BRITISH STANDARD

BS EN
60068-2-2:2007

Environmental testing —

Part 2-2: Tests — Test B: Dry heat

The European Standard EN 60068-2-2:2007 has the status of a British Standard

ICS 19.040

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 60068-2-2:2007. It is identical to IEC 60068-2-2:2007. It supersedes BS EN 60068-2.2:1993 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GEL/104, Environmental conditions, classification and testing.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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(IEC 60068-2-2:2007)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

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Foreword

The text of document 104/412/FDIS, future edition 5 of IEC 60068-2-2, prepared by IEC TC 104, Environmental conditions, classification and methods of test, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60068-2-2 on 2007-09-01.

This European Standard supersedes EN 60068-2-2:1993 + A1:1993 + A2:1994.

The main changes from EN 60068-2-2:1993 + A1:1993 + A2:1994 are as follows: Tests Ba and Bc have been deleted since they were more severe tests than Test Nb, EN 60068-2-14: Change of temperature. Secondly it was considered justified to delete the 3 % value on the temperature difference between the chamber air and the wall temperatures. Thirdly it is proposed that the test specimen be powered throughout the test where required; and, finally, the annexes have been removed.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2008-06-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2010-09-01

Annex ZA has been added by CENELEC.

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Endorsement notice

The text of the International Standard IEC 60068-2-2:2007 was approved by CENELEC as a European Standard without any modification.

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CONTENTS

INTRODUCTION

RELATIONSHIP OF SUFFIXES BETWEEN TESTS A: COLD, AND TESTS B: DRY HEAT

The relationship of suffixes between Tests A: Cold, and Tests B: Dry heat, is shown in the following table:

	Tests A: Cold			Tests B: Dry heat		
Suffix letter	Specimen type	Temperature change	Air velocity	Specimen type	Temperature change	Air velocity
a	Withdrawn			Withdrawn		
b	Non heat	Gradual	High preferred	Non heat	Gradual	High preferred
c	Withdrawn			Withdrawn		
d	Heat dissipating	Gradual	Low preferred	Heat	Gradual	Low preferred
e	Heat dissipating powered throughout	Gradual	Low preferred	Heat, powered throughout	Gradual	Low preferred

ENVIRONMENTAL TESTING –

Part 2-2: Tests – Test B: Dry heat

1 Scope

This standard deals with dry heat tests applicable both to heat-dissipating and non heat-dissipating specimens. For non heat-dissipating specimens, Tests Bb and Bd do not deviate essentially from earlier issues.

The object of the dry heat test is limited to the determination of the ability of components, equipment or other articles to be used, transported or stored at high temperature.

These dry heat tests do not enable the ability of specimens to withstand or operate during the temperature variations to be assessed. In this case, it would be necessary to use IEC 60068-2-14 Test N: Change of temperature.

The dry heat tests are subdivided as follows:

Dry heat test for non heat-dissipating specimens

– with gradual change of temperature, Bb.

Dry heat tests for heat-dissipating specimens

– with gradual change of temperature, Bd;
– with gradual change of temperature, specimen powered throughout, Be.

The procedures given in this standard are normally intended for specimens that achieve temperature stability during the performance of the test procedure.

2 Normative references

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-3-1, *Environmental testing – Part 3: Background information – Section one: Cold and dry heat tests*

IEC 60068-3-5, *Environmental testing – Part 3-5: Supporting documentation and guidance – Confirmation of the performance of temperature 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 60068-5-2, *Environmental testing – Part 5-2: 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 definitions in IEC 60068-5-2 and the following definitions apply.

3.1
low air velocity in the working space
the 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 (if possible, not more than 0,5 m/s)

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

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

4.1 General

The temperature chamber(s) shall be constructed and verified in accordance with specifications IEC 60068-3-5 and IEC 60068-3-7.

Further guidance for the dry heat and cold tests can be found in IEC 60068-3-1, and general guidance in IEC 60068-1.

A specimen is considered heat-dissipating only if the hottest point on its surface, measured in free air conditions (i.e. low air velocity circulation), is more than 5 K above the ambient temperature of the surrounding atmosphere after temperature stability has been reached (see 4.8 of IEC 60068-1). When the relevant specification calls for a storage or transportation test or does not specify an applied load during the test, the Dry Heat Test Bb will apply.

4.2 Ascertaining high or low air velocity in the test chamber

Under standard atmospheric conditions for measurements and test (see IEC 60068-1) with an air velocity <0,2 m/s, the specimen shall be switched on or electrically loaded as specified for the high temperature at which the test is to be carried out.

When temperature stability of the specimen has been reached, the temperature of a number of representative points around or on the specimen shall be measured using a suitable monitoring device. The temperature rise that occurs at each point shall then be noted.

The chamber air flow is switched on and, once temperature stability has been achieved, the temperature of the representative points shall again be measured. If the temperatures differ from those measured without air flow by more than 5 K (or a value stated by the relevant specification) this value shall be noted in the test report and the test chamber is considered to have high velocity circulation. The specimen is then switched off and any loading conditions removed.

4.3 Application of tests with sudden change of temperature versus tests with gradual change of temperature

In Tests Bb, Bd and Be with gradual change of temperature, the specimen is introduced into the test chamber, the latter being at the laboratory temperature. The temperature in the chamber is then increased gradually so as to cause no detrimental effects on the test specimen due to the temperature change.

4.4 Testing of heat-dissipating specimens

Tests Bd and Be describe procedures for testing heat-dissipating specimens with low air velocity circulation. This is to allow localised hot spots to develop within the specimen similar to those that would appear in installed applications.

4.5 Temperature monitoring

The air temperature in the chamber shall be measured by temperature sensors located at such a distance from the specimen that the effect of the dissipation is negligible. Suitable precautions should be taken to avoid heat radiation affecting these measurements. For more information see IEC 60068-3-5.

4.6 Packaging

For storage and transportation tests, equipment may be tested with its packaging in place. However, as these tests are steady state tests the equipment will eventually stabilise at chamber's temperature. Packaging shall be removed unless the relevant specification requires it to remain in place or heating elements are incorporated in the package.

4.7 Diagrammatic representations

To facilitate the choice of test method, a diagrammatic representation of the various procedures is given in Figure 1.

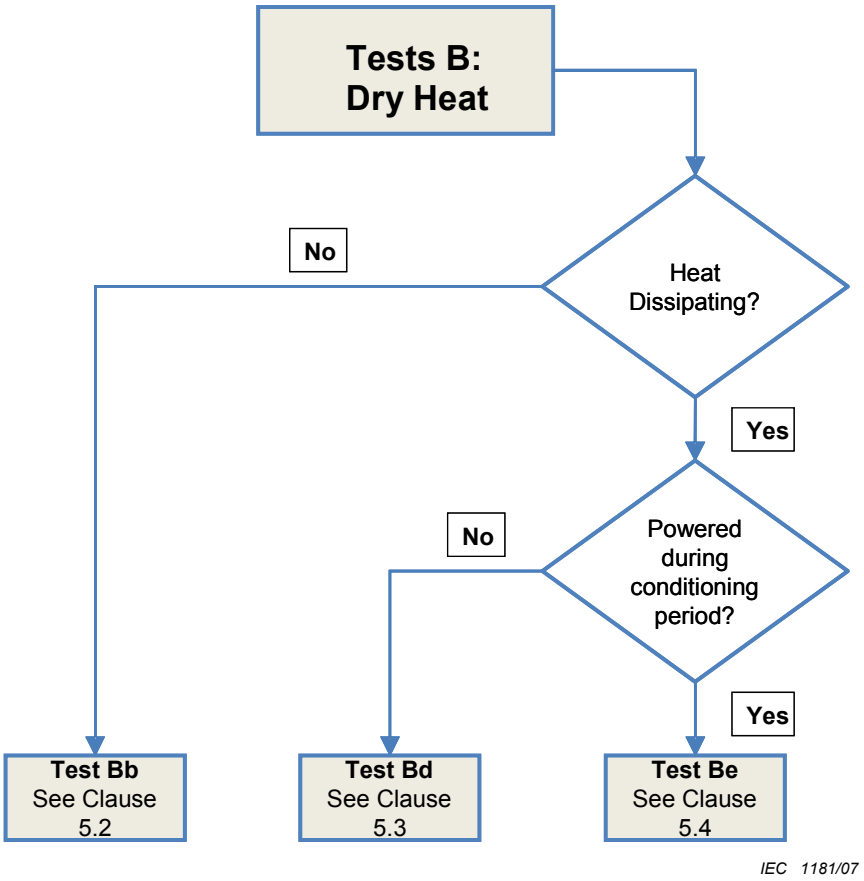

Figure 1 – Block diagram Tests B: Dry Heat

5 Test descriptions

5.1 General

Tests Bb, Bd, and Be are similar. Differences are noted in Subclauses 5.2.2, 5.3.2 and 5.4.2. All other portions of the tests are the same, starting with Clause 6. The rate of change of temperature within the chamber shall not exceed 1 K per minute, averaged over a period of not more than 5 min. The relevant specification shall define the functioning of the specimen under test.

Care shall be taken that any cooling devices of the specimen are in accordance with the prescription in the relevant specification.

5.2 Test Bb: Dry heat for non heat-dissipating specimens with gradual change of temperature

5.2.1 Object

This procedure is for non heat-dissipating specimens which are subjected to an elevated temperature for a time long enough for the specimen to achieve temperature stability.

5.2.2 General description

The specimen is introduced into the chamber, which is at the temperature of the laboratory. The temperature is then adjusted to the temperature appropriate to the degree of severity as specified in the relevant specification. After temperature stability of the test specimen has been reached, the specimen is exposed to these conditions for the specified duration. For specimens that are required to be operational (even though they do not meet the requirements of being heat dissipating) power shall then be applied to the specimen and a functional test is performed as necessary. A further period of stabilization may be necessary and the specimen shall then be exposed to the high temperature conditions for a duration as specified in the relevant specification.

Specimens under test are normally in non-operating conditions.

High air velocity circulation is normally used for this test.

5.3 Test Bd: Dry heat for heat-dissipating specimens with gradual change of temperature that are not powered during the conditioning period

5.3.1 Object

This procedure is for heat dissipating specimens which are subjected to an elevated temperature for a time long enough for the specimen to achieve temperature stability.

5.3.2 General description

If necessary, a test is performed to determine if the test facility fulfils the requirements of a low air velocity chamber or not. The specimen is introduced into the chamber, which is at the temperature of the laboratory. The temperature is then adjusted to the temperature appropriate to the degree of severity as specified in the relevant specification.

Low air velocity circulation is normally used for this test.

5.3.3 Energising the specimen

The specimen shall then be switched on or electrically loaded and checked to ascertain whether it is capable of functioning in accordance with the relevant specification.

The specimen shall remain in the operating condition in accordance with the duty cycle and at the loading condition (if applicable) as prescribed by the relevant specification.

After temperature stability of the test specimen has been reached, the specimen is exposed to these conditions for the duration as specified in the relevant specification. Low air velocity circulation is normally used for this test.

5.4 Test Be: Dry heat for heat-dissipating specimens with gradual change of temperature that are required to be powered throughout the test

5.4.1 Object

This procedure is for heat dissipating specimens which are subjected to an elevated temperature for a time long enough for the specimen to achieve temperature stability and which are required to be powered throughout the test period.

5.4.2 General description

If necessary, a test is performed to determine if the test facility fulfils the requirements of a low air velocity chamber or not. The specimen is introduced into the chamber, which is at the temperature of the laboratory. The specimen shall then be switched on or electrically loaded and checked to ascertain whether it is capable of functioning in accordance with the relevant specification.

The specimen shall remain in the operating condition in accordance with the duty cycle and at the loading condition (if applicable) as prescribed by the relevant specification.

The temperature is then adjusted to the temperature appropriate to the degree of severity as specified in the relevant specification.

After temperature stability of the test specimen has been reached, the specimen is exposed to these conditions for the specified duration.

The relevant specification shall define the functioning of the specimen under test.

Low air velocity circulation is normally used for this test.

6 Test procedure

6.1 Confirmation of performance

IEC 60068-3-5 provides guidance for the confirmation of performance of temperature test chambers. IEC 60068-3-1 provides general guidance for the performance of tests A and B.

The chamber shall be large enough compared with the size and amount of heat-dissipation of the test sample.

6.2 Working space

The dimensions of the test sample shall be such that it is entirely within the working space of the test chamber.

The temperature of the incident air delivered to the test specimen shall be within ± 2 K of test severity temperature during the steady state conditions. The air temperature in the working space shall be measured in accordance with Subclause 4.5.

NOTE Where due to the size of the chamber it is not feasible to maintain these tolerances, the tolerance may be widened to ±3 K up to 100 °C, ±5 K from 100 °C to 200 °C and ±10 K from 200 °C to 315 °C. When this is done, the tolerance used should be specified in the test report. The user should also specify the tolerance achieved at temperatures above 315 °C.

6.3 Thermal radiation

The ability of the specimen to transfer heat by thermal radiation shall be minimised. This will normally result in the screening of any heating or cooling elements from the specimen and ensuring that parts of the chamber surfaces are not significantly different in temperature from that of the conditioning air.

6.4 Mounting

The thermal conduction and other relevant characteristics of the mounting and connections of the test specimen should be specified in the relevant specification. When the test specimen is intended for use with specific mounting devices, these shall be used for testing.

6.5 Severities

6.5.1 General

The severities, as indicated by temperature and duration of exposure, shall be prescribed by the relevant specification. They shall be

a) chosen from the values given in 6.5.2 and 6.5.3; or

b) derived from the known environment if this gives significantly different values; or

c) derived from other known sources of relevant data (for example IEC 60721).

6.5.2 Temperature

+1 000 °C	+250 °C	+85 °C	+45 °C
+800 °C	+200 °C	+70 °C	+40 °C
+630 °C	+175 °C	+65 °C	+35 °C
+500 °C	+155 °C	+60 °C	+30 °C
+400 °C	+125 °C	+55 °C	
+315 °C	+100 °C	+50 °C	

6.5.3 Duration

2 h	72 h	168 h	336 h
16 h	96 h	240 h	1 000 h

When this testing procedure is used in connection with tests associated with endurance or reliability, due note shall be taken of IEC publications which give particular recommendations for durations for such tests.

6.6 Preconditioning

The relevant specification may call for a preconditioning.

6.7 Initial measurements

The initial state of the specimen shall be known. This may be achieved by visual inspection, and/or functional tests as required by the relevant specification.

6.8 Conditioning

6.8.1 Steady state conditions

The specimen shall then be exposed to the high temperature conditions for the duration as detailed in the relevant specification.

For the exceptional cases when the specimen does not achieve temperature stability, the duration of the test commences at the time that the specimen is energised. Such cases are typically caused by specimens having long duty cycles.

6.8.2 Absolute humidity

The absolute humidity shall not exceed 20 g of water vapour per cubic metre of air (corresponding to approximately 50 % relative humidity at 35 °C) the relative humidity shall not exceed 50 %.

6.9 Intermediate measurements

The relevant specification may call for loading and/or measurements during or at the end of conditioning while the specimen is still in the chamber. If such measurements are required, the relevant specification shall define the measurements and the period or periods after which they shall be carried out. For these measurements, the specimen shall not be removed from the chamber.

NOTE If it is desired to know the performance of the type of specimen before the end of the prescribed duration, one additional lot will be required for each specified duration. Recovery and final measurements should be performed separately for each lot.

6.10 Final temperature ramp

In case the specimen remains in operating or loaded conditions during the test, it shall be switched off or unloaded before the temperature is lowered with the exception of test Be in which the specimen shall remain operational throughout the recovery period.

At the end of the specified duration, the specimen shall remain in the chamber and the temperature shall be gradually lowered to a value lying within the limits of standard atmospheric conditions for testing. The rate of change of the temperature within the chamber shall not exceed 1 K per minute, averaged over a period of not more than 5 min.

6.11 Recovery

The specimen shall be subjected to the recovery procedure in the chamber or otherwise as appropriate.

The specimen shall then remain under standard atmospheric conditions for recovery for a period adequate for the attainment of temperature stability, with a minimum of 1 h.

If required by the relevant specification, the specimen shall be switched on or loaded and measured continuously during the recovery period.

If the standard conditions given above are not appropriate for the specimen to be tested, the relevant specification may call for other recovery conditions.

6.12 Specimen with artificial cooling

The relevant specification shall define the characteristics of the coolant supplied to the specimen. When the coolant is air, care shall be taken that the air is not contaminated by oil and dry enough to avoid moisture problems.

6.13 Final measurements

The specimen shall be visually inspected and such performance checks as are required by the relevant specification.

7 Information to be given in the relevant specification

When this test is included in the relevant specification, the following details shall be given as far as they are applicable:

a) preconditioning;
b) initial measurements;
c) details of mounting or supports;
d) state of specimen including cooling system during conditioning;
e) severity, temperature and duration of exposure;
f) the rate of change of temperature;
g) measurements and/or loading during conditioning;
h) recovery if non-standard;
i) final measurements;
j) any deviation in procedure as agreed upon between customer and supplier;
k) temperature difference if low air velocity was not established (see Subclause 4.2).

8 Information to be given in the test report

As a minimum, the test report shall show the following information:

1.	Customer	(name and address)
2.	Test laboratory	(name, address and details of accreditation - if any)
3.	Test dates	
4.	Type of test	(Bb, Bd, or Be)
5.	Purpose of test	(development, qualification etc.)
6.	Test standard, edition	(IEC 60068-2-2, edition *)
7.	Relevant laboratory test procedure	(code and issue)
8.	Test specimen description	(unique id, drawing, photo, quantity build status, etc.).
9.	Test chamber identity	(manufacturer, model number, unique id, etc.).
10.	Performance of test apparatus	(set point temperature control, air flow, etc.)
11.	Air velocity and direction	(air velocity and direction of incident air to the specimen)
12.	Uncertainties of measuring system	
13.	Calibration data	(last and next due date)
14.	Initial, intermediate and final measurements	
15.	Required severities	(from test specification)
16.	Test severities	(measuring points, data, etc.)
17.	Performance of test specimens	(results of functional tests, etc.)
18.	Observations during testing and actions taken	
19.	Summary of test	
20.	Distribution	

NOTE A test log should be written for the testing which can be attached to the report.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60068-1	1988	Environmental testing - Part 1: General and guidance	EN 60068-1[1)]	1994
IEC 60068-3-1	-[2)]	Environmental testing - Part 3: Background information - Section One: Cold and dry heat tests	EN 60068-3-1	1999[3)]
IEC 60068-3-5	-[2)]	Environmental testing - Part 3-5: Supporting documentation and guidance - Confirmation of the performance of temperature chambers	EN 60068-3-5	2002[3)]
IEC 60068-3-7	-[2)]	Environmental testing - Part 3-7: Supporting documentation and guidance - Measurements in temperature chambers for tests A and B (with load)	EN 60068-3-7	2002[3)]
IEC 60068-5-2	-[2)]	Environmental testing - Part 5: Guide to drafting of test methods - Terms and definitions	EN 60068-5-2	1999[3)]
IEC 60721	Series	Classification of environmental conditions	EN 60721	Series

[1)] EN 60068-1 includes A1:1992 to IEC 60068-1 + corr. October 1988.

[2)] Undated reference.

[3)] Valid edition at date of issue.

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