SLOVENSKI STANDARD
oSIST prEN IEC 60068-2-1:2024

01-junij-2024

Okoljski preskusi - 2-1. del: Preskusi - Preskusi a: Mraz

Environmental testing - Part 2-1: Tests - Test a: Cold

Umgebungseinflüsse - Teil 2-1: Prüfverfahren - Prüfung A: Kälte

Essais d'environnement - Partie 2-1: Essais - Essai a: Froid

Ta slovenski standard je istoveten z: **prEN IEC 60068-2-1:2024**

ICS:

19.040	Preskušanje v zvezi z okoljem	Environmental testing

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COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 60068-2-1 ED7**	
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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

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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.

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TITLE:

Environmental testing - Part 2-1: Tests - Test A: Cold

PROPOSED STABILITY DATE: 2031

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ENVIRONMENTAL TESTING –

Part 2-1: Tests – Test A: Cold

FOREWORD

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International Standard IEC 60068-2-1 has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test.

This seventh edition cancels and replaces the sixth edition published in 2007.

The major changes with regard to the previous edition concern:

a) Revision of the introduction and scope;
b) Including new figures and symbols for clarification purposes;
c) Clarification of the test procedure for ascertaining high or low air velocity in the test chamber;
d) Clarification of the requirements for measuring points around, on or in specimens;
e) Reintroducing the nomogram procedure for the correction of the conditioning temperature when testing with high air velocity (Test Ad and Test Ae);
f) Revision of the temperature tolerances of the test;
g) Revision of standardized requirements for the relevant specification and test report;
h) Including the advantages and disadvantages of the testing procedures.

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

FDIS	Report on voting

137
138 Full information on the voting for the approval of this standard can be found in the report on
139 voting indicated in the above table.

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

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

143 The committee has decided that the contents of this publication will remain unchanged until the
144 maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data
145 related to the specific publication. At this date, the publication will be

146 • reconfirmed,
147 • withdrawn,
148 • replaced by a revised edition, or
149 • amended.

150

INTRODUCTION

The working ranges and performance of equipment and machinery can be significantly affected or limited by ambient temperatures. The degree of this influence may depend on temperature distributions of the environment as well as temperatures on components of the device itself. In order to determine the existing degree of influence and to ensure that the device is suitably designed for its ambient conditions, tests are carried out with cold and/or dry heat (IEC 60068-2-2). During the test, it is to be taken into account whether the tested device itself emits heat or not.

Reducing the air flow within the test chamber may be required to reduce the air velocity at heat-dissipating specimens. This can be achieved by using air baffles or adjusting the air flow of the test chamber. If the reduction of air velocity is not practical or possible due to the required test conditions, this document provides an alternative test procedure without the need for adjustable air flow as well as guidance on selecting the applicable test procedure.

ENVIRONMENTAL TESTING –

Part 2-1: Tests – Test A: Cold

1 Scope

This document specifies temperature tests at low temperatures, generally referred to as “cold tests”, that are applicable to non-heat-dissipating and heat-dissipating specimens, to determine the ability of components, equipment, or other articles to be used, transported or stored at low temperature.

This document is applicable to energized as well as not energized specimens, that normally achieve temperature stability during the test. The specimens can be packed or unpacked in the test.

This document does not specify tests to determine the impact of temperature changes on specimens.

2 Normative references

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

IEC 60068-5-2, *Environmental testing – Part 5: Guide to drafting of test methods – Terms and definitions*

3 Terms and definitions

For the purposes of this document, the definitions given in IEC 60068-1 and IEC 60068-5-2, as well as the following definitions, apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
low air velocity
velocity of conditioning airflow within a working space which is sufficient to maintain conditions but low enough so that the temperature at any point on the test specimen is not reduced by more than 5 K by the influence of the circulation of the air

3.2
high air velocity
velocity of conditioning airflow within a working space, which in order to maintain conditions, also reduces the temperature at the relevant point or points on the test specimen by more than 5 K by the influence of the circulation of the air

4 Symbols

T_A	low conditioning temperature
$T_{A'}$	corrected low conditioning temperature (nomogram procedure)
T_{STD}	temperature of standard atmospheric conditions for measurement and test (15 °C to 35 °C)
T_{Ca}	measured ambient temperature in the vicinity of the specimen, either in the test chamber or the laboratory air, without forced convection (see 5.2)
T_{Cb}	measured test chamber temperature with forced convection (see 5.2)
T_S	temperature of the energized specimen at the specified conditioning temperature
T_{Sa}	temperature of the energized specimen at the temperature of standard atmospheric conditions without forced convection (see 5.2)
T_{Sb}	temperature of the energized specimen at the temperature of standard atmospheric conditions with forced convection (see 5.2)
ΔT_S	temperature difference between the energized specimen and the air
$\Delta T_{Sa/b}$	temperature difference between the energized specimen without forced convection (T_{Sa}) and with forced convection (T_{Sb}) at the temperature of standard atmospheric conditions
dT_R	temperature change rate
t_s	stabilization time of specimen temperature before exposure to the low conditioning temperature
t_{s0}	stabilization time of specimen temperature after energizing
t_1	exposure time of the specimen to the low conditioning temperature

5 Application of tests for non-heat-dissipating specimens versus tests for heat-dissipating specimens

5.1 General

This test is subdivided as follows:

− Test Ab, Cold for non-heat-dissipating specimens;

− Test Ad, Cold for heat-dissipating specimens that are energized after initial temperature stabilization;

− Test Ae: Cold for heat-dissipating specimens that are energized throughout the test.

A specimen, while energized, is considered to be heat-dissipating only if the hottest point on its surface or any other relevant point, measured in free air conditions (i.e., with low air velocity circulation), is more than 5 K above the ambient temperature of the surrounding atmosphere after temperature stability has been reached (see 3.11 of IEC 60068-1).

NOTE 1 In some cases, for example for test specimens with air-permeable housings, the relevant measuring points can be located inside the external housing.

Tests of heat-dissipating and non-heat-dissipating specimens generally differ in the air velocity applied. Non-heat-dissipating specimens are typically tested at high air velocity to reduce the time required to reach temperature stability. Heat-dissipating specimens are generally tested at low air velocity to allow for the formation of local hotspots similar to those that would appear

in installed applications. Annex A gives an overview of the relevant test conditions and shows the relationship of suffixes between Test A: Cold and Test B: Dry heat.

Testing with low air velocity may not apply to heat-dissipating specimens with an external housing and built-in fan, provided that the representative measuring point is located at a point inside the external housing which is not affected by external air movement. It should be ensured that the induced air movement does not interfere with the operation of the built-in fan, if not specified otherwise.

NOTE 2 The induced air movement can have an influence on the operation of a built-in fan if both air movements act either in the same or opposite direction.

Where it is not feasible to test heat-dissipating specimens with low air velocity, e.g., due to the required test conditions, Annex B gives an alternative procedure for testing with high air velocity.

The relevant specification shall state which test procedure shall be applied. The advantages and disadvantages of both test procedures should be considered when specifying the intended test. For more information on these advantages and disadvantages, see Annex C.

When the relevant specification calls for a storage or transportation test or does not specify an applied load during the test, Test Ab applies.

5.2 Ascertaining high or low air velocity in the test chamber

To ascertain, whether high or low air velocity prevails in the test chamber, the cooling effect of the air movement on the specimen shall be determined. Therefore, the specimen's temperature shall be measured with and without forced convection by the test chamber's fan. Both temperatures shall be compared in accordance with the following procedure. It is recommended to ascertain the prevailing air velocity in the test chamber for every specimen, since the occurring cooling effect can vary for different specimens.

Under standard atmospheric conditions for measurements and test (see IEC 60068-1) with an air velocity <0,2 m/s, achieved without forced convection, the heat-dissipating specimen shall be switched on or electrically loaded as specified for the low temperature at which the test is to be carried out.

When temperature stability of the specimen has been reached, the temperature of a representative point around or on the specimen and the ambient temperature T_{Ca} shall be measured using a suitable monitoring device. Either the hottest point or any point of particular interest on the specimen may be used as representative point for measuring the temperature of the energized specimen T_{Sa} without forced convection.

NOTE 1 To determine the representative point, an infrared camera can be helpful.

The temperature rise that occurs at each point shall then be noted. This measurement may be done in an open test chamber (e.g. with an opened door or a lifted test space enclosure, if applicable) or outside of the test chamber to prevent an improper temperature rise of the surrounding air.

NOTE 2 The operation of a heat-dissipating specimen in a closed and switched-off test chamber leads to a temperature rise within the test space. In a small test chamber or with a large heat load, the temperature rise can influence the measurement result.

NOTE 3 The temperature T_{Ca} is the temperature in the vicinity of the specimen during the measurement without forced convection. It can be the temperature in the test chamber or the temperature of the laboratory air, depending on where the test was done.

The specimen is then introduced into the test chamber, if applicable, and the test chamber is switched on. The temperature is set to the previously recorded temperature T_{Ca}.