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REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

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

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FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60068-3-5 has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test.

This second edition cancels and replaces the first edition published in 2001. This edition constitutes a technical revision.

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

a) Confirmation procedures are clarified.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
104/759/FDIS	104/778/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60068 series, published under the general title *Environmental testing*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

INTRODUCTION

IEC 60068 (all parts) contains fundamental information on environmental testing procedures and severities.

The expression "environmental conditioning" or "environmental testing" covers the natural and artificial environments to which components or equipment may be exposed so that an assessment can be made of their performance under conditions of use, transport and storage to which they may be exposed in practice.

Temperature chambers used for "environmental conditioning" or "environmental testing" are not described in any publication, although the method of maintaining and measuring temperature and/or humidity has a great influence on test results. The physical characteristics of temperature chambers can also influence test results.

ENVIRONMENTAL TESTING –

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

1 Scope

This part of IEC 60068 provides a uniform and reproducible method of confirming that temperature test chambers, without ~~load~~ specimens, conform to the requirements specified in climatic test procedures of IEC 60068-2 (all parts) and other standards. This document is intended for users when conducting regular chamber performance monitoring.

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 60068-1, *Environmental testing – Part 1: General and guidance*~~

IEC 60068-2 (all parts), *Environmental testing – Part 2: Tests*

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

IEC 60068-3-7, *Environmental testing – Part 3-7: Supporting documentation and guidance – Measurements in temperature chambers for tests A and B (with load)*

IEC 60068-3-11, *Environmental testing – Part 3-11: Supporting documentation and guidance – Calculation of uncertainty of conditions in climatic test chambers*

~~IEC 60584-1, *Thermocouples – Part 1: Reference tables*~~

~~IEC 60751, *Industrial platinum resistance thermometer sensors*~~

~~ISO 10012-1, *Quality assurance requirements for measuring equipment – Part 1: Metrological confirmation system for measuring equipment*~~

~~ISO 10012-2, *Quality assurance for measuring equipment – Part 2: Guidelines for control of measurement processes*~~

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
temperature test chamber
enclosure or space in some parts of which the temperature conditions, specified in IEC 60068-2 (all parts), can be achieved

3.2
temperature setpoint
desired temperature as set by the chamber controls

3.3
achieved temperature
stabilized temperature ~~in the chamber at any point within the working space after stabilization~~ which desired temperature at the centre of the working space achieves within specified tolerance

3.4
temperature stabilization
~~temperature at which all points in the working space have reached and maintained the setpoint temperature within a given tolerance~~ state of maintaining temperature within specified tolerance during specified time at specified points in the working space

3.5
temperature fluctuation
difference, after stabilization, between the maximum and minimum temperatures at ~~any~~ specified point in the working space during a specified interval of time

Note 1 to entry: For calibration, the centre point of working space may be used.

3.6
working space
part of the chamber in which the specified conditions can be maintained within the specified tolerances

Note 1 to entry: See Figure 1 and Table 1.

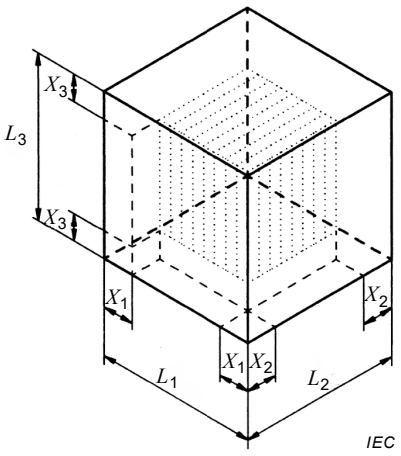


Figure 1 – Working space

Table 1 – Practical dimensions

Size	Volume l	Distance X mm	X (min.) mm
Small	Up to 1 000	$L/10$	50
Medium	1 000 to 2 000	$L/10$	100
Large	More than 2 000	$L/10$	150
NOTE Not all chambers are cubic in construction.			

3.7
temperature gradient
maximum difference in mean value, after stabilization, at any moment in time between two separate points in the working space

3.8
temperature variation in space
difference in mean value, after stabilization, at any moment in time between the temperature at the centre of the working space and at any other point in the working space

3.9
temperature rate of change
rate, in ~~degrees~~ kelvin per minute, for the transition between two specified temperatures measured at the centre of the working space

Note 1 to entry: See Figure 2.

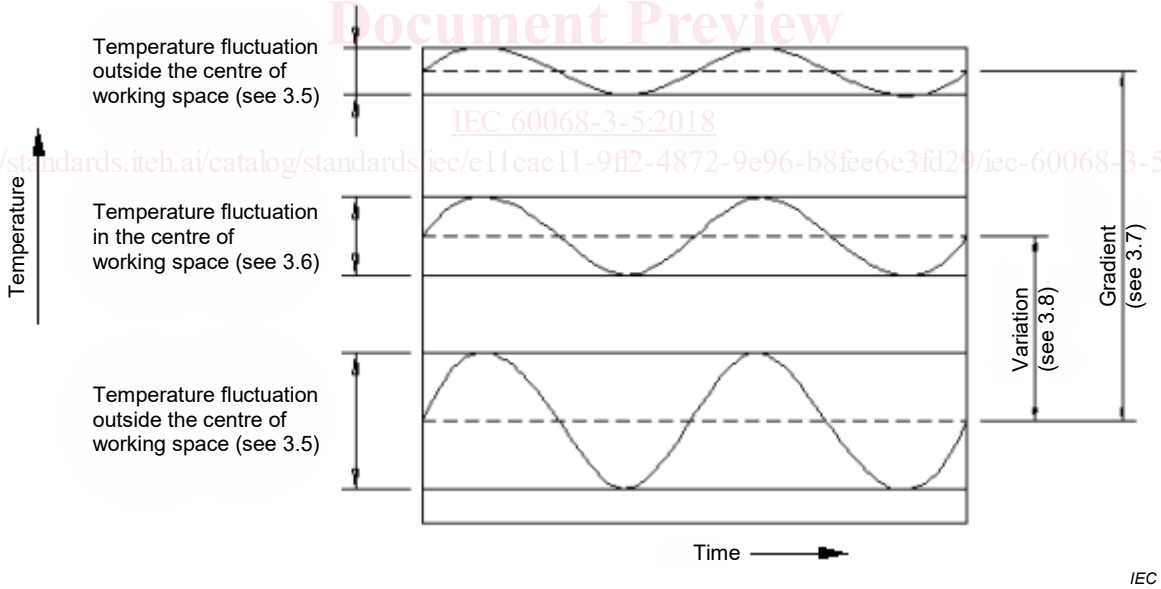


Figure 2 – Example of temperature differences

~~**3.10**~~
~~**temperature extremes**~~

~~maximum and minimum measured temperatures achieved in the working space after stabilization~~

4 Measuring chamber performances

4.1 Test area environment

The environment around a temperature test chamber may influence the conditions inside the test chamber.

The confirmation of performance of temperature chambers should be carried out under standard atmospheric conditions specified in IEC 60068-1.

~~The following items should be taken into consideration:~~

- ~~the ambient conditions described in IEC 60068-1 should be satisfied in principle;~~
- ~~the chamber should not be exposed to direct solar radiation;~~
- ~~the chamber should not be exposed to electromagnetic interference;~~
- ~~the chamber should be levelled;~~
- ~~the chamber should be fixed in a location free from any mechanical and acoustic vibration interference.~~

~~Manufacturer's advice on electrical power requirements and the environmental conditions should be taken into consideration.~~

~~Abnormal conditions should be recorded.~~

4.2 Temperature measurement system

The uncertainty of measurement of the output of the measurement system should be determined by calibration of the system, traceable to international standards (see ISO 10012~~-1 and ISO 10012-2~~).

~~Normally sensors should be either the resistance type (in accordance with IEC 60751) or the thermocouple type (in accordance with IEC 60584-1). The 50 % response time in air of the sensor shall be between 10 s and 40 s. The response time of the overall system should be less than 40 s.~~

~~In a temperature range from –200 °C to +200 °C the sensor measurement uncertainty should be in accordance with class A of IEC 60751.~~

The temperature sensors may be either calibrated platinum resistors or a thermocouple. The thermal response time of the sensors shall be within a minimum of 10 s and a maximum of 40 s for 50 % of response. It is preferred that the thermal response time of the entire measurement system to be less than 40 s. The use of sensors that are compliant to IEC 60584-1 tolerance class 1 (for thermocouples) or IEC 60751 tolerance class A (for resistors) is recommended.

4.3 Temperature chamber test ~~load~~ specimens

All measurements described in 4.5 are performed with an empty working space. ~~If it is not possible to empty the chamber totally this should be recorded.~~ For measuring with test ~~load~~ specimens (with or without heat dissipation), see IEC 60068-3-7.

4.4 ~~Installation~~ Specified location of temperature sensors in working space

Temperature measuring sensors are located in each corner and in the centre of the working space (see Figure 3, minimum 9 sensors). For temperature chambers over 2 000 l, additional sensors should be located in front of the centre of each wall (see Figure 4, minimum 15 sensors). The measuring system is to be arranged in such a way that the temperature

distribution of the empty test chamber will not be affected. For a large capacity chamber, there may be a significant difference between the temperature control sensor(s) and the temperature at the centre of the working space. It may be necessary to adjust the temperature setting to achieve the necessary tolerance.

~~Recording of the achieved temperature should be effected.~~

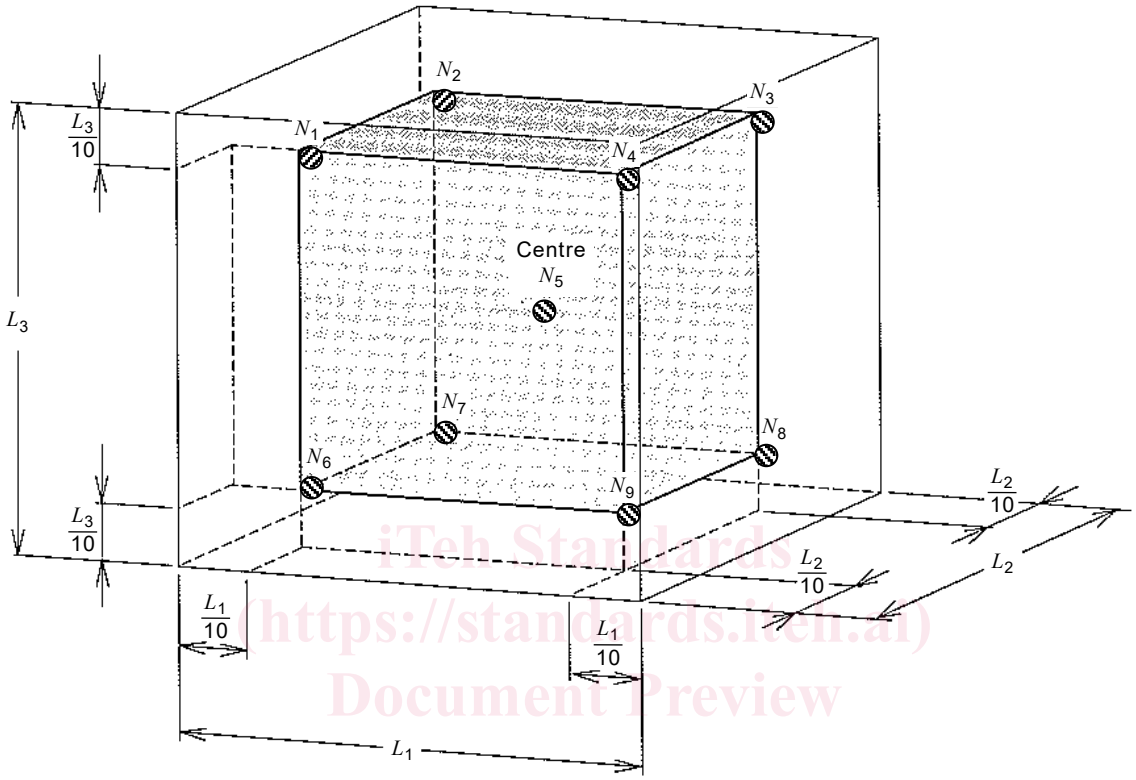


Figure 3 – Location of ~~air temperature~~ sensors for temperature chambers up to 2 000 l

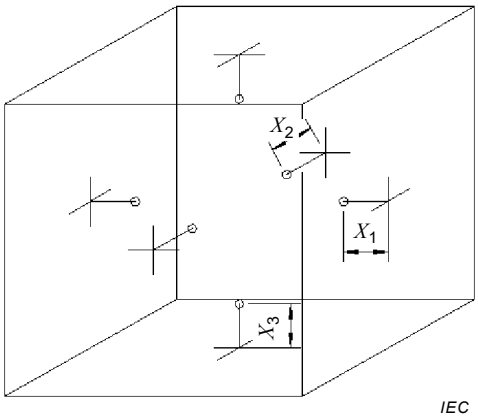


Figure 4 – Location of minimal additional ~~air temperature~~ sensors for temperature chambers over 2 000 l

For confirmation monitoring, data should be recorded at least once a minute. The device used for recording data from the chamber monitoring sensors should be independent of the chamber control system.

4.5 ~~Determination of temperature performance~~ Measurement method

~~4.5.1 Achieved temperature, temperature fluctuation, temperature variation in space, temperature gradient~~

~~The output of the temperature measuring system (see figure 3 or figure 4) determine, after chamber stabilization, the achieved temperature, temperature fluctuation and temperature gradient of the working space. Uncertainty of measurement of the temperature measuring system should be taken into account and the allowable tolerance reduced by the magnitude of the uncertainty.~~

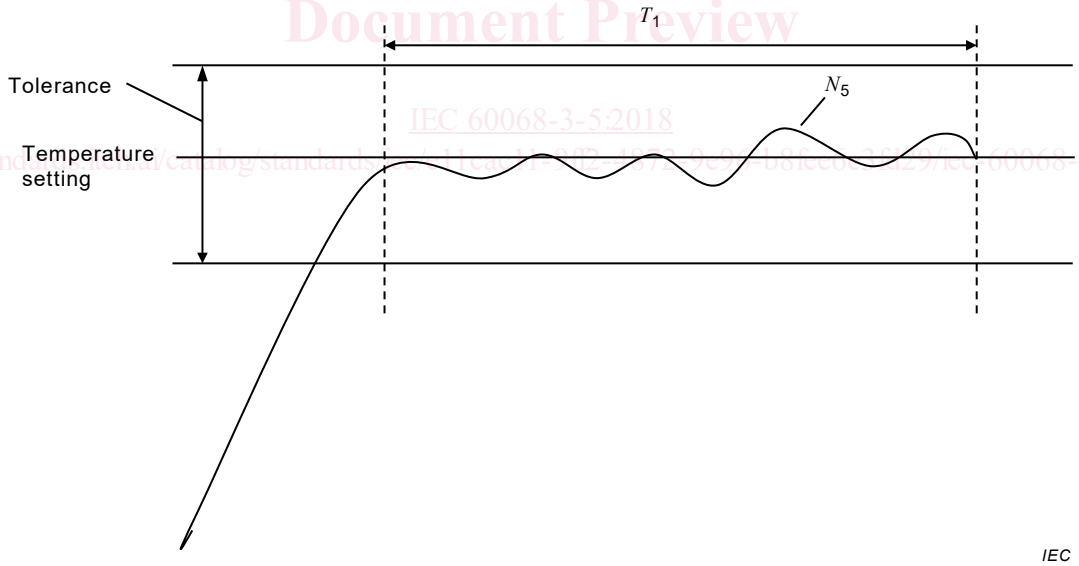
4.5.1 General

The temperature output of the temperature measuring system (see Figure 3 or Figure 4) determines, after chamber stabilization, the achieved temperature, temperature fluctuation and temperature gradient of the working space. For tolerance, the specification of the temperature/humidity chamber or, as necessary, tolerance specified in IEC 60068-2 (all parts), is required to maintain at the centre of the working space. Location of sensor is minimum 9 points or 15 points. This depends on the test chamber size. The measurement method is explained based on 9 points.

Uncertainty of measurement of the temperature measuring system shall be according to IEC 60068-3-11.

4.5.2 Achieved temperature

Temperature is achieved when the centre of the working space maintains the tolerance as required by IEC 60068-2 (all parts). An example is shown in Figure 5.



For tolerance, check the specification of the temperature chamber, or, as necessary, use tolerance specified in IEC 60068-2 which is required to maintain at the centre of the working space.

T_1 must be minimum 30 min. N_5 is the temperature at the centre of the working space.

Figure 5 – Example of achieved temperature

4.5.3 Temperature stabilization

Temperature reached and maintained within the allowable range in the working space is shown in Figure 6. Allowable range is based on the temperature fluctuation, temperature variation in space, and temperature gradient as the temperature chamber specification.

Specified time T_2 is minimum 30 min after the measurement points (e.g. N_1 to N_9) are within the allowable range.

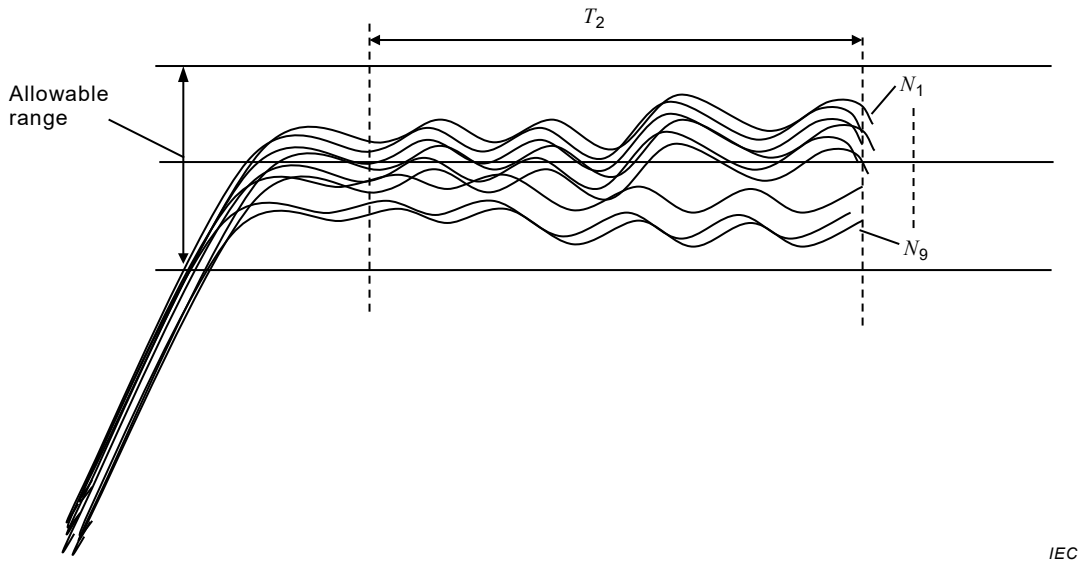


Figure 6 – Example of temperature stabilization for chambers up to 2 000 l

4.5.4 Temperature fluctuation

The fluctuation during a specified interval of time at specified temperature points in the working space, after temperature stabilization, is shown in Figure 7.

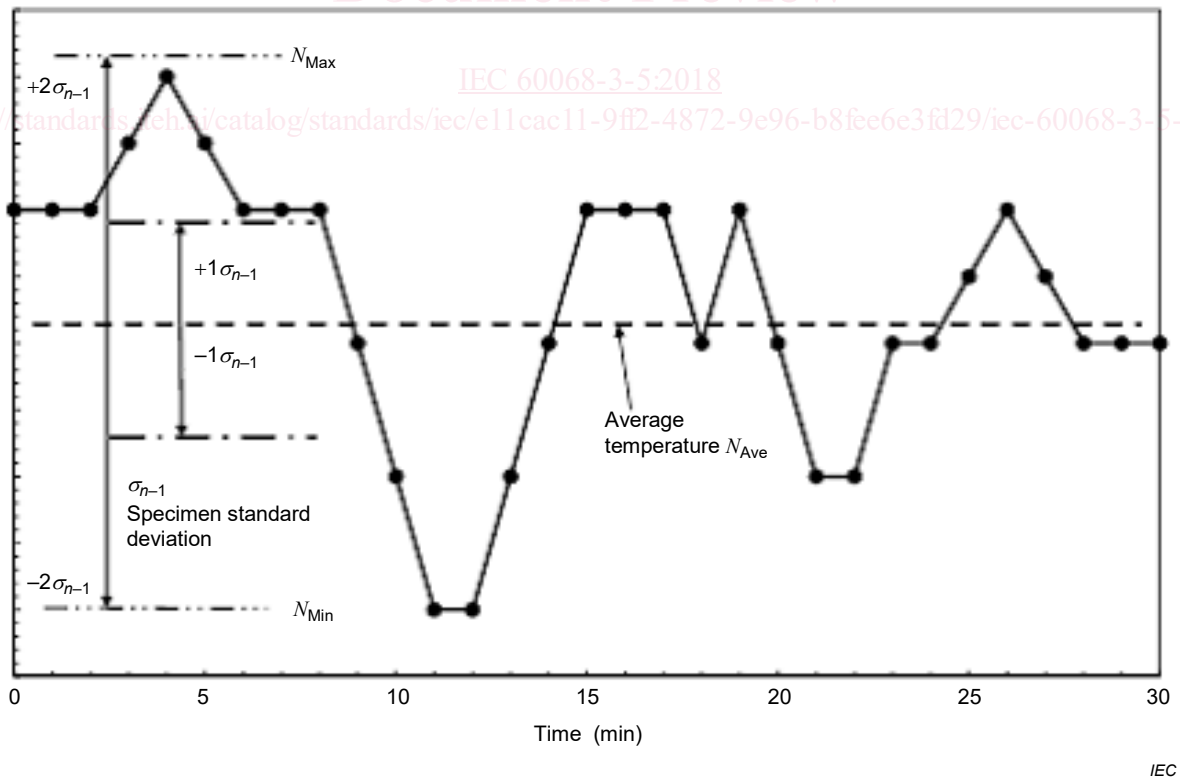


Figure 7 – Example of temperature fluctuation