SLOVENSKI STANDARD
SIST EN 60068-3-3:2001

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Environmental testing - Part 3: Guidance - Seismic test methods for equipments

Environmental testing -- Part 3: Guidance - Seismic test methods for equipments

Umweltprüfungen -- Teil 3: Leitfaden - Seismische Prüfverfahren für Geräte

Essais d'environnement -- Partie 3: Guide - Méthodes d'essais sismiques applicables aux matériels

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19.040	Preskušanje v zvezi z okoljem	Environmental testing

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ENGLISH VERSION

Environmental testing
Part 3: Guidance
Seismic test methods for equipments
(IEC 68-3-3:1991)

Essais d'environnement
Troisième partie: Guide
Méthodes d'essais sismiques
applicables aux matériels
(CEI 68-3-3:1991)

Umweltprüfungen
Teil 3: Leitfaden
Seismische Prüfverfahren für
Geräte
(IEC 68-3-3:1991)

This European Standard was approved by CENELEC on 1993-03-09. 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

At the request of CENELEC Reporting Secretariat SR 50A, HD 323.3.3 S1:1991 (IEC 68-3-3:1991) was submitted to the CENELEC voting procedure for conversion into a European Standard.

The text of the International Standard was approved by CENELEC as EN 60068-3-3 on 9 March 1993.

The following dates were fixed:

- latest date of publication of an identical national standard	(dop)	1994-03-01
- latest date of withdrawal of conflicting national standards	(dow)	-

Annexes designated "normative" are part of the body of the standard. In this standard, annex ZA is normative.

ENDORSEMENT NOTICE

The text of the International Standard IEC 68-3-3:1991 was approved by CENELEC as a European Standard without any modification.

ANNEX ZA (normative)

OTHER INTERNATIONAL PUBLICATIONS QUOTED IN THIS STANDARD WITH THE REFERENCES OF THE RELEVANT EUROPEAN PUBLICATIONS

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

IEC Publication	Date	Title	EN/HD	Date
68-1	1988	Basic environmental testing procedures Part 1: General and guidance	HD 323.1 S2	1988
68-2-6	1982	Part 2: Tests - Test Fc and guidance: Vibration (sinusoidal)	HD 323.2.6 S2*	1988
68-2-47	1982	Mounting of components, equipment and other articles for dynamic tests including shock (Ea), bump (Eb), vibration (Fc and Fd) and steady-state acceleration (Ga) and guidance	EN 60068-2-47	1993
68-2-57	1989	Test Ff: Vibration - Time-history method	EN 60068-2-57	1993
68-2-59	1990	Test Fe: Vibration - Sine beat method	EN 60068-2-59	1993
Other publication quoted:				
ISO 2041	1975	Vibration and shock - Vocabulary		

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* HD 323.2.6 S2 includes A1:1983 + A2:1985 to IEC 68-2-6

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Essais d'environnement

Troisième partie:
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Environmental testing

Part 3:
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Seismic test methods for equipments

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ENVIRONMENTAL TESTING

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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.

PREFACE

This standard has been prepared by Sub-Committee 50A: Shock and vibration tests, of IEC Technical Committee No. 50: Environmental testing.

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

Six Months' Rule	Report on Voting
50A(CO)179	50A(CO)182

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

The following IEC publications are quoted in this standard:

Publications Nos. 68-1 (1988): Environmental testing, Part 1: General and guidance.

68-2: Part 2: Tests.

68-2-6 (1982): Test Fc and guidance: Vibration (sinusoidal).

68-2-47 (1982): Mounting of components, equipment and other articles for dynamic tests including shock (Ea), bump (Eb), vibration (Fc and Fd) and steady-state acceleration (Ga) and guidance.

68-2-57 (1989): Test Ff: Vibration - Time-history method.

68-2-59 (1990): Test Fe: Vibration - Sine-beat method.

Other document quoted:

ISO Standard 2041 (1975): Vibration and shock - Vocabulary.

ENVIRONMENTAL TESTING

Part 3: Guidance
Seismic test methods for equipments

Introduction

Guidance is included in each of the three test methods referred to in this standard but it is specific to the test method. The guidance in this standard is directed towards choosing the appropriate test method and applying it to seismic testing.

This standard is to be used in conjunctin wit IEC Publication 68-1.

SECTION ONE- GENERAL

1 Object

This guide applies primarily to electrotechnical equipments but its application can be extended to other equipments and to components.

The verification of the performance of an equipment by analysis or by a combination of testing and analysis may be acceptable but is outside the scope of this guide, which is restricted to verification based entirely upon data from dynamic testing.

This guide deals solely with the seismic testing of a full size equipment which can be tested on a vibration table. The seismic testing of an equipment is intended to demonstrate its ability to perform its required function during and/or after the time it is subjected to the stresses and displacements resulting from an earthquake.

The object of this guide is to present a range of methods of testing which, when prescribed by the relevant specification, can be applied to demonstrate the performance of equipments for which seismic testing is required with the main aim of achieving qualification.

> NOTE - Qualification by so-called "fragility-testing" is not considered to be within the scope of this guide which has been prepared to give generally applicable guidance on seismic testing and specifically on the use of IEC Publication 68-2 test methods.

The choice of the method of testing can be made according to the criteria described in this guide. The methods themselves are closely based on published IEC test methods.

This guide is intended for use by manufacturers to substantiate, or by users to evaluate and verify, the performance of an equipment.

2 General considerations

Two seismic classes have been established: a general seismic class and a specific seismic class. Neither of these classes can be considered to be more demanding than the other. The difference between the two classes lies in the availability of and/or the accuracy in defining the characteristics of the seismic environment. When high reliability safety equipment for a specified environment is required, such as safety related equipment in nuclear power plants, the use of precise data is necessary and, therefore, the specific seismic class is applicable and not the general seismic class. Appendix A contains a flow chart for the selection of the test class (general seismic class or specific seismic class) and four flow charts (A1 to A4) covering the possibilities discussed in this guide. To obtain the maximum advantage from this guide it is strongly recommended that the flow charts be studied very thoroughly.

2.1 *General seismic class*

This class covers equipments for which the relevant seismic motion does not result from a specific study taking into account the characteristics of the geographic location and of the supporting structure or building.

In the case of equipments in this class, the seismic motion is generally characterized by one datum which is a peak acceleration at the ground level. This acceleration is derived from the seismic data relative to the area of interest.

When an equipment is not mounted at ground level, the transmissibility of the building and/or the supporting structure should be taken into account.

2.2 *Specific seismic class*

This class covers the equipment for which the relevant seismic motion results from a specific study taking into account the characteristics of the geographic location and of the supporting structure or building.

For equipment in this class, the seismic motion is defined by response spectra (evaluated for different damping ratios) or by a time-history.

3 Definitions

The terms used in this standard are generally defined in ISO Standard 2041 or in IEC Publications 68-1, 68-2-6, 68-2-57 and 68-2-59. Where, for the convenience of the reader, a definition from one of these sources is included here, the derivation is indicated and departures from the definitions in those sources are also indicated.

The additional terms and definitions that follow are also applicable for the purpose of this standard.

3.1 **assembly:** Two or more devices sharing a common mounting or supporting structure.

3.2 **bandpass at 3 dB:** Frequency intervals defined by the points possessing an ordinate larger than or equal to $\sqrt{2}/2$ times the maximum value of the plot (see Figure 1).

3.3 **basic response spectrum:** Unmodified response spectrum defined by the characteristics of the building, its floor level, damping ratio, etc. and obtained from a specific ground motion (see Figure 1).

NOTE - The basic response spectrum is generally of the narrow band type at floor level.

3.4 **broad-band response spectrum:** Response spectrum that describes the motion indicating that a number of interacting frequencies exist which must be treated as a whole (see Figure 2c).

NOTE - The bandwidth is normally greater than one octave.

3.5 **critical frequency** (definition technically equivalent to that in Sub-clause 8.1 of IEC Publication 68-2-6): Frequencies at which:

- malfunctioning and/or deterioration of performance of the specimen which are dependent on vibration are exhibited, and/or
- mechanical resonances and/or other response effects occur, for example chatter.

3.6 **crossover frequency** (definition technically equivalent to that of ISO 2041): Frequency at which the characteristic of a vibration changes from one relationship to another.

NOTE - For example, a crossover frequency may be that frequency at which the vibration amplitude changes from a constant displacement value versus frequency to a constant acceleration value versus frequency.

3.7 **damping** (not identical with ISO 2041 definitions): Generic term ascribed to the numerous energy dissipation mechanisms in a system. In practice, damping depends on many parameters, such as the structural system, mode of vibration, strain, applied forces, velocity, materials, joint slippage, etc.

3.7.1 **critical damping:** Minimum viscous damping that will allow a displaced system to return to its initial position without oscillation.

3.7.2 **damping ratio:** Ratio of actual damping to critical damping in a system with viscous damping.

3.8 **direction factor:** Factor taking account of the difference in magnitude at ground level that normally exists between the horizontal and vertical accelerations resulting from earthquakes.