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INTERNATIONAL STANDARD

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

IEC 60068-3-6:2018-01 RLV(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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ENVIRONMENTAL TESTING –

Part 3-6: Supporting documentation and guidance – Confirmation of the performance of temperature/humidity chambers

FOREWORD

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International Standard IEC 60068-3-6 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
104/760/FDIS	104/779/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.

IEC 60068-3-6 is to be read in conjunction with IEC 60068-3-5:2001 and IEC 60068-3-7:2001.

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- withdrawn,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.

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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 and humidity 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 and humidity chambers can also influence test results.

ENVIRONMENTAL TESTING –

Part 3-6: Supporting documentation and guidance – Confirmation of the performance of temperature/humidity chambers

1 Scope

This part of IEC 60068 provides a uniform and reproducible method of confirming that temperature and humidity test chambers, without ~~load~~ specimens, conform to the requirements specified in climatic test procedures ~~contained in~~ of IEC 60068-2 (all parts). This document is ~~destined~~ 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 60068-3-4, *Environmental testing – Part 3-4: Supporting documentation and guidance – Damp heat tests*~~

IEC 60068-3-5:2001, *Environmental testing – Part 3-5: Supporting documentation and guidance – Confirmation of the performance of temperature chambers*

IEC 60068-3-7:2001, *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*~~

~~ISO 4677-1, *Atmospheres for conditioning and testing – Determination of relative humidity – Part 1: Aspirated psychrometer method*~~

~~ISO *(unnumbered), Guide to the Expression of Uncertainty in Measurement*~~

3 Terms and definitions

For the purpose 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

NOTE 1 For terms and definitions regarding temperature testing, refer to IEC 60068-3-5.

NOTE 2 Unless otherwise specified, "humidity" is relative humidity (RH).

3.1
temperature/humidity chamber
enclosure or space in some parts of which the temperature/humidity conditions specified in IEC 60068-2 (all parts) can be achieved

Note 1 to entry: See IEC 60068-3-4.

~~**3.2**~~
~~**generation of humidity**~~
~~see clause 3 of IEC 60068-3-4~~

3.2
absolute humidity
mass of water vapour present in a unit volume of moist air

Note 1 to entry: Typical units of measure are g/m3.

3.3
dewpoint
T_d
temperature at which the saturation vapour pressure over water ~~or ice~~ is equal to the partial pressure of the water vapour in the air

3.4
saturation vapour pressure
~~when a given volume of air, at a constant temperature, has water present and is incapable of holding any more water it is said to be saturated~~
maximum possible pressure exerted by a water vapour in equilibrium with its solid or liquid phase, such that any increase will initiate within the vapour a change to a more condensed state

3.5
partial vapour pressure
contribution of water vapour in a given volume of air at a constant pressure and temperature ~~to the pressure exerted by~~ of the atmosphere

3.6
relative humidity
RH
ratio of the partial vapour pressure, divided by the saturation vapour pressure of a given volume of air at a constant temperature, expressed as percentage

Note 1 to entry: The most popular method to express the water vapour content in air is relative humidity.

3.7
temperature/humidity stabilization
~~temperature/humidity in the chamber can be considered stable when all points in the working space have reached and have maintained the setpoint temperature/humidity within a given tolerance~~
state of maintaining temperature/humidity within specified tolerance for a specified time at specified points in the working space

3.8
achieved humidity
~~humidity in the chamber at any point within the working space after stabilization~~
stabilized humidity which desired humidity at the centre of the working space achieves within specified tolerance

3.9
climatogram
graphic display of combined temperature with relative humidity

Note 1 to entry: See Figure 9.

3.10
relative humidity fluctuation
~~fluctuation calculated with the temperature sensor which has the largest fluctuation~~
difference, after stabilization, between the maximum and minimum humidity at specified points 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.

3.11
relative humidity gradient
~~gradient whose predominant contribution is caused by the temperature gradient in the working space~~
maximum difference in mean humidity value, after stabilization, at any moment in time between two separate points in the working space

Note 1 to entry: The absolute humidity of the air can be considered to be the same throughout the working space.

Note 2 to entry: See Figure 1.

3.12
relative humidity variation in space
difference in mean value, after stabilization, at any moment in time between the humidity at the centre of the working space and at any other point in the working space

Note 1 to entry: See Figure 1.

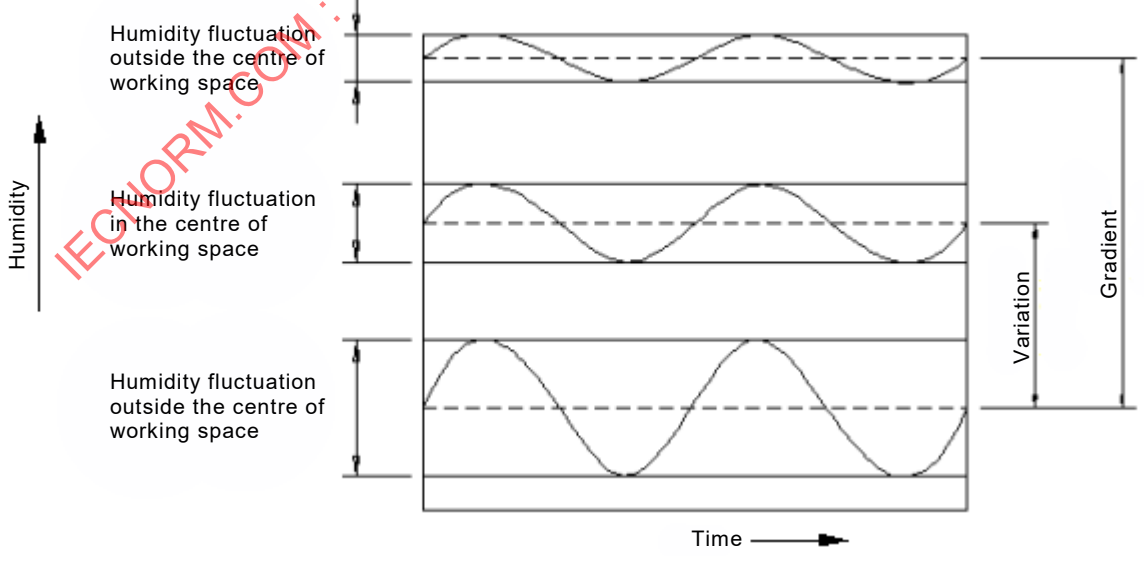
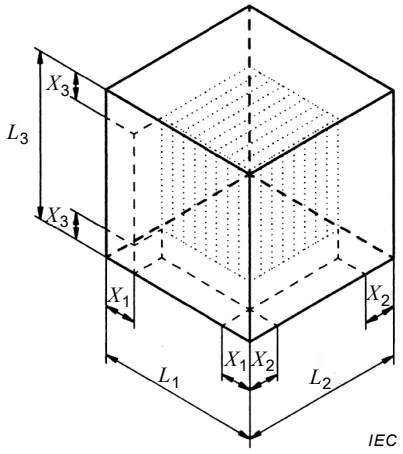


Figure 1 – Example of humidity differences

3.13
working space
part of the chamber in which the specified conditions can be maintained within the specified tolerances

Note 1 to entry: See Figure 2 and Table 1.



NOTE Practical dimensions of working space see Table 1.

Figure 2 – 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.			

4 Measuring of performances

4.1 Test area environment

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

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

4.2 Measurement system

When performing an assessment of a temperature/humidity chamber, a temperature/humidity measuring system, which is independent of the chamber's control system should be used.

4.3 Temperature measurement system

~~In accordance with~~ See IEC 60068-3-5.

4.4 Humidity 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).The measurement system should have a calibration at the test conditions~~, traceable to international standards (see ISO 10012~~-1 and ISO 10012-2~~) and the overall measurement uncertainty should be established using ~~the~~ ISO/IEC Guide 98-3 related to the expression of uncertainty in measurement.

Some examples of humidity measurement systems include, but are not limited to, those listed below.

a) Wet and dry bulb method

This method ~~(see ISO 4677-1)~~ uses the cooling effect of water evaporation from a wet sock. The temperature of the sock is measured with a temperature sensor whilst simultaneously measuring the temperature of the air with a second temperature sensor.

b) Dewpoint mirror method

This method cools the surface of the mirror until condensation occurs on it. The temperature indicated is the dewpoint temperature.

c) Lithium chloride sensor

This method gives absolute humidity values (dewpoint temperature).

d) Capacitive sensor

Permeation of humidity changes the dielectric properties of certain materials and this is used for direct measurement of relative humidity.

4.5 Temperature/humidity chamber test specimens

All measurements described below are performed with an empty working space. For measuring with test specimens (with or without heat dissipation), see IEC 60068-3-7.

4.6 Specified location of temperature sensors and humidity sensor in working space

4.6.1 General

Temperature measuring sensors are located in each corner and in the centre of the working space (see Figure 3, minimum 9 sensors). Humidity measuring sensor is located in the centre of the working space. For temperature/humidity chambers over 2 000 l, additional temperature sensors should be located in front of the centre of each wall (see Figure 4, minimum 15 sensors).

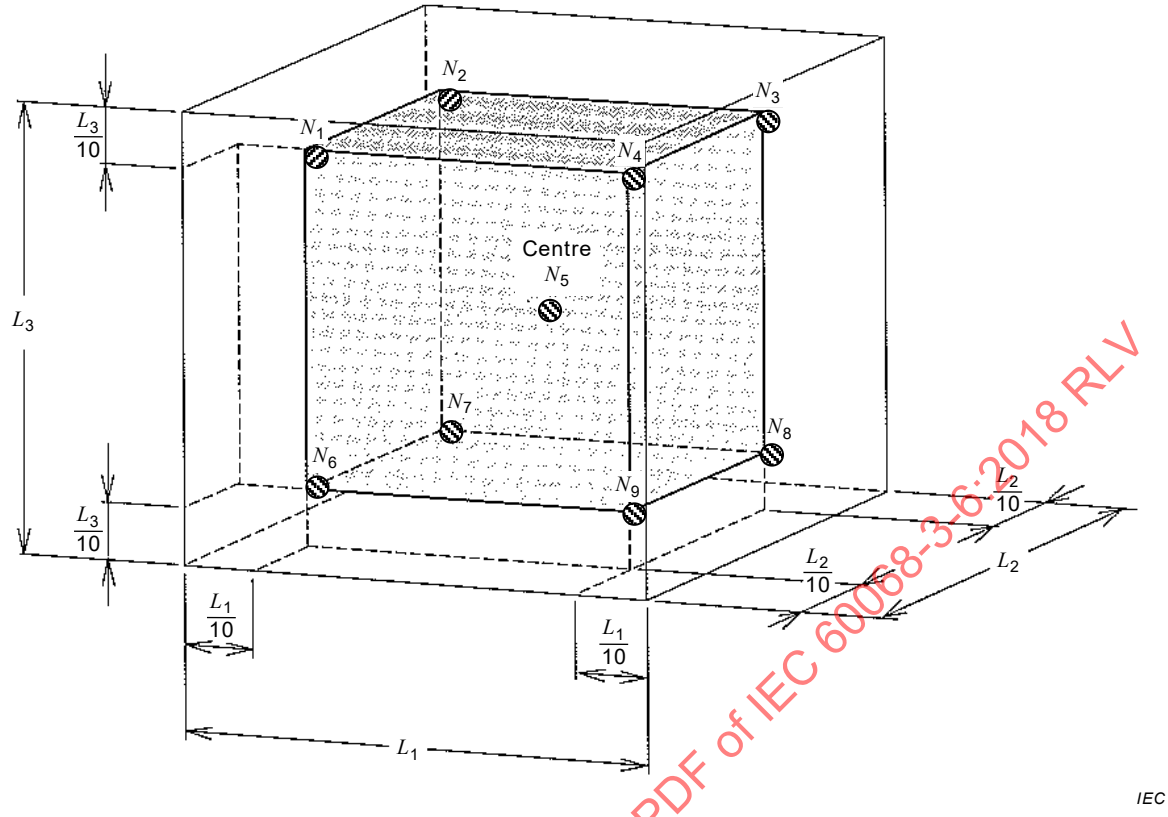


Figure 3 – Location of sensors for temperature/humidity chambers up to 2 000 l

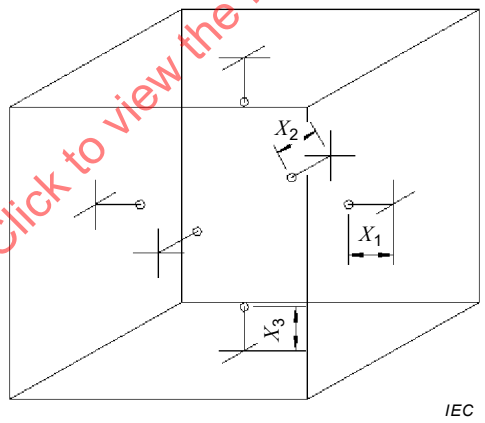


Figure 4 – Location of minimal additional sensors for temperature/humidity chambers over 2 000 l

~~**4.4 Installation of sensors**~~

4.6.2 Temperature sensors

~~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.~~

See IEC 60068-3-5, 4.2.

4.6.3 Humidity sensor

A single humidity sensor ~~should~~ shall be positioned at the centre of the working space. The relative humidity is ~~then~~ calculated (by Pernter's or Sprung's psychrometric formula) at each point in the working space where a temperature sensor is located by using the temperature difference. This assumes that the absolute humidity remains the same throughout the working space.

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

~~Sensor measurement uncertainty should not exceed ±3 % RH.~~

4.7 Measurement method

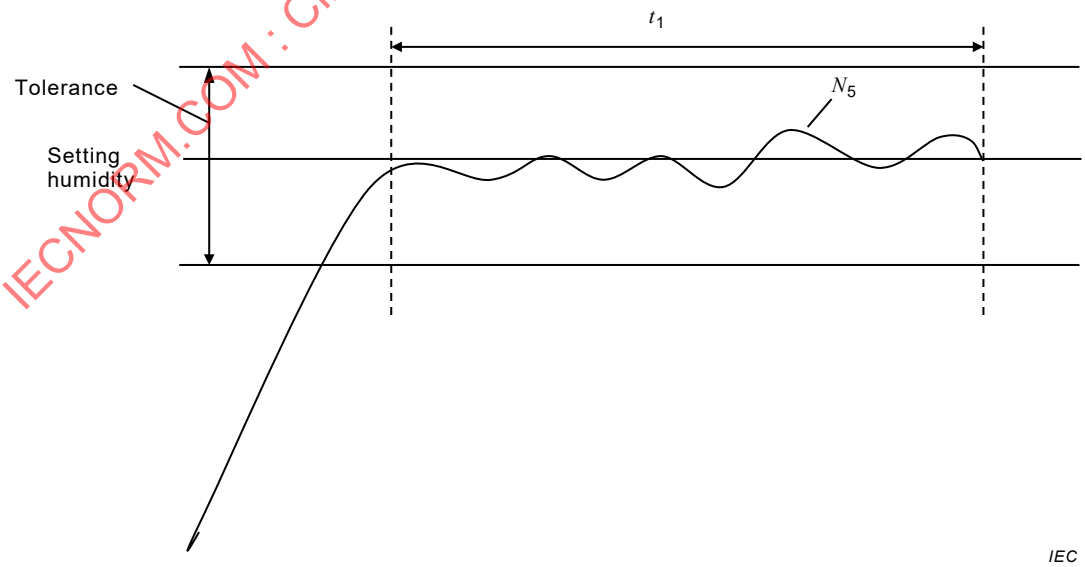
4.7.1 General

The confirmation of temperature performance of temperature/humidity chamber shall be carried out by IEC 60068-3-5. Humidity measurement point is at the centre of the working space only. The output of the temperature/humidity measuring system (see Figure 3 or Figure 4) determine, after chamber stabilization, the achieved humidity, humidity fluctuation and humidity 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. Measurement method is explained based on 9 points.

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

4.7.2 Achieved humidity

Humidity at the centre of the working space, shown in Figure 5, has reached and maintained the set humidity within tolerance.



t_1 should be minimum 30 min. N_5 is the humidity at the centre of the working space.

Figure 5 – Example of achieved humidity

4.7.3 Temperature/humidity stabilization

Humidity reached and maintained at the centre of the working space within the tolerance of the chamber specification or the requirement of the relevant part of the IEC 60068-2 series. An example is shown in Figure 6. Specified time t_2 is minimum 30 min.

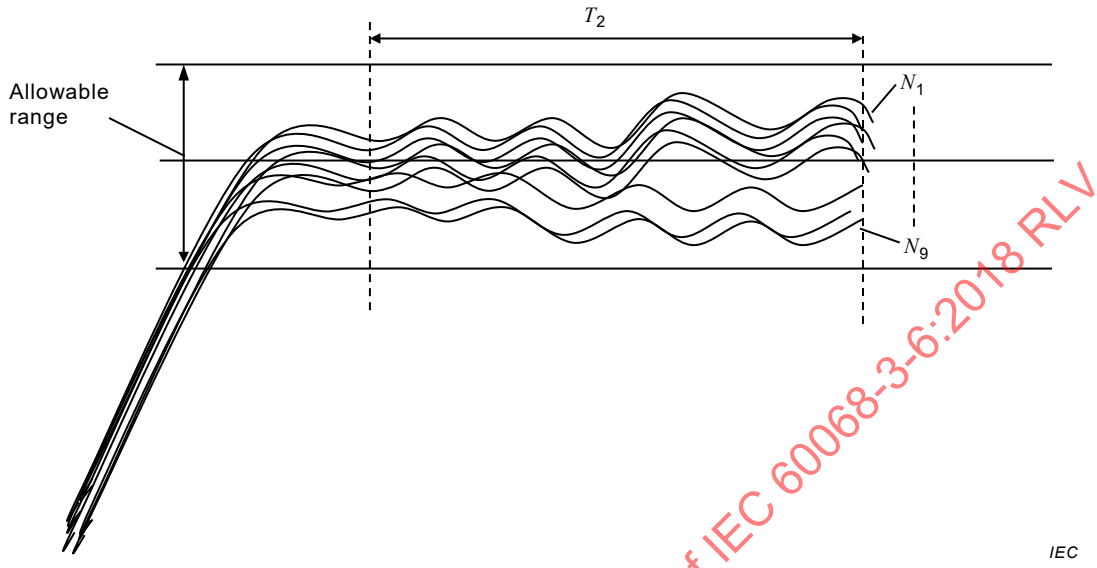


Figure 6 – Example of temperature/humidity stabilization

4.7.4 Humidity fluctuation

The fluctuation during a specified interval of time at a measuring point is shown in Figure 7. After the temperature and humidity has stabilized, the humidity at the centre of the working space shall be measured at least 10 times at evenly spaced time intervals over a period of at least 30 min. At the same time, temperature shall be measured in 9 points at least 10 times at evenly spaced time intervals over a period of at least 30 min. Humidity shall be calculated assuming a uniform humidity mixing ratio, using the humidity value at the centre and temperature values measurement at 9 points. Measurements are actually made at a certain sampling interval. It is not guaranteed that that data captures the fluctuation peak. For that reason, the sample standard deviation, σ_{n-1}, shall be obtained from the data measured in each measurement point after temperature has stabilized. Values $\pm 2\sigma_{n-1}$ shall be obtained in all 9 measurement points, and the highest value within that shall be annotated as the humidity fluctuation.

The calculated values shall be indicated as N_1, N_2, … , N_i , … N_n ($n \geqq 10$).

The mean of N shall be N_{ave}.

The sample standard deviation,σ_{n-1}, shall be defined as follows.

$$\sigma_{n-1} = \sqrt{\frac{\sum(X_i - N_{Ave})^2}{n-1}}$$

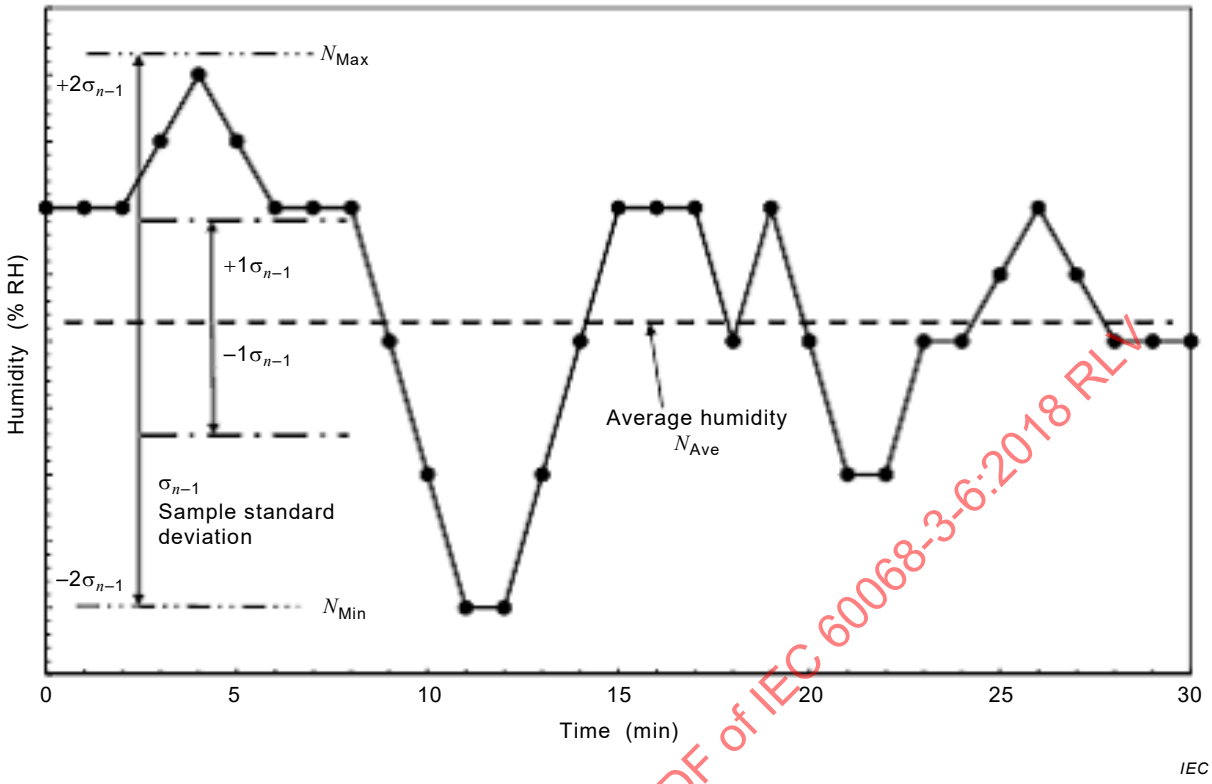
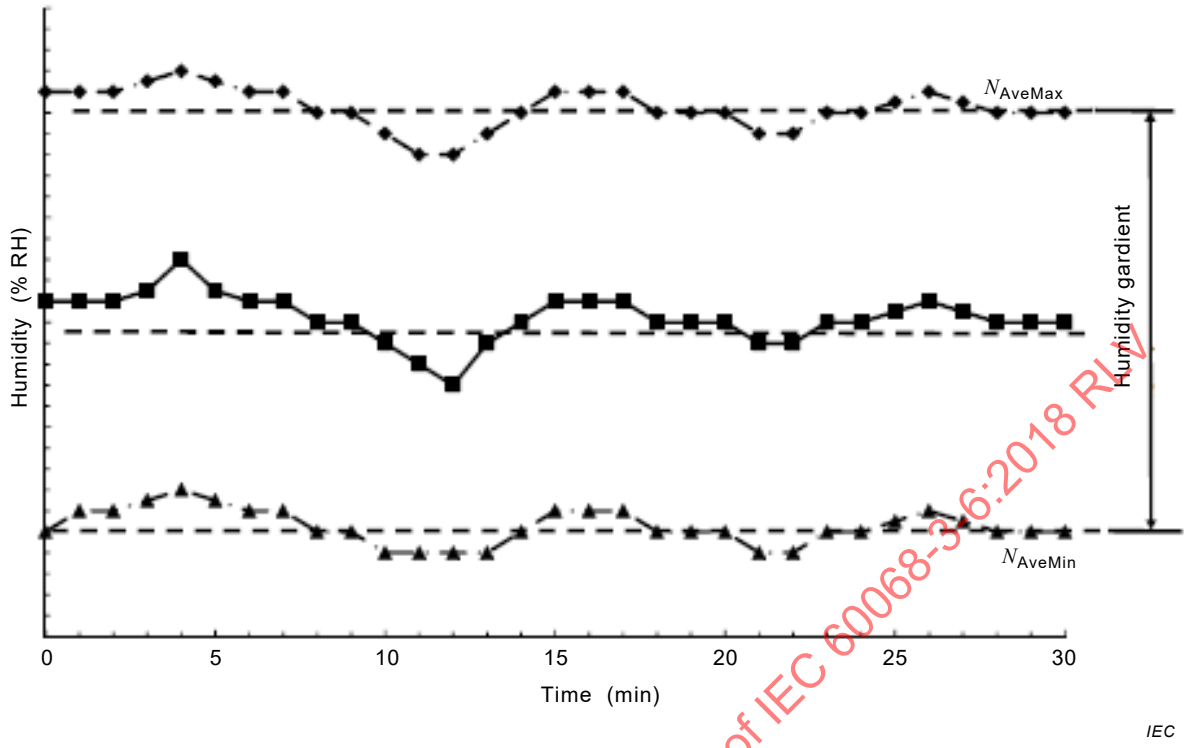


Figure 7 – Example of humidity fluctuation

4.7.5 Humidity gradient

As shown in Figure 8, the maximum difference in average humidity in all measurement points of the working space shall be the humidity gradient.



N_{AveMax}: Mean highest humidity in each of 9 measurement points

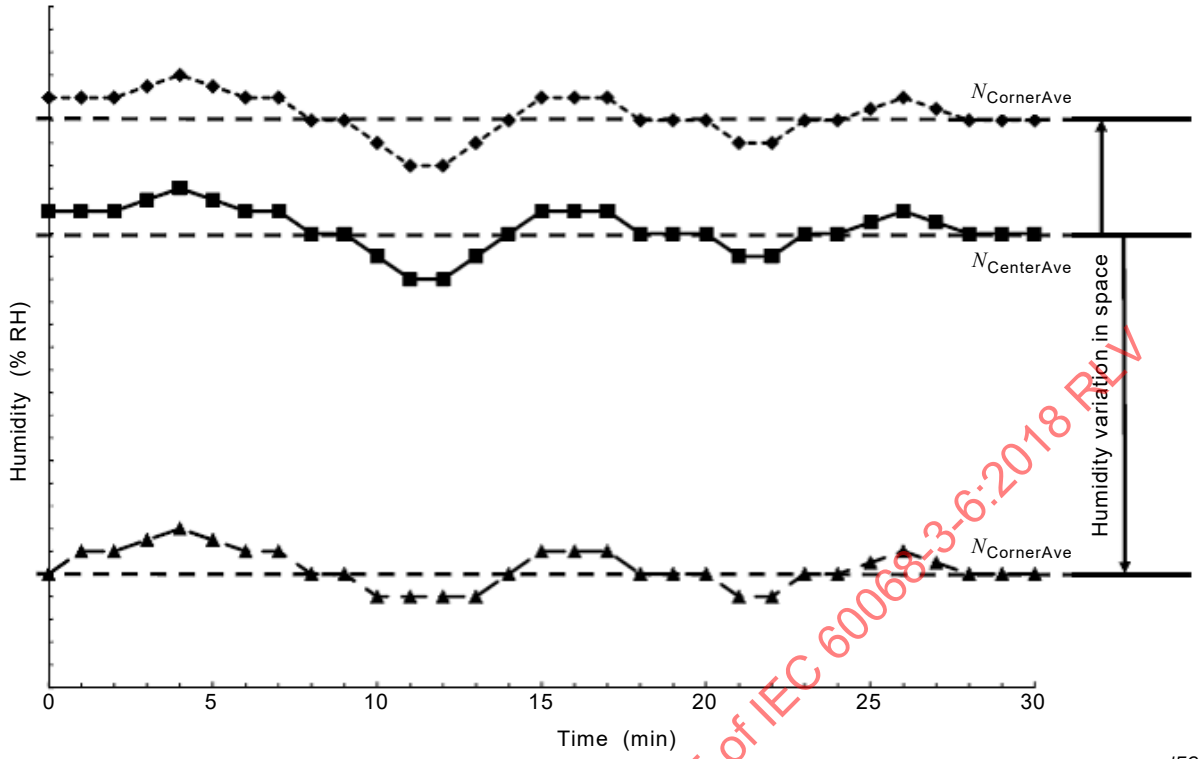
N_{AveMin}: Mean lowest humidity in each of 9 measurement points

Humidity gradient = $N_{AveMax} - N_{AveMin}$

Figure 8 – Example of humidity gradient for chambers up to 2 000 l

4.7.6 Humidity variation in space

As shown in Figure 9, humidity variation in space is the difference between the mean humidity at the centre of the working space and the mean humidity from all other measurement points. The maximum difference between the centre of the working space and each measuring point shall be stated.



$N_{centreAve}$: Mean humidity at centre of working space

$N_{CornerAve(j)}$ j = 1 to 8: Mean humidity at corner of working space

Humidity variation in space = | Max($N_{cornerAve[j]} - N_{CentreAve}$) |

The value obtained as the humidity variation in space shall be ($N_{CornerAve(j)} - N_{CentrerAve}$), and the absolute value of the highest difference obtained for the all measurement points shall be annotated as the humidity variation in space.

Figure 9 – Example of humidity variation in space for chambers up to 2000 l

~~**5 Determination of humidity performance**~~

~~**5.1 Temperature**~~

~~If the chamber is also to be used for dry temperature testing it will be necessary to determine the temperature profile of the working space in accordance with IEC 60068-3-5 before determining the humidity performance.~~

4.8 Standard humidity sequence

The following test sequence is ~~recommended~~ considered to obtain the necessary data for confirming the range of operation of a temperature/humidity chamber.

~~For chambers required to continuously test at set temperature/humidity conditions, a single value verification will suffice.~~

~~Test area conditions should be in accordance with 4.1 of IEC 60068-3-5.~~

An example of a test sequence is given in Table 2.

Table 2 – Example of test sequence

Step	Temperature °C	Relative humidity %	~~Remarks~~
1	23	50	~~Start~~
2	23	U_2	~~t_{d2}(min.)~~
3	t_3(min.)	U_3	~~t_{d3}(min.)~~
4	t_4(min.)	U_4(max.)	
5	t_5(max.)	U_5(min.)	
6	t_6(max.)	U_6	~~t_{d6}(max.)~~
7	t_7(max.)	50	
8	23	50	~~End~~

From data obtained during the above test sequence a climatogram may be constructed for the chamber. An example is given in Figure 10.

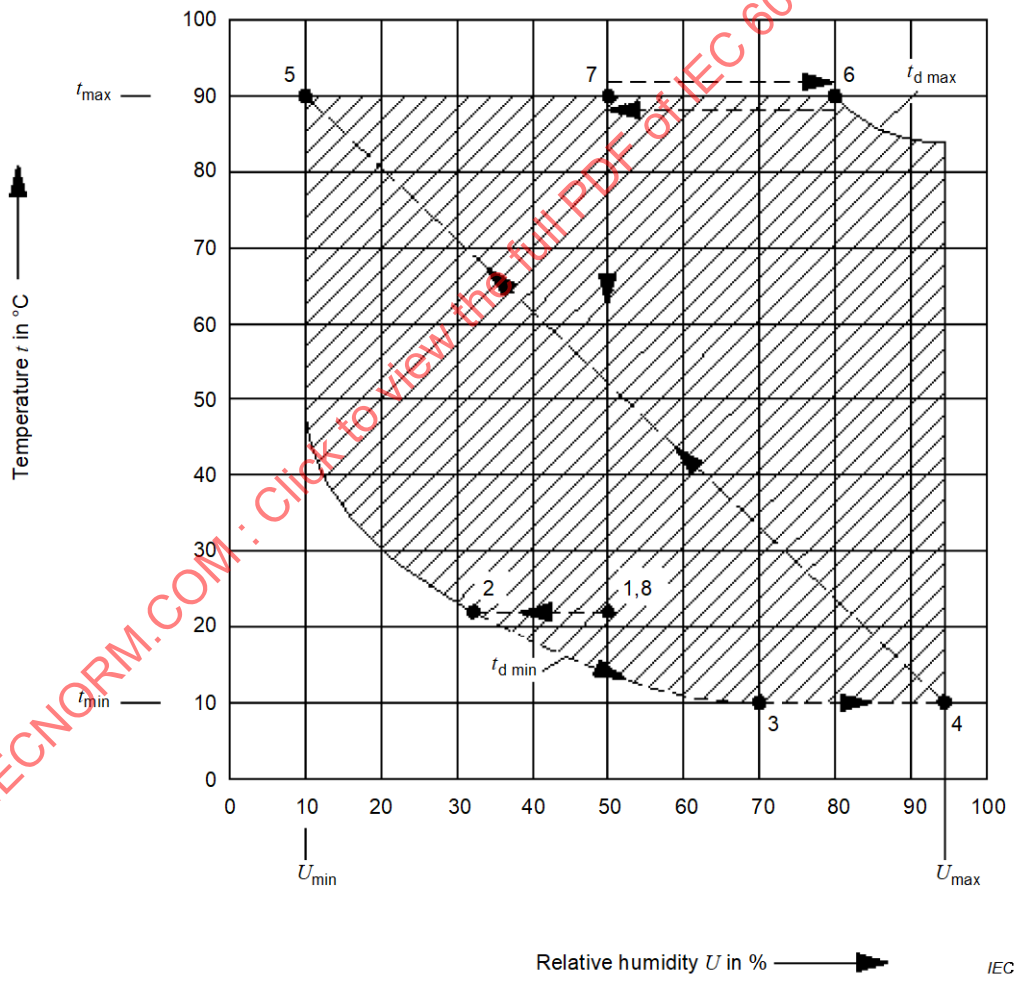


Figure 10 – Example of climatogram

~~7 Evaluation criteria~~

~~The performance of the temperature/humidity test chamber is confirmed if all results are within the specification limits of the relevant IEC 60068-2 standards.~~

5 Information to be given in the performance test report

As a minimum, the following information shall be contained in the test report.

~~– Temperature fluctuation and temperature variation in space and temperature gradient at each point of clause 5 of IEC 60068-3-5.~~

~~– Temperature rate of change, heating and cooling and if necessary humidity rate of change.~~

~~– Temperature extremes.~~

~~– Any deviations such as overshoot.~~

a) Atmospheric conditions in the test area for measurement.

b) Size and volume of chamber enclosure and working space.

c) Humidity fluctuation, humidity variation in space and humidity gradient.

d) Highest/Lowest humidity.

e) Measurement results from each measurement position.

f) Details of data acquisition systems.

g) ~~Evaluation of~~ Measurements uncertainties.

h) Fixtures used for measurement.

Bibliography

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

IEC 60068-3-4, *Environmental testing – Part 3-4: Supporting documentation and guidance – Damp heat tests*

IEC 60584-1, *Thermocouples – Part 1: EMF specifications and tolerances*

IEC 60751, *Industrial platinum resistance thermometers and platinum temperature sensors*

ISO 10012, *Measurement management systems – Requirements for measurement processes and measuring equipment*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ENVIRONMENTAL TESTING –

Part 3-6: Supporting documentation and guidance – Confirmation of the performance of temperature/humidity chambers

FOREWORD

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International Standard IEC 60068-3-6 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
104/760/FDIS	104/779/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.

IEC 60068-3-6 is to be read in conjunction with IEC 60068-3-5:2001 and IEC 60068-3-7:2001.

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.

A bilingual version of this publication may be issued at a later date.

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 and humidity 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 and humidity chambers can also influence test results.

ENVIRONMENTAL TESTING –

Part 3-6: Supporting documentation and guidance – Confirmation of the performance of temperature/humidity chambers

1 Scope

This part of IEC 60068 provides a uniform and reproducible method of confirming that temperature and humidity test chambers, without specimens, conform to the requirements specified in climatic test procedures of IEC 60068-2 (all parts). 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 60068-3-5:2001, *Environmental testing – Part 3-5: Supporting documentation and guidance – Confirmation of the performance of temperature chambers*

IEC 60068-3-7:2001, *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*

3 Terms and definitions

For the purpose 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

NOTE 1 For terms and definitions regarding temperature testing, refer to IEC 60068-3-5.

NOTE 2 Unless otherwise specified, "humidity" is relative humidity (RH).

3.1
temperature/humidity chamber
enclosure or space in some parts of which the temperature/humidity conditions specified in IEC 60068-2 (all parts) can be achieved

Note 1 to entry: See IEC 60068-3-4.

3.2
absolute humidity
mass of water vapour present in a unit volume of moist air

Note 1 to entry: Typical units of measure are g/m3.

3.3
dewpoint
T_d
temperature at which the saturation vapour pressure over water is equal to the partial pressure of the water vapour in the air

3.4
saturation vapour pressure
maximum possible pressure exerted by a water vapour in equilibrium with its solid or liquid phase, such that any increase will initiate within the vapour a change to a more condensed state

3.5
partial vapour pressure
contribution of water vapour in a given volume of air at a constant pressure and temperature of the atmosphere

3.6
relative humidity
RH
ratio of the partial vapour pressure, divided by the saturation vapour pressure of a given volume of air at a constant temperature, expressed as percentage

Note 1 to entry: The most popular method to express the water vapour content in air is relative humidity.

3.7
temperature/humidity stabilization
state of maintaining temperature/humidity within specified tolerance for a specified time at specified points in the working space

3.8
achieved humidity
stabilized humidity which desired humidity at the centre of the working space achieves within specified tolerance

3.9
climatogram
graphic display of combined temperature with relative humidity

Note 1 to entry: See Figure 9.

3.10
relative humidity fluctuation
difference, after stabilization, between the maximum and minimum humidity at specified points 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.

3.11
relative humidity gradient
maximum difference in mean humidity value, after stabilization, at any moment in time between two separate points in the working space

Note 1 to entry: The absolute humidity of the air can be considered to be the same throughout the working space.

Note 2 to entry: See Figure 1.

3.12
relative humidity variation in space
difference in mean value, after stabilization, at any moment in time between the humidity at the centre of the working space and at any other point in the working space

Note 1 to entry: See Figure 1.

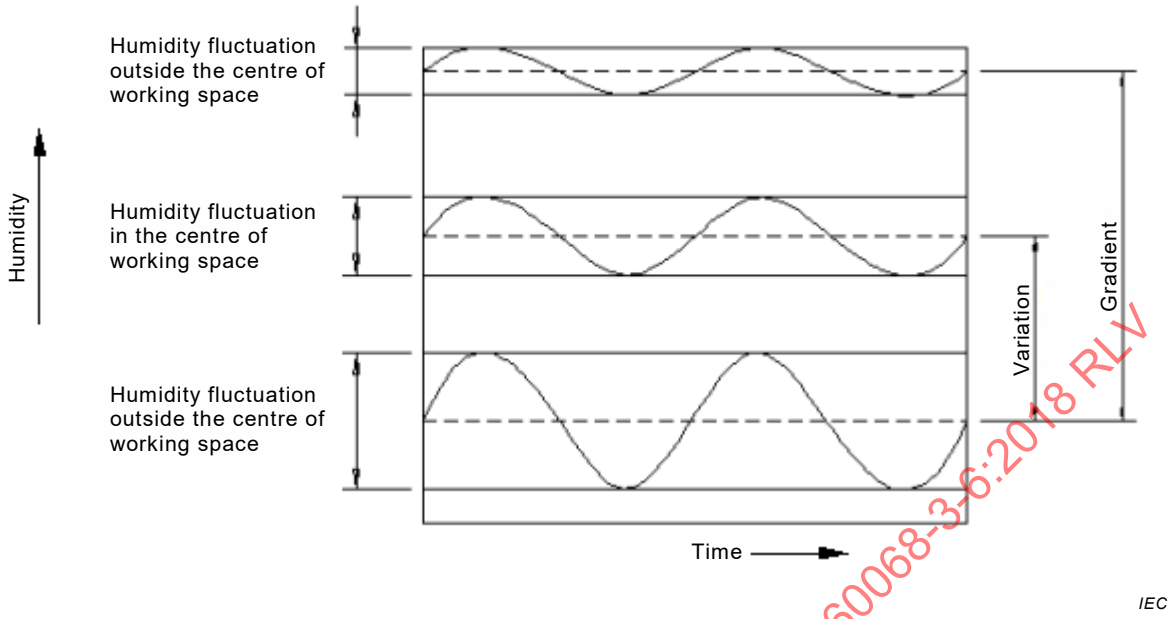
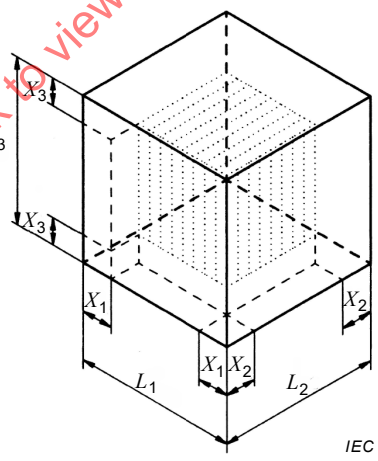


Figure 1 – Example of humidity differences

3.13
working space
part of the chamber in which the specified conditions can be maintained within the specified tolerances

Note 1 to entry: See Figure 2 and Table 1.



NOTE Practical dimensions of working space see Table 1.

Figure 2 – 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.			

4 Measuring of performances

4.1 Test area environment

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

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

4.2 Measurement system

When performing an assessment of a temperature/humidity chamber, a temperature/humidity measuring system which is independent of the chamber's control system should be used.

4.3 Temperature measurement system

See IEC 60068-3-5.

4.4 Humidity 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), and the overall measurement uncertainty should be established using ISO/IEC Guide 98-3 related to the expression of uncertainty in measurement.

Some examples of humidity measurement systems include, but are not limited to, those listed below.

a) Wet and dry bulb method

This method uses the cooling effect of water evaporation from a wet sock. The temperature of the sock is measured with a temperature sensor whilst simultaneously measuring the temperature of the air with a second temperature sensor.

b) Dewpoint mirror method

This method cools the surface of the mirror until condensation occurs on it. The temperature indicated is the dewpoint temperature.

c) Lithium chloride sensor

This method gives absolute humidity values (dewpoint temperature).

d) Capacitive sensor

Permeation of humidity changes the dielectric properties of certain materials and this is used for direct measurement of relative humidity.

4.5 Temperature/humidity chamber test specimens

All measurements described below are performed with an empty working space. For measuring with test specimens (with or without heat dissipation), see IEC 60068-3-7.

4.6 Specified location of temperature sensors and humidity sensor in working space

4.6.1 General

Temperature measuring sensors are located in each corner and in the centre of the working space (see Figure 3, minimum 9 sensors). Humidity measuring sensor is located in the centre of the working space. For temperature/humidity chambers over 2 000 l, additional temperature sensors should be located in front of the centre of each wall (see Figure 4, minimum 15 sensors).

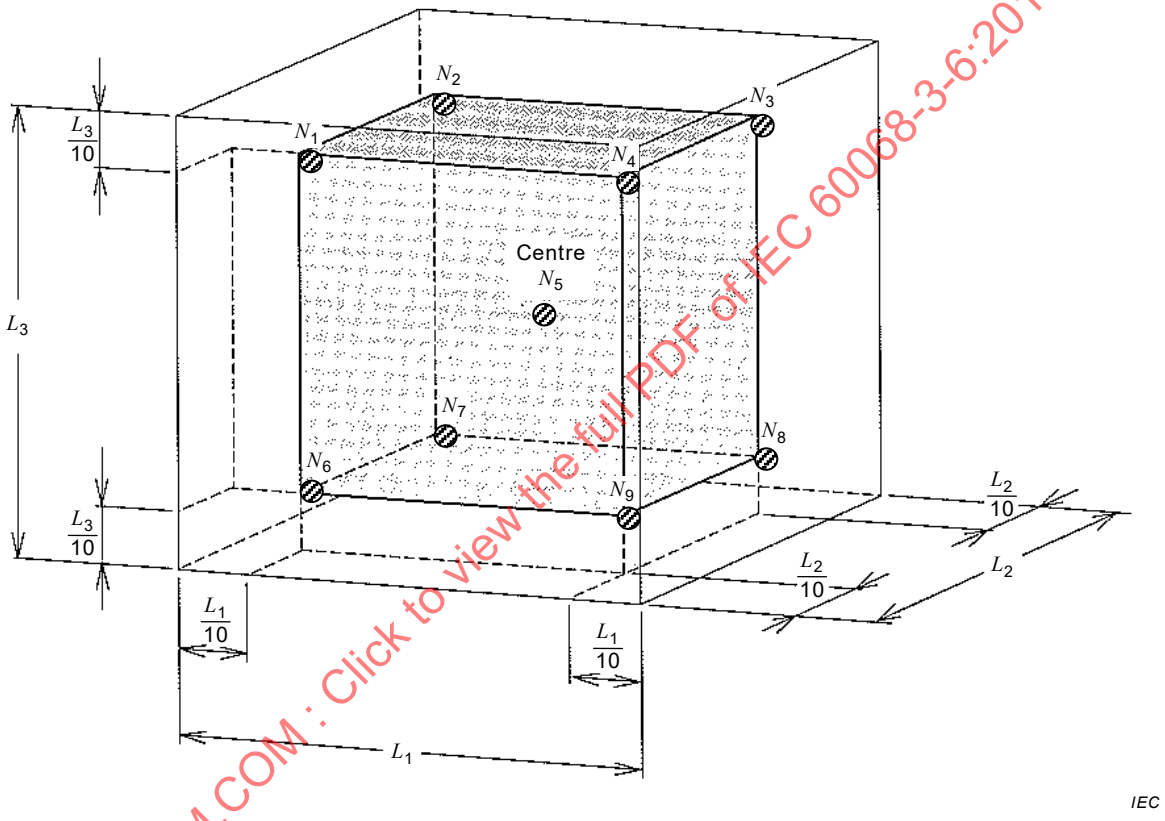


Figure 3 – Location of sensors for temperature/humidity chambers up to 2 000 l

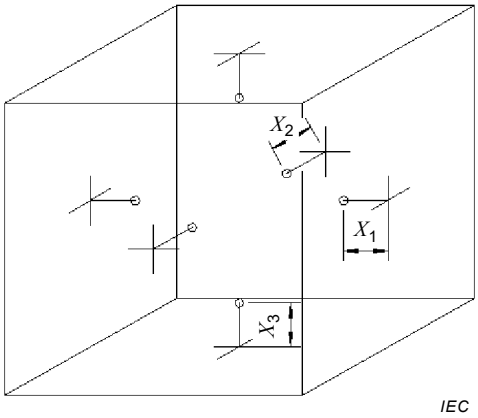


Figure 4 – Location of minimal additional sensors for temperature/humidity chambers over 2 000 l

4.6.2 Temperature sensors

See IEC 60068-3-5, 4.2.

4.6.3 Humidity sensor

A single humidity sensor shall be positioned at the centre of the working space. The relative humidity is calculated (by Pernter's or Sprung's psychrometric formula) at each point in the working space where a temperature sensor is located by using the temperature difference. This assumes that the absolute humidity remains the same throughout the working space.

4.7 Measurement method

4.7.1 General

The confirmation of temperature performance of temperature/humidity chamber shall be carried out by IEC 60068-3-5. Humidity measurement point is at the centre of the working space only. The output of the temperature/humidity measuring system (see Figure 3 or Figure 4) determine, after chamber stabilization, the achieved humidity, humidity fluctuation and humidity 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. Measurement method is explained based on 9 points.

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

4.7.2 Achieved humidity

Humidity at the centre of the working space, shown in Figure 5, has reached and maintained the set humidity within tolerance.