SLOVENSKI STANDARD
oSIST prEN IEC 60068-3-4:2022

01-september-2022

Okoljsko preskušanje - 3-4. del: Podporna dokumentacija in navodilo - Vlažni toplotni preskusi

Environmental testing - Part 3-4: Supporting documentation and guidance - Damp heat tests

Umweltprüfungen - Teil 3-4: Unterstützende Dokumentation und Leitfaden - Prüfungen mit feuchter Wärme

Essais d'environnement - Partie 3-4: Documentation d'accompagnement et recommandations - Essais de chaleur humide

Ta slovenski standard je istoveten z: **prEN IEC 60068-3-4:2022**

ICS:

19.040	Preskušanje v zvezi z okoljem	Environmental testing
29.020	Elektrotehnika na splošno	Electrical engineering in general

oSIST prEN IEC 60068-3-4:2022 **en**

104/931/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 60068-3-4 ED2**	
DATE OF CIRCULATION: **2022-06-24**	CLOSING DATE FOR VOTING: **2022-09-16**
SUPERSEDES DOCUMENTS: **104/910/CD, 104/923A/CC**	

IEC TC 104 : ENVIRONMENTAL CONDITIONS, CLASSIFICATION AND METHODS OF TEST

SECRETARIAT: Sweden	SECRETARY: Mr Henrik Lagerström
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

FUNCTIONS CONCERNED:

☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY

☒ SUBMITTED FOR CENELEC PARALLEL VOTING

☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

Attention IEC-CENELEC parallel voting

The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting.

The CENELEC members are invited to vote through the CENELEC online voting system.

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Environmental testing - Part 3-4: Supporting documentation and guidance - Damp heat tests

PROPOSED STABILITY DATE: 2027

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ENVIRONMENTAL TESTING –

Part 3-4: Supporting documentation and guidance – Damp heat tests

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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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6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60068-3-4 has been prepared by IEC Technical Committee 104: Environmental conditions, classification and methods of test.

This second edition of IEC 60068-3-4 replaces the first edition of IEC 60068-3-4 published in 2001.

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

FDIS	Report on voting
104/208/FDIS	104/215/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 3.

Annex A is for information only.

The committee has decided that the contents of this publication will remain unchanged until 2026. At this date, the publication will be

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

INTRODUCTION

Temperature and relative humidity (RH) of the air, in varying combinations, are climatic factors which act upon a product during storage, transportation and operation.

Meteorological measurements made over many years have shown that a relative humidity >95 % combined with a temperature >30 °C does not occur in free air conditions over long periods, except in regions with extreme climates. In dwelling rooms and workshops temperatures of >30 °C may occur but in most cases are combined with a lower relative humidity than in the open air.

Special conditions exist in certain wet rooms for example, in the chemical industry, metallurgical plants, mines, electroplating plants and laundries, where the temperature can reach 45 °C combined with a relative humidity up to saturation over long periods.

Certain equipment placed under particular conditions may be subjected to relative humidity of more than 95 % at higher temperatures. This may happen when the equipment is placed in enclosures, such as vehicles, tents or aircraft cockpits, since this can result in intense heating through solar radiation while, because of inadequate ventilation, any humidity that may be developed will be retained permanently within the interior.

In rooms having several heat sources, temperatures and relative humidity may vary in different parts of the room.

To take these climatic factors over the lifetime of the product into account, environmental testing includes the practice of accelerated testing (see 6).

Atmospheric pollution can intensify the effects of a damp climate on products. Attention is drawn to this fact because of its general importance, although pollutants are not contained in the atmospheres used for damp heat testing. If the effects of pollutants, for example corrosion and mould growth, are to be investigated, a suitable test from the IEC 60068-2 series should be used.

ENVIRONMENTAL TESTING –

Part 3-4: Supporting documentation and guidance – Damp heat tests

1 Scope

This part of IEC 60068 provides the necessary information to assist in preparing relevant specifications, such as standards for components or equipment, in order to select appropriate tests and test severities for specific products and, in some cases, specific types of application.

The object of damp heat tests is to determine the ability of products to withstand the stresses occurring in a high relative humidity environment, with or without condensation, and with special regard to variations of electrical and mechanical characteristics. Damp heat tests may also be utilized to check the resistance of a specimen to some forms of corrosion attack.

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

IEC 60068-2-1, *Environmental testing – Part 2: Tests. Tests A: Cold*

IEC 60068-2-14, *Environmental testing - Part 2-14: Tests - Test N: Change of temperature*

IEC 60068-2-17, *Environmental testing - Part 2-17: Tests - Test Q: Sealing*

IEC 60068-2-30, *Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-38, *Environmental testing - Part 2-38: Tests - Test Z/AD: Composite temperature/ humidity cyclic test*

IEC 60068-2-39, *Environmental testing - Part 2-39: Tests and Guidance: Combined temperature or temperature and humidity with low air pressure tests*

IEC 60068-2-66, *Environmental testing - Part 2: Test methods - Test Cx: Damp heat, steady state (unsaturated pressurized vapour)*

IEC 60068-2-67, *Environmental testing - Part 2-67: Tests - Test Cy: Damp heat, steady state, accelerated test primarily intended for components*

IEC 60068-2-78, *Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state*

3 Definitions

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

For the purpose of this part of IEC 60068, the following definitions apply.

NOTE A more detailed explanation of some phenomena is available in Annex A.2.1.

3.1

condensation

precipitation of water vapour on a surface when the surface temperature is lower than the dewpoint temperature of the ambient air whereby water is transformed from vapour to the liquid state of aggregation

3.2

adsorption

adherence of water vapour molecules to a surface when the surface temperature is higher than the dewpoint temperature

3.3

absorption

accumulation of water molecules within a material

3.4

diffusion

transportation of water molecules through a material, induced by a partial pressure difference

Note 1 to entry: Diffusion results in a balance of partial pressures, whilst flow (such as through leaks, when the dimensions of such leaks are great enough to provide viscous or laminar flow) always finally results in the balance of the total pressures.

3.5

breathing

exchange of air between a hollow space and its surroundings, induced by changes of temperature or pressure

4 Procedures for the production and control of humidity

4.1 General

There are a great number of humidity test chambers available, equipped with different methods of humidity generation and of humidity control.

The water resistivity shall be between 2 000 Ωm to 500 Ωm corresponding to a conductivity between 5 μS/cm to 20 μS/cm at +23 °C. Before the water is placed in the humidifier or storage tank of the chamber, all internal parts of the chamber shall be cleaned.

NOTE A conductivity lower than 5 μS/cm might harm the humidifier system. A conductivity higher than 20 μS/cm can cause limescale or other mineral deposits to form on parts of the humidifier system or specimen.

The chamber and its internal parts may be cleaned using diluted laboratory cleaning agent and a soft brush and rinsed with distilled or deionized water. It is recommended that the chamber is cleaned prior to each test.

During cleaning, it is recommended that gloves and a protective mask are used as a precaution against the contamination of the test chamber and of the internal fixtures. The test facility should be operated in a clean area.

Unless otherwise specified, the test specimen should be tested in the as-delivered condition without any special treatment. Test items that are specially cleaned before the test may not give an indication of effects which occur in service.

Sensors should not be modified during cleaning procedure and some sensors (e.g. capacitive humidity sensors) might be damaged by some cleaning agents. Therefore, it must be ensured that the used cleaning agent is compatible.

In the following subclauses, only the principal methods of generation of humidity are mentioned.

4.2 Injection of water (spraying)

Water is atomized to very fine particles or droplets.

The spray produced in this way moistens the air stream before it enters the working space, the greater part of the droplets evaporating on the way. Small droplets of water may remain in the airflow.

Direct water injection into the working space must be avoided, otherwise liquid water can accumulate on the test specimen.

These simple systems provide rapid humidification and require little maintenance. Examples for such humidification systems are ultrasonic humidifiers and atomization by means of a nozzle (one- and two-substance nozzles).

4.3 Injection of water vapour (steam)

Evaporated water (steam) is blown into the working space of the chamber.

This system gives rapid humidification and is easier maintained (steam valve). However, the resultant heat input may necessitate additional cooling with possible dehumidification effects.

4.4 Saturation type

Air is blown through a vessel containing water, thus becoming saturated with vapour.

At a fixed airflow, the humidity is controlled by changing the water temperature. If an increase of humidification is produced by increasing the water temperature, this may cause a temperature rise in the working space and, due to the thermal capacity of the water, the response time may be longer. This may necessitate additional cooling with possible de-humidification effects.

If bubbles occur, they may produce a small amount of spray when bursting.

4.5 Surface evaporation

The air is humidified by passing it over a large surface area of water. Different methods are used, for example repeated air flow over standing water or water-jet scrubbing over a vertical surface with the air stream in counter current. In this system, the spray is minimized. The humidity is controlled by changing the water temperature. Due to the thermal capacity of the water, the response time may be longer.

4.6 Aqueous solutions

Relative humidity is generated over standardized aqueous solutions of salts in small, sealed chambers at constant temperature. This system is not appropriate for heat-dissipating specimens or for specimens absorbing large quantities of moisture.

NOTE Salt particles may be deposited on the surface of the test specimens. In some cases, for example with ammonium salts, these particles may be hazardous to health and may cause stress corrosion in some materials.

4.7 Dehumidification

In order to control humidity, various dehumidification methods are used, including cold surfaces, injection of dry air, desiccants etc.

NOTE Even with temperature tests, condensation can occur on the test specimen, when humidity in the test space condenses on the cold test specimen during heating.

4.8 Control of humidity

The size of the chamber, the humidifier and the response time of temperature/humidity sensors have important influences on the possible uncertainties of the humidity control system. The chamber performance can degrade, and therefore uncertainty is affected by the quality of maintenance.

NOTE The humidity can be measured using e.g. psychrometers or capacitive sensors. With capacitive sensors, the dielectric may drift (e.g. due to acetic acid), regular reference measurement is recommended, because outgassing test specimens could damage the measuring system.

5 Physical appearance of the effects of humidity

5.1 Condensation

The dewpoint temperature depends on the content of water vapour in the air. A direct relationship exists between dewpoint, absolute humidity and vapour pressure.

When introducing a specimen into a test chamber condensation may occur if its surface temperature is lower than the dewpoint temperature of the chamber air. It may be necessary to pre-heat the specimen or dehumidify the chamber air according to the test parameters if condensation has to be prevented.

When condensation is required on the specimen during the conditioning period, the temperature and the water content of the air shall be raised so that the dewpoint temperature of the air becomes higher than the surface temperature of the specimen.

An example for a test where such condensation may be induced is IEC 60068-2-38 Test Z/AD.