded uncertainty

NOTE A coverage factor of k=2 corresponds to a confidence level of approximately 95 % if normally distributed and if the number of degrees of freedom is sufficiently large.

See also GUM.