INTERNATIONAL STANDARD

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Packaging — Complete, filled transport packages and unit loads — Vertical random vibration test

Emballages — Emballages d'expédition complets et pleins et charges unitaires — Essais de vibration verticale aléatoire

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13355 was prepared by Technical Committee ISO/TC 122, *Packaging*, Subcommittee SC 3, *Performance requirements and tests for means of packaging, packages and unit loads (as required by ISO/TC 122)*.

Annex A of this International Standard is for information only.

Introduction

A random vibration test is the most realistic way to reproduce environmental vibration during transportation. For this reason, if suitable laboratory facilities are available, this kind of test should be preferred to any fixed or swept frequency sinusoidal vibration tests similar to those given in ISO 2247 [1] and ISO 8318 [2].

Packaging — Complete, filled transport packages and unit loads — Vertical random vibration test

1 Scope

This International Standard specifies a method to carry out a vertical random vibration test on a complete, filled transport package(s) and unit loads using a random excitation[1)].

This test may be used to assess the performance of a package in terms of its strength or the protection that it offers to its contents when it is subjected to vertical vibration. It may be performed either as a single test to investigate the effects of vertical vibration or as a part of a sequence of tests designed to measure the ability of a test item to withstand a distribution system that includes a vibration hazard.

NOTE In the following text a package or unit load is called a test item.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 2206, *Packaging — Complete, filled transport packages — Identification of parts when testing*

ISO 2233, *Packaging — Complete, filled transport packages and unit loads — Conditioning for testing*

ISO 2234, *Packaging — Complete, filled transport packages and unit loads — Stacking tests using a static load*

3 Principle

The test item is placed on a vibration table and made to vibrate using a random excitation with frequency between 3 Hz and 200 Hz. The atmospheric conditions, the duration of the test, the acceleration power spectral density, the attitude of the test item and its method of restraint are predetermined.

NOTE When required, a load may be superimposed on the test item to simulate conditions at the bottom of a stack.

4 Apparatus

4.1 Vibration table, of sufficient size and performance (in terms of power, displacement, frequency range) capable of being stiff (its lower resonant frequency shall be higher than the higher test frequency) and remaining horizontal during the test.

The table may be equipped with the following components.

4.1.1 Low fences, restricting sideways and endways movements during testing.

1) The treatment of random vibration theory can be found in IEC 60068-2-64 (see reference [3] in the Bibliography).

4.1.2 High fences, or other means of maintaining a superimposed load in position on the test item during testing.

4.1.3 Means to simulate the method of restraint, of the test item during transit.

Furthermore, the apparatus shall meet the requirements and tolerances of clause 6.

4.2 Vibration-measurement, data-storage and control system, comprising accelerometers, signal conditioners and a computer capable of:

a) generating vibration with the required power spectral density;

b) controlling the motion of the vibration table by feeding back the signal from the control accelerometer which monitors the table acceleration;

c) performing the analysis with at least 120 statistical degrees of freedom;

d) having data acquisition and control channels with a response accurate to 5 % over the frequency range specified for the test.

5 Sampling

5.1 Test item preparation

The test item shall normally be filled with its intended contents. However, simulated or substituted contents may be used, provided that the dimensions and physical properties of such contents are as close as possible to those of the intended contents.

Ensure that the test item is closed normally, as if ready for distribution. If simulated or substituted contents are used, ensure that the normal method of closure is still employed.

5.2 Conditioning

Condition the test item in accordance with ISO 2233.

6 Procedure

Carry out the test in the same atmospheric conditions as used for conditioning where this is critical to the performance of the test item.

In other circumstances, carry out the test in atmospheric conditions which are as near as practicable to those used for conditioning.

Place the test item in the predetermined attitude on the vibration table (see 4.1), with the centre of gravity placed as near as practicable to the centre of the table; if the test item is not secured to the table it may be fenced. If a superimposed load is required, the loading procedure shall comply with ISO 2234.

Measure the imposed acceleration as closely as possible to the test item. Protect the accelerometer suitably to avoid damage.

Ensure the horizontal components of the acceleration are no greater than 20 % of the value of the vertical component.

Start the test 6 dB below the test level to allow the system to equalize the power spectral density profile, then carefully adjust the level to reach full test level and continue the test for the predetermined duration.

The test duration and the power spectral density of the vibration table, in absence of experimental data concerning the effects of transportation to be reproduced, may be chosen as indicated in annex A.

The tolerance on root mean square acceleration shall not exceed 15 %; the obtained acceleration power spectral density of the test control signal shall not deviate by more than ± 3 dB over the entire test frequency range.

Tests may be interrupted at any time to allow visual inspection of the test item, or for any other purpose.

7 Test report

The test report shall include the following information:

a) a reference to this International Standard, i.e. ISO 13355;

b) the name and address of the testing laboratory and name and address of the customer;

c) the unique identification of report;

d) the date of receipt of the test items and the date(s) of performance of test;

e) the name, the title and the signature of persons accepting responsibility for the test report;

f) a statement to the effect that the test results relate only to the items tested;

g) a statement that the report shall not be reproduced except in full without the written approval of the testing laboratory;

h) the number of replicate test items tested;

i) a full description, including dimensions, mass, structural and material specifications of the test item and its fittings, cushioning, blocking, closure or reinforcing arrangements, in accordance with ISO 2206;

j) a description of the contents, i.e. if simulated or substituted contents were used, full details shall be given;

k) the gross mass of the test item;

l) the relative humidity, the temperature and the time of conditioning; the temperature and the relative humidity of the test area at the time of test; whether these values comply with the requirements of ISO 2233;

m) the duration of the test, the frequency range, the applied acceleration power spectral density and the obtained root mean square acceleration value;

n) whether a superimposed load was used; if so, the mass, in kilograms, of the superimposed load and the period of time during which the test item was under load;

o) the method of restraint, and whether low or high fences were used;

p) any deviations from the test method described in this International Standard;

q) the recorded acceleration power spectral densities, with any observations which may assist in correct interpretation;

r) the attitude(s) in which the package was tested, using the method of identification as given in ISO 2206;

s) a list of the equipment and the serial numbers.

Annex A
(informative)

Indicative power spectral density

Table A.1 gives the indicative power spectral density which can be used to simulate generic (mainly road) transportation, when experimental recordings are not available.

Table A.1 — Spectral density

Frequency Hz	**Level** g^2/Hz	**Slope** dB/oct.
3	0,000 5	—
3 to 6	—	+ 13,75
6 to 18	0,012	—
18 to 40	—	− 9,34
40	0,001	—
40 to 200	—	− 1,29
200	0,000 5	—

The total root mean square acceleration value of the frequency range is 0,59 g.

The minimum recommended test duration is 30 min for each test item attitude to be tested. The correlation between transport distance and test time is not addressed in this International Standard.

NOTE Vibration spectra depend very much on the transportation vehicle selected. Therefore, whenever possible, perform tests with spectra obtained from measured data of the particular transportation vehicles.

Bibliography

[1] ISO 2247, *Packaging — Complete, filled transport packages and unit loads — Vibration tests at fixed low frequency*

[2] ISO 8318, *Packaging — Complete, filled transport packages and unit loads — Sinusoidal vibration tests using a variable frequency*

[3] IEC 60068-2-64, *Environmental testing — Part 2: Test methods — Test Fh: Vibration, broad-band random (digital control) and guidance*

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