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Packaging — Complete, filled transport packages — General rules for the compilation of performance test schedules

Emballages — Emballages d'expédition complets et pleins — Règles générales pour l'établissement de programmes d'essais d'aptitude à l'emploi

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 4180 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)*.

This first edition of ISO 4180 cancels and replaces ISO 4180-1:1980 and ISO 4180-2:1980.

Packaging — Complete, filled transport packages — General rules for the compilation of performance test schedules

1 Scope

This International Standard establishes general rules to be used for the compilation of performance test schedules for complete, filled transport packages intended for use within any distribution system except for the packages used for dangerous goods.

For a known distribution environment with experimental data available (case 1), this International Standard provides guide lines for the compilation of appropriate test schedules.

For an unknown distribution environment (case 2), this International Standard provides test schedules in dependence of the test specimen mass and forecast destination.

This International Standard also gives the factors to be considered in assessing the criteria of acceptance of such packages after they have been subjected to a package performance test schedule.

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.

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*

ISO 2244, *Packaging — Complete, filled transport packages and unit loads — Horizontal impact tests*

ISO 2248, *Packaging — Complete, filled transport packages — Vertical impact test by dropping*

ISO 2873, *Packaging — Complete, filled transport packages and unit loads — Low pressure test*

ISO 4178, *Complete, filled transport packages — Distribution trials — Information to be recorded*

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

ISO 12048, *Packaging — Complete, filled transport packages — Compression and stacking tests using a compression tester*

ISO 13355:2001, *Packaging — Complete, filled transport packages and unit loads — Vertical random vibration test*

EN 14149, *Packaging — Complete, filled transport packages and unit loads — Impact test by rotational drop*

3 Terms and definitions

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

3.1
performance test schedule
single laboratory test, or series of tests, intended to ascertain the performance, under working conditions, of the subject under test

3.2
complete, filled transport package
packaging, including contents, prepared for distribution

NOTE ISO 21067 [6] provides terminology relating to packaging.

3.3
distribution system
operations which take place after a package has been filled and closed, including all handling, transport and storage operations up to and including delivery to the user

4 Distribution systems

Distribution systems exist in great variety and complexity, but however great the complexity, they may be considered to be combinations of a number of simple elements. These simple elements are:

a) transport of packages from one point to another, with or without change of mode of transport (where transport shall be considered to include the loading and unloading operations);

b) storage.

5 Hazards

During distribution, a transport package is subjected to a number of hazards which might cause damage. These hazards are the result of a number of factors, the most important of which are:

a) the characteristics of the distribution system, i. e. the carrier, the mode of transport, the geographic area;

b) the design of the package, i.e. its dimensions, mass and shape and the mechanical characteristic of the materials of which it is composed.

6 Tests

6.1 General

Laboratory tests on transport packages aim to simulate or represent the distribution hazards.

6.2 Appropriate application of tests

The appropriate application of tests requires

a) a knowledge of the stress arising from these hazards, and

b) the capability of reproducing these stresses by a particular test or, alternatively, of producing damage identical to that observed in practice.

6.3 Levels of intensity

The levels of intensity selected for the tests could depend on the factors in 6.2 and:

a) the mass of the package;

b) the distance and the geographic location of the destination;

c) the degree of assurance that the package should give;

d) the nature of the contents and the frequency and value of the consignment.

7 Determination of criteria for acceptance

The criteria for acceptance of a complete filled transport package might be determined by

— the reduction of quality of the package and/or its contents,

— the extent of loss of package contents,

— the extent of deterioration of the package and/or its contents, or

— whether the damaged package represents a hazard or potential hazard in subsequent distribution, including storage.

In determining the extent of damage that is acceptable the following factors should be considered:

a) the unit value of the contents;

b) the number of units in the complete, filled transport package;

c) the number of complete, filled transport packages in the consignment;

d) the cost of distribution.

In addition it should be considered whether the contents are

— non-dangerous, or

— dangerous.

Methods of quantifying damage to a package are given in Annex A.

8 Selection of package attitude

The package attitude selected for use in the test should be the attitude of the package presented by the hazard being simulated by the test.

9 Compilation of test schedules

9.1 Case 1: distribution system well defined and intensity of hazards determined

In this case, the performance test schedule shall be written using the experimental test data acquired in accordance with ISO 4178. Applicable tests shall be chosen depending on the distribution system. Appropriate test sequence and test intensity shall be chosen.

The steps of the procedure are as follows:

a) identify the simple elements in the distribution system;

b) decide what hazards these elements involve;

c) decide which tests are necessary to represent or simulate these hazards (including, for example, decisions concerning appropriate conditioning, package attitude, interposed hazards, duration of vibration and number of impacts);

d) decide the test sequence;

e) decide what are the test intensities associated with the particular package and distribution system combination concerned.

9.2 Case 2: distribution system undefined and intensity of hazards unknown

Very often, the package manufacturer does not have a clear knowledge of the distribution system, and the intensities of the hazards are unknown.

In this case, this International Standard provides *recommended* performance test schedules.

Choice criteria are the mass and the destination of the package.

10 Case 1

10.1 Preferred test sequence

A typical test sequence is:

a) conditioning for testing;

b) climatic treatment;

c) vibration;

d) stacking;

e) impacts.

Other tests may be interposed in the test schedule as appropriate. When circumstances require a different order, this should be reported.

10.2 Preferred test parameters

To allow repeatability and reproducibility, test levels and parameters should be chosen among those proposed in this paragraph and should comply with the included recommendations.

10.3 Atmospheric conditioning (performed in accordance with ISO 2233)

Table 1 — Preferred test parameters

Temperature		Relative humidity
°C	°K	%
−55	218	—
−35	238	—
−18	255	—
+5	278	85
+20	293	65
+20	293	90
+23	296	50
+27	300	65
+30	303	65
+30	303	90
+35	308	65
+35	308	90
+40	313	65
+40	313	90
+55	328	30

10.4 Low pressure tests (performed in accordance with ISO 2873)

Table 2 — Preferred test pressures

Pressure	Corresponding altitude	
hPa	m	
800	about 2 000	(a pass through the Alps)
650	about 3 500	(aircraft)
550	about 5 000	(the city of La Paz, Bolivia)
360	about 8 000	(unpressurized aircraft)
190	about 12 000	(unpressurized aircraft)

10.5 Horizontal impact (performed in accordance with ISO 2244)

The test can be defined using an impact velocity chosen from Table 3.

Table 3 — Preferred impact test velocities

Preferred test velocities m/s
1,0
1,3
1,5
1,8
2,2
2,7
3,3
4,0
5,0
7,0

These shocks can also be defined in terms of wave shape, peak acceleration and duration. This method of defining shocks is only possible where a test lab has a sophisticated acquisition system and suitable accelerometers. Recording these data improves the quality of the test. The severity is well determined and the reproducibility is assured.

In this case, test parameters are given in Tables 4 to 6.

Table 4 — Shock definitions: preferred wave shapes

Preferred wave shapes
Half sine
Sawtooth
Trapezium

Table 5 — Shock definitions: preferred duration

Preferred duration ms
6
11
20
30
40
50
100

Table 6 — Shock definitions: preferred peak acceleration

Preferred peak acceleration m/s^2
50
100
150
200
300
400
500
600
800
1 000

The horizontal impact test is defined by choosing an impact velocity or duration and peak acceleration from Table 3, Table 5 or Table 6 for the type of waveform desired (see Table 4).

10.6 Vertical impact (performed in accordance with ISO 2248)

The fall height shall be chosen from Table 7.

Table 7 — Preferred test heights

Preferred test heights mm
50
100
150
200
300
400
500
600
800
1 000
1 200
1 500
1 800
2 100