



SLOVENSKI STANDARD
SIST EN 60068-2-68:2001
01-september-2001

Environmental testing - Part 2: Tests - Test L: Dust and sand

Environmental testing -- Part 2: Tests - Test L: Dust and sand

Umweltprüfungen -- Teil 2: Prüfungen - Prüfung L: Staub und Sand

Essais d'environnement -- Partie 2: Essais - Essai L: Poussière et sable

Ta slovenski standard je istoveten z: EN 60068-2-68:1996

[SIST EN 60068-2-68:2001](https://standards.iteh.ai/catalog/standards/sist/e6c81722-970f-4287-82a1-3ebc73a23691/sist-en-60068-2-68-2001)

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19.040 Preskušanje v zvezi z Environmental testing
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EUROPEAN STANDARD
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EN 60068-2-68

April 1996

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Descriptors: Environmental testing, electrotechnical products, test methods, non-abrasive fine dust, free settling dust, blown dust and sand

English version

Environmental testing
Part 2: Tests - Test L: Dust and sand
(IEC 68-2-68:1994)

Essais d'environnement
Partie 2: Essais
Essai L: Poussière et sable
(CEI 68-2-68:1994)

Umweltprüfungen
Teil 2: Prüfungen
Prüfung L: Staub und Sand
(IEC 68-2-68:1994)

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This European Standard was approved by CENELEC on 1996-03-05. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of the International Standard IEC 68-2-68:1994, prepared by SC 50B, Climatic tests, of IEC TC 50, Environmental testing, was submitted to the formal vote and was approved by CENELEC as EN 60068-2-68 on 1996-03-05 without any modification.

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) 1997-03-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 1997-03-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annexes A and B are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 68-2-68:1994 was approved by CENELEC as a European Standard without any modification.

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In the official version, for annex B, Bibliography, the following note has to be added for the standard indicated:

[SIST EN 60068-2-68:2001](https://standards.iteh.ai/catalog/standards/sist/e6c81722-970f-4287-82a1-254761129688)
<https://standards.iteh.ai/catalog/standards/sist/e6c81722-970f-4287-82a1-254761129688>
IEC 947-1 NOTE: Harmonized as EN 60947-1:1991 (modified).



Annex ZA (normative)**Normative references to international publications
with their corresponding European publications**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529 + corr. May	1991 1993
IEC 721-2-5	1991	Classification of environmental conditions Part 2: Environmental conditions appearing in nature Section 5: Dust, sand, salt mist	HD 478.2.5 S1	1993

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Première édition
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Essais d'environnement –

Partie 2:

Essais –

Essai L: Poussière et sable

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Environmental testing –

SIST EN 60068-2-68:2001

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Part 2:

Tests –

Test L: Dust and sand

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

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Pour prix, voir catalogue en vigueur
For price, see current catalogue

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ENVIRONMENTAL TESTING –

Part 2: Tests –
Test L: Dust and sand

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 cooperation 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.
- 2) The formal decisions or agreements of the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

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International Standard IEC 68-2-68 has been prepared by sub-committee 50B; Climatic tests, of IEC technical committee 50: Environmental testing.

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

DIS	Report on voting
50B(CO)334	50B(CO)338

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

Annexes A and B are for information only.

INTRODUCTION

The tests described in this part of IEC 68-2 give information on effects for which the relevant specification may specify assessment criteria. Some of such effects are:

- a) ingress of dust into enclosures;
- b) change of electrical characteristics (for example, faulty contact, change of contact resistance, change of track resistance);
- c) seizure, or disturbance in motion of bearings, axles, shafts and other moving parts;
- d) surface abrasion (erosion);
- e) contamination of optical surfaces; contamination of lubricants;
- f) clogging of ventilating openings, bushings, pipes, filters, apertures necessary for operation etc.

Different tests have been specified to consider diversified aspects which may be used to verify constructional integrity of electrotechnical products or to simulate the conditions of operation in service.

The tests differ by the character of the air flow carrying the particulate matter, and by the type of such matter, resulting in a special methodology for each test.

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ENVIRONMENTAL TESTING –

Part 2: Tests – Test L: Dust and sand

1 General

This survey indicates the general structure of the dust/sand tests included in this publication. The structuring and a summary of the characteristics of the different tests are given in figure 1 and table 1. It should be noted that the dust test of IEC 529 has its equivalent in the proposed method La2. See also annex A.

1.1 Scope

This part of IEC 68-2 specifies test methods to determine the effects of dust and sand suspended in air, on electrotechnical products.

The test methods of this standard are not intended for the testing of air filters. Only method Lc2 is suitable for the simulation of the erosion effects of high velocity (more than 100 m/s) particles.

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1.2 Description of Test L (standards.iteh.ai)

The dust and sand test is structured into three groups:

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- La: *non-abrasive fine dust*. A test which is primarily oriented towards investigation of the seals of the test specimen. The test specimen is exposed to a very fine dust in the form of talc or an equivalent. The effects of temperature cycling resulting in a pressure difference between the inside and outside of the specimen may be reproduced.
- Lb: *free settling dust*. A test which is oriented towards investigation of the effects when simulating conditions at sheltered locations. The test specimen is exposed to a low-density dust atmosphere created by the intermittent injection of a small quantity of dust which is allowed to fall by gravity onto the specimen.
- Lc: *blown dust and sand*. A test which is oriented towards investigation of the seals and the effect of erosion when simulating outdoor and vehicle conditions. The test specimen is exposed to either a turbulent or a laminar air flow to which is added a quantity of dust, sand or a dust/sand mixture.

Table 1 – Summary of test characteristics

Procedure	Dust/sand type	Particle size	Dust/sand concentration	Notes
Test La				
Method La1	Talc or FE powder	<75 µm	600 g/m ² /h (grams per square metre per hour) deposit on reference surface	Test includes a cycling of the air pressure in the chamber
Method La2	Talc or FE powder	<75 µm	2 kg/m ³ (chamber volume)	Air pressure in the specimen may be reduced
Test Lb	Olivine or quartz or feldspar	<75 µm	6 g/m ² /d (grams per square metre per day) deposit on reference surface	Free settling dust
Test Lc				
Method Lc1	Olivine or quartz or feldspar	<75 µm or <150 µm or <850 µm	1 g/m ³ or 3 g/m ³ or 10 g/m ³	Blown dust and sand Recirculating chamber
Method Lc2	Olivine or quartz or feldspar	<75 µm or <150 µm or <850 µm	1 g/m ³ or 3 g/m ³ or 10 g/m ³	Free blowing dust

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2 Normative references [\(standards.iteh.ai\)](http://standards.iteh.ai)

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 68-2. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 68-2 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 529: 1989, *Degrees of protection provided by enclosures (IP code)*

IEC 721-2-5: 1991, *Classification of environmental conditions – Part 2: Environmental conditions appearing in nature – Section 5: Dust, sand, salt mist*

3 Definitions

For the purpose of this part of IEC 68-2 the following definitions apply.

3.1 dust: Particulate matter of unspecified origin or composition whose size ranges from 1 µm to 150 µm (see note to 3.7).

3.2 dust concentration: Total mass of dust particles per unit volume of air.

3.3 humidity: Relative humidity is defined as the ratio of the actual vapour pressure in the air at any temperature to the maximum of saturation vapour pressure at the same temperature.

3.4 hygroscopic: Having a tendency to absorb moisture.

3.5 particle size: General dimension of the dust and sand particles based on the premise that the particles are spheres; commonly measured by sieving, by calculating settling velocities, or by determining areas of microscopic images.

3.6 sand: Grains vary from spherical to angular whose size lies between 100 μm and 2 000 μm , but for environmental testing, the range is usually restricted from 150 μm to 850 μm (see note to 3.7).

3.7 sieve (square-meshed): Intended for the particle size analysis of the material to be sieved, which conforms to a test sieve standard specification.

NOTE - In test Lc of this standard the word "dust" has been used to include "sand".

4 Test La: non-abrasive fine dust

4.1 Method La1: cyclic air pressure

4.1.1 Object

The object of this test is to determine the degree of protection against ingress of fine dust into electrotechnical products.

4.1.2 General description

Method La1 is a dust test in which the specimen is exposed to a dust-laden air flow containing non-abrasive powder of particle size $<75 \mu\text{m}$ (see 4.3). The test does not simulate natural or induced environments.

A vertical air flow downwards is specified for the test.

For enclosures of a specific category the pressure in the dust chamber is varied cyclically in order to encourage the ingress of powder.

4.1.3 Description of test apparatus

The test chamber shall expose the test specimen to a mainly vertical, non-laminar air flow containing a specified quantity of test dust. For this purpose, the test dust shall be agitated and blown into a sealed chamber. It shall be possible to cycle the chamber pressure as required by 4.1.4.6.

Dust settled in the base of the test chamber shall be brought back into circulation.

The volume of the specimen shall be no more than 25 % of the test chamber volume and its base shall be no more than 50 % of the horizontal working space surface of the test chamber.

If the size of the specimen does not comply with this standard, the relevant specification shall prescribe which of the following procedures shall be applied:

- a) testing of individually enclosed sections of the product;
- b) testing of representative parts of the product comprising components such as doors; ventilating openings, seats, shaft seals etc, with the delicate parts of the product such as terminals, collector rings etc, in position at the time of testing;
- c) testing of smaller products having the same design details as full scale products.

An example of a suitable test apparatus is given in figure 3.

4.1.4 Test conditions

4.1.4.1 Test dust

The test dust consists of dry fine-granular non-abrasive powder which shall be able to pass through a square-meshed sieve with a nominal wire diameter of 50 μm and a nominal width between wires of 75 μm .

Talc can be used for this test as analysis shows that it meets these requirements (see 4.3.4.2).

The test dust shall not be used for more than 20 tests. Care should be taken to keep the powder dry to maintain its fine granularity. It shall be dried by heating for 2 h at +80 °C before use.

4.1.4.2 Dust concentration

The quantity of test dust used for the test shall be sufficient to obtain a uniform deposition on the reference surface in the chamber of (600 ± 200) g/m²/h.

4.1.4.3 Air flow

The air flow in the test chamber shall be mainly vertical from top to bottom and it should not be laminar.

4.1.4.4 Air velocity

The air velocity shall give the possibility to generate a homogeneous distribution of the dust in the test chamber.

4.1.4.5 Humidity

The relative humidity in the test chamber shall be less than 25 %. This may be achieved by raising the test chamber air temperature. (see clause A.3).

4.1.4.6 *Air pressure in the specimen*

Depending on the operating conditions there are two different categories of specimen enclosures.

Category 1: enclosures where an air pressure different from the environmental atmospheric air pressure may occur, for example caused by thermal cycling effects during operation.

Category 2: Enclosures where the air pressure is that of the ambient air pressure.

The relevant specification shall state the category of the enclosure and the pressure reduction.

4.1.4.6.1 A specimen with a category 1 enclosure shall be introduced into the test chamber and mounted in its normal operating position. It shall be submitted to periods of reduced pressure specified in figure 2. The pressure reduction below ambient shall be 2 kPa (20 mbar) or 5 kPa (50 mbar), as prescribed in the relevant specification.

The dust shall be injected during each single cycle as shown in figure 2.

4.1.4.6.2 A specimen with a category 2 enclosure shall be introduced into the test chamber and mounted in its normal operating position. The vacuum pump shall not be operating in such a case.

4.1.4.7 *Severities*

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The test severity defined by air pressure in the chamber and duration of test, depending on the category of enclosure (see 4.1.4.6) shall be prescribed by the relevant specification.

Category 1: pressure reduction of 2 kPa (20 mbar) or 5 kPa (50 mbar), as required by the relevant specification, for a duration of 2 h.

Category 2: atmospheric pressure for a duration of 4 h.

4.1.5 *Preconditioning*

The relevant specification may call for a preconditioning.

4.1.6 *Initial measurements*

The specimen shall be submitted to visual, dimensional and functional checks prescribed by the relevant specification.

4.1.7 *Testing*

The test chamber air shall be at a temperature high enough to ensure a relative humidity of 25 % or less. The specimen, while being at the ambient temperature of the laboratory, shall be introduced into the test chamber in the unpacked, switched-off, "ready for use" state, in its normal operating position or as otherwise specified in the relevant specification. In the case of multiple specimens, care shall be taken that the specimens neither touch each other nor shield each other against the influence of dust.