IEC 60068-2-64

Edition 2.1 2019-10
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Environmental testing –
Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance

Essais d'environnement –
Partie 2-64: Essais – Essai Fh: Vibrations aléatoires à large bande et guide

IEC 60068-2-64:2008-04+AMD1:2019-10 CSV(en-fr)

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ELECTROTECHNICAL
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ICS 19.040 ISBN 978-2-8322-7498-9

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VERSION REDLINE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 60068-2-64 edition 2.1 contains the second edition (2008-04) [documents 104/456/FDIS and 104/459/RVD] and its amendment 1 (2019-10) [documents 104/848/FDIS and 104/855/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60068-2-64 has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test.

This second edition constitutes a technical revision.

The major changes with regard to the previous edition concern the removal of Method 1 and Method 2, replaced by a single method, and replacement of Annex A with suggested test spectra and removal of Annex C.

Also included in this revision is the testing of soft packed specimens.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

It has the status of a basic safety publication in accordance with IEC Guide 104.

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 the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

This part of IEC 60068 deals with broadband random vibration testing intended for general application to components, equipment and other products, hereinafter referred to as ”specimens”, that may be subjected to vibrations of a stochastic nature. The methods and techniques in this standard are based on digital control of random vibration. It permits the introduction of variations to suit individual cases if these are prescribed by the relevant specification.

Compared with most other tests, test Fh is not based on deterministic but on statistical techniques. Broad-band random vibration testing is therefore described in terms of probability and statistical averages.

It is emphasized that random testing always demands a certain degree of engineering judgement, and both supplier and purchaser should be fully aware of this fact. The writer of the relevant specification is expected to select the testing procedure and the values of severity appropriate to the specimen and its use.

The test method is based primarily on the use of an electrodynamic or a servo-hydraulic vibration generator with an associated computer based control system used as a vibration testing system.

The traditional general purpose broad-band random vibration test utilizes waveforms with a Gaussian distribution of amplitudes. However, when so specified, this test procedure can also be utilized with random vibration tests with a non-Gaussian distribution of amplitudes. Such tests are sometimes alternatively known as high kurtosis tests.

Annexes A and B are informative annexes giving examples of test spectra for different environmental conditions, a list of details to be considered for inclusion in specifications and guidance.

Annex C is an informative annex giving information on non-Gaussian distribution/high kurtosis tests.

ENVIRONMENTAL TESTING –

Part 2-64: Tests-Test Fh: Vibration, broadband random and guidance

1 Scope

This part of IEC 60068 demonstrates the adequacy of specimens to resist dynamic loads without unacceptable degradation of its functional and/or structural integrity when subjected to the specified random vibration test requirements.

Broadband random vibration may be used to identify accumulated stress effects and the resulting mechanical weakness and degradation in the specified performance. This information, in conjunction with the relevant specification, may be used to assess the acceptability of specimens.

This standard is applicable to specimens which may be subjected to vibration of a stochastic nature resulting from transportation or operational environments, for example in aircraft, space vehicles and land vehicles. It is primarily intended for unpackaged specimens, and for items in their transportation container when the latter may be considered as part of the specimen itself. However, if the item is packaged, then the item itself is referred to as a product and the item and its packaging together are referred to as a test specimen. This standard may be used in conjunction with IEC 60068-2-47:2005, for testing packaged products.

If the specimens are subjected to vibration of a combination of random and deterministic nature resulting from transportation or real life environments, for example in aircraft, space vehicles and for items in their transportation container, testing with pure random may not be sufficient. See IEC 60068-3-8:2003 for estimating the dynamic vibration environment of the specimen and based on that, selecting the appropriate test method.

Although primarily intended for electrotechnical specimens, this standard is not restricted to them and may be used in other fields where desired (see Annex A).

2 Normative references

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.

IEC 60050-300: *International Electrotechnical Vocabulary – Electrical and electronic measurements and measuring instruments – Part 311: General terms relating to measurements – Part 312: General terms relating to electrical measurements – Part 313: Types of electrical measuring instruments – Part 314: Specific terms according to the type of instrument*

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

IEC 60068-2-6: *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-47:2005, *Environmental testing – Part 2-47: Tests – Mounting of specimens for vibration, impact and similar dynamic tests*

IEC 60068-3-8:2003, *Environmental testing – Part 3-8: Supporting documentation and guidance – Selecting amongst vibration tests*

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

IEC 60721-3 (all parts), *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities*

IEC Guide 104, *The preparation of safety publications and the use of basic safety publications and group safety publications*

ISO 2041: *Vibration and shock – Vocabulary*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE The terms used are generally defined in IEC 60050-300, IEC 60068-1, IEC 60068-2-6, and IEC 60068-5-2 and ISO 2041. If a definition from one of those sources is included here, the derivation is indicated and departures from the definitions in those sources are also indicated.

3.1
cross-axis motion
motion not in the direction of the stimulus; generally specified in the two axes orthogonal to the direction of the stimulus

NOTE The cross-axis motion should be measured close to the fixing points.

3.2
actual motion
motion represented by the wideband signal returned from the reference point transducer

3.3
fixing point
part of the specimen in contact with the fixture or vibration table at a point where the specimen is normally fastened in service

NOTE If a part of the real mounting structure is used as the fixture, the fixing points are taken as those of the mounting structure and not of the specimen.

3.4
control methods

3.4.1
single point control
control method using the signal from the transducer at the reference point in order to maintain this point at the specified vibration level

3.4.2
multipoint control
control method using the signals from each of the transducers at the checkpoints

NOTE The signals are either continuously averaged arithmetically or processed by using comparison techniques, depending upon the relevant specification. See also 3.13.

3.5
g_n
standard acceleration due to the earth's gravity, which itself varies with altitude and geographical latitude

NOTE For the purposes of this standard, the value of g_n is rounded up to the nearest whole number, that is 10 m/s^2.

3.6
measuring points
specific points at which data are gathered for conducting the test

NOTE These points are of three types, as defined in 3.7 to 3.9.

3.7
checkpoint
point located on the fixture, on the vibration table or on the specimen as close as possible to one of its fixing points, and in any case, rigidly connected to it

NOTE 1 A number of checkpoints are used as a means of ensuring that the test requirements are satisfied.

NOTE 2 If four or fewer fixing points exist, each is used as a checkpoint. For packaged products, where a fixing point may be interpreted as the packaging surface in contact with the vibration table, one checkpoint may be used, provided that there are no effects due to resonances of the vibration table or the mounting structure in the frequency range specified for the test. If this is the case, multipoint control may be necessary, but see also NOTE 3. If more than four fixing points exist, four representative fixing points will be defined in the relevant specification to be used as checkpoints.

NOTE 3 In special cases, for example for large or complex specimens, the checkpoints will be prescribed by the relevant specification if not close to the fixing points.

NOTE 4 Where a large number of small specimens are mounted on one fixture, or in the case of a small specimen with a number of fixing points, a single checkpoint (that is the reference point) may be selected for the derivation of the control signal. This signal is then related to the fixture rather than to the fixing points of the specimen(s). This procedure is only valid when the lowest resonance frequency of the loaded fixture is well above the upper frequency of the test.

3.8
reference point (single-point control)
point, chosen from amongst the checkpoints, whose signal is used to control the test, such that the requirements of this standard are satisfied

3.9
fictitious reference point (multipoint control)
point, derived from multiple checkpoints either manually or automatically, the result of which is used to control the test so that the requirements of this standard are satisfied

3.10
response points
specific points on the specimen from which data is gathered for the purpose of the vibration response investigation

NOTE These points are not the same as checkpoints or reference points.

3.11
preferred testing axes
three orthogonal axes that correspond to the most vulnerable axes of the specimen

3.12
sampling frequency
number of discrete magnitude values taken per second to record or represent a time-history in a digital form

3.13
multipoint control strategies
method for calculating the reference control signal when using multipoint control

NOTE Different frequency domain control strategies are discussed to in 4.7.1.

3.14
averaging
process of determining the control acceleration spectral density formed from the arithmetic average of the acceleration spectral densities at each frequency line of more than one checkpoint

3.15
extremal (maximum or minimum)
process of determining the control acceleration spectral density formed from the maximum or minimum acceleration spectral density at each frequency line of more than one checkpoint

3.16
crest factor
ratio of the peak value to the r.m.s. value of the time history

[ISO 2041]

3.17
–3 dB bandwidth
frequency bandwidth between two points in a frequency response function which are at 0,707 of the maximum response when associated with a single resonance peak

3.18
acceleration spectral density
ASD
mean-square value of that part of an acceleration signal passed by a narrow-band filter of a centre frequency, per unit bandwidth, in the limit as the bandwidth approaches zero and the averaging time approaches infinity

3.19
control acceleration spectral density
acceleration spectral density measured at the reference point or the fictitious reference point

3.20
control system loop
sum of the following actions:

– digitizing the analogue waveform of the signal derived from the reference point or fictitious reference point;
– performing the necessary processing;
– producing an updated analogue drive waveform to the vibration system power amplifier (see Clause B.1.)

3.21
drive signal clipping (see also Figure 1)
limitation of the maximum crest factor of the drive signal effective frequency range

3.22
effective frequency range (see also Figure 1)
frequency range between 0,5 times f_1 and 2,0 times f_2

NOTE Due to initial and final slope, the effective frequency range is higher than the test frequency range between f_1 and f_2.

3.23
error acceleration spectral density
difference between the specified acceleration spectral density and the control acceleration spectral density