



SLOVENSKI STANDARD
SIST EN 60068-2-9:2001
01-september-2001

Environmental testing - Part 2: Tests - Guidance for solar radiation testing

Environmental testing -- Part 2: Tests - Guidance for solar radiation testing

Umweltprüfungen -- Teil 2: Prüfungen - Leitfaden für Prüfung S: Sonnenstrahlung

Essais d'environnement -- Partie 2: Essais - Guide pour l'essai de rayonnement solaire

Ta slovenski standard je istoveten z: EN 60068-2-9:1999

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ICS:

| | | |
|--------|-------------------------------|-----------------------|
| 19.040 | Preskušanje v zvezi z okoljem | Environmental testing |
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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 60068-2-9

November 1999

ICS 19.040

Supersedes HD 323.2.9 S2:1987

English version

Environmental testing
Part 2: Tests - Guidance for solar radiation testing
(IEC 60068-2-9:1975 + A1:1984)

Essais d'environnement
Partie 2: Essais - Guide pour l'essai
de rayonnement solaire
(CEI 60068-2-9:1975 + A1:1984)

Umweltprüfungen
Teil 2: Prüfungen - Leitfaden für
Prüfung S: Sonnenstrahlung
(IEC 60068-2-9:1975 + A1:1984)

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This European Standard was approved by CENELEC on 1999-10-01. 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, Czech Republic, 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 60068-2-9:1975 and its amendment 1:1984, prepared by IEC TC 50 (transformed into IEC TC 104 "Environmental conditions, classification and methods of test), was approved by CENELEC as HD 323.2.9 S2 on 1985-12-03.

This Harmonization Document was submitted to the formal vote for conversion into a European Standard and was approved by CENELEC as EN 60068-2-9 on 1999-10-01.

The following date was 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) 2000-10-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60068-2-9:1975 and its amendment 1:1984 was approved by CENELEC as a European Standard without any modification.

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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 60068-1 | | Environmental testing Part 1: General and guidance | EN 60068-1 | |
| IEC 60068-2-5 | | Part 2: Tests - Test Sa: Simulated solar radiation at ground level | EN 60068-2-5 | |

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(affiliée à l'Organisation Internationale de Normalisation — ISO)

NORME DE LA CEI

INTERNATIONAL ELECTROTECHNICAL COMMISSION

(affiliated to the International Organization for Standardization — ISO)

IEC STANDARD

Publication 68-2-9

Première édition — First edition

1975

Essais fondamentaux climatiques et de robustesse mécanique

Deuxième partie: Essais

Guide pour l'essai de rayonnement solaire
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Basic environmental testing procedures

Part 2: Tests

Guidance for solar radiation testing



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

BASIC ENVIRONMENTAL TESTING PROCEDURES

Part 2: Tests – Guidance for solar radiation testing

FOREWORD

- 1) 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.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

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PREFACE

This publication has been prepared by IEC Technical Committee No. 50, Environmental Testing.

A first draft was discussed at the meeting held in Leningrad in 1971, as a result of which a new draft, document 50(Central Office)171, was submitted to the National Committees for approval under the Six Months' Rule in July 1973.

The following countries voted explicitly in favour of publication:

| | |
|----------------|----------------------------|
| Australia | Norway |
| Belgium | Portugal |
| Canada | Romania |
| Czechoslovakia | South Africa (Republic of) |
| Denmark | Spain |
| Germany | Sweden |
| Hungary | Switzerland |
| India | Turkey |
| Israel | Union of Soviet |
| Italy | Socialist Republics |
| Japan | United Kingdom |
| Netherlands | United States of America |

HISTORICAL SURVEY OF GUIDANCE FOR SOLAR RADIATION TESTING

First edition (1975)

No previous editions of IEC Publication 68 have contained a solar radiation test.

For directly related specifications, see:

Publication 68-1: General.

Publication 68-2-5: Test Sa: Simulated Solar Radiation at Ground Level.

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BASIC ENVIRONMENTAL TESTING PROCEDURES

Part 2: Tests – Guidance for solar radiation testing

WARNING NOTE

Intending users of solar radiation tests are directed to the health hazards associated with tests of this nature and should therefore read Clause 9 of this publication and take particular note of its contents.

1. Introduction

This publication describes methods of simulation designed to examine the effect of solar radiation on equipment and components at the surface of the earth. The main characteristics of the environment to be simulated are the spectral energy distribution of the sun, as observed at the earth's surface, and the intensity of received energy, in combination with controlled temperature conditions. However, it may be necessary to consider combination of solar radiation – including sky radiation – with other environments, e.g. temperature, humidity, air velocity, etc.

2. Irradiance and spectral distribution of test source

The effect of radiation on the specimen(s) will depend on the level of irradiance and its spectral distribution.

2.1 Irradiance

The irradiance by the sun on a plane perpendicular to the incident radiation outside the earth's atmosphere at the mean earth-sun distance is known as the solar constant E_0 [12].*

The irradiance at the surface of the earth is influenced by the solar constant and the attenuation and scattering of radiation in the atmosphere. For test purposes, CIE Technical Committee No. 2.2 has recommended a value of 1.120 kW/m² for the global (total) radiation at the surface of the earth from sun and sky, with the sun at zenith; value based on a solar constant $E_0 = 1.35$ kW/m² [22].

2.2 Spectral distribution

The standard spectral distribution of the global radiation specified for this test, in accordance with the recommendations of the CIE [22], is given in Table I of Test Sa of IEC Publication 68-2-5. Where only the thermal effects of solar radiation are of interest, then the use of tungsten filament lamps may be permitted. However, it must be clearly understood that the spectral distribution of tungsten filament lamps differs markedly from that of natural solar radiation (see Figure 2, page 29) and the irradiance shall be adjusted in accordance with Sub-clause 2.3 below.

2.3 Irradiance to be used with other spectral distribution

If the source of radiation used for the test does not meet the standard spectral distribution given in Table I of Test Sa, e.g. where tungsten filament lamps are used (permissible if the test is solely to assess thermal effects), the irradiance shall be adjusted so that the heating effect is the same as if the test specimen (s) were irradiated by the global radiation of sun and sky. Therefore, the absorbed radiation from the test source shall be the same as for the global radiation of sun and sky, i.e.:

* All the numbers in square brackets [] refer to the Bibliography, pages 26 and 27.

$$E_{\text{ex}} = 1.120 \frac{\alpha_{\text{es}}}{\alpha_{\text{ex}}} \text{ kW/m}^2$$

where:

E_{ex} = irradiance from the test source

α_{ex} = absorptance factor of the specimen for the radiation from the test source

α_{es} = absorptance factor of the specimen for the global radiation of sun and sky

(See also Appendix A.)

3. Test procedure and duration

3.1 Consideration must be given to the duration of exposure and whether it should be continuous or intermittent. Three possible procedures are specified:

Procedure A

A 24 h cycle, with 8 h irradiation and 16 h darkness, repeated as required. (This gives a total irradiation of 8.96 kWh/m² per diurnal cycle, which approximates to the most severe natural conditions. Procedure A should be specified where the principal interest is in thermal effects.)

Procedure B

A 24 h cycle, with 20 h irradiation and 4 h darkness, repeated as required. (This gives a total irradiation of 22.4 kWh/m² per diurnal cycle and is applicable where the principal interest is in degradation effects.)

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Procedure C

Continuous irradiation, as required. (A simplified test, applicable where cyclic thermal stressing is unimportant and photochemical effects only are to be assessed. Also for the assessment of heating effects on specimens with low thermal capacity).

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3.2 The level of irradiance, as prescribed in Test Sa, is 1.120 kW/m² ± 10%. Acceleration of the test by increasing the irradiation above this level is not recommended. As stated above, the total daily irradiation approximating the most severe natural conditions is simulated by Procedure A with a duration of exposure to the standard irradiation conditions of 8 h per day. Thus, exposure for periods in excess of 8 h will effect acceleration over natural conditions. However, continuous exposure of 24 h per day, Procedure C, might mask any degradation effects of cyclic thermal stressing, and this procedure is therefore not generally recommended in this instance.

3.3 The duration called for will depend on the object of the test. Where the interest is in heating effects only, then three cycles should be adequate (except for large equipment which may require longer to attain maximum internal temperatures). A much longer test duration is necessary if degradation effects are to be assessed.

4. Other environmental factors to be considered

4.1 *Temperature within the enclosure*

The temperature within the enclosure during irradiation and darkness periods shall be controlled in accordance with the procedure (A, B or C) specified. The relevant specification shall state whether + 40 °C or + 55 °C is to be attained during irradiation, depending on the intended usage of the equipment or component.

4.2 *Humidity*

Different humidity conditions can markedly affect photochemical degradation of materials, paints, plastics, etc., but requirements are so varied that no attempt has been made here to give guidance on this matter. Individual requirements should be clearly stated in the relevant specification, e. g. a 4 h period of damp heat (40 ± 2 °C and 93% R.H. ± 3%) could be specified at the beginning of a test in accordance with Procedure B.