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INTERNATIONAL STANDARD

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

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FOREWORD

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

This seventh edition cancels and replaces the sixth edition published in 2007. This edition constitutes a technical revision.

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

a) revision of the introduction and scope;
b) inclusion of 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) reintroduction of 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) inclusion of the advantages and disadvantages of the testing procedures.

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

Draft	Report on voting
104/1107/FDIS	104/1127/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all the 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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,

– withdrawn, or

– revised.

INTRODUCTION

The working ranges and performance of equipment and machinery (a device) can be significantly affected or limited by ambient temperatures. The degree of this influence can 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 or dry heat (IEC 60068-2-2), or both. During the test detailed in this document, it will be taken into account whether the tested device itself emits heat or not.

Reducing the air flow within the test chamber can 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.

1 Scope

This part of IEC 60068 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 non-energized specimens that normally achieve temperature stability during the test. The specimens can be subject to test in packed condition (to simulate transportation and storage) or in unpacked condition (to simulate use).

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

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

IEC 60721 (all parts), *Classification of environmental conditions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60068-1, IEC 60068-5-2 and the following 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 the relevant point or relevant points on the test specimen is not reduced by more than 5 K by the influence of the circulation of the air

Note 1 to entry: The relevant points to be considered are determined by the relevant test specification.

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 relevant 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 [°C]
$T_{A'}$	corrected low conditioning temperature (nomogram procedure) [°C]
T_{STD}	temperature of standard atmospheric conditions for measurement and tests (15 °C to 35 °C) [°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) [°C]
T_{Cb}	measured test chamber temperature with forced convection (see 5.2) [°C]
T_S	temperature of the energized specimen at the specified conditioning temperature [°C]
T_{Sa}	temperature of the energized specimen at the temperature of standard atmospheric conditions without forced convection (see 5.2) [°C]
T_{Sb}	temperature of the energized specimen at the temperature of standard atmospheric conditions with forced convection (see 5.2) [°C]
ΔT_S	temperature difference between the energized specimen and the air [K]
$\Delta T_{Sa/b}$	temperature difference between the energized specimen without forced convection (T_{Sa}) and with forced convection (T_{Sb}) at the temperature of standard atmospheric conditions [K]
$\mathrm{d}T_R$	temperature change rate [K/min]
t_s	stabilization time of specimen temperature before exposure to the low conditioning temperature [min or h]
t_{s0}	stabilization time of specimen temperature after energizing [min or h]
t_1	exposure time of the specimen to the low conditioning temperature [h]

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 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.