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Packaging — Complete, filled transport packages — Stability testing of unit loads

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*Emballages — Emballages d'expédition complets et pleins — Essai de
stabilité des unités de charge*
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INTERNATIONAL

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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.

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.

International Standard ISO 10531 was prepared by Technical Committee ISO/TC 122, *Packaging*, Sub-Committee 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.

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Packaging — Complete, filled transport packages — Stability testing of unit loads

1 Scope

This International Standard specifies methods of testing for the stability of unit loads. These tests are intended to assess the performance of completely formed unit loads as they are subjected to the hazards of environmental exposure, storage, handling and transportation. These tests may be performed as part of a sequence.

The considered hazards relate to a land environment. Similar hazards may be expected in a marine environment but to a substantially greater degree, and additional hazards not covered by this International Standard may occur in a marine environment. It should not be assumed that unit loads which satisfactorily pass the tests of this International Standard will be stable in a marine environment.

The unit loads covered in this International Standard are not restricted to those incorporating a pallet platform, but may include other devices such as pallet boxes or slipsheets.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2234:1985, *Packaging — Complete, filled transport packages — Stacking tests using static load.*

ISO 2244:1985, *Packaging — Complete, filled transport packages — Horizontal impact tests (horizontal or inclined plane test; pendulum test).*

ISO 2247:1985, *Packaging — Complete, filled transport packages — Vibration test at fixed low frequency.*

ISO 2874:1985, *Packaging — Complete, filled transport packages — Stacking test using compression tester.*

ISO 3676:1983, *Packaging — Unit load sizes — Dimensions.*

ISO 4180-1:1980, *Complete, filled transport packages — General rules for the compilation of performance test schedules — Part 1: General principles.*

ISO 4180-2:1980, *Complete, filled transport packages — General rules for the compilation of performance test schedules — Part 2: Quantitative data.*

ISO 8318:1986, *Packaging — Complete, filled transport packages — Vibration tests using a sinusoidal variable frequency.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 unit load: Load consisting of items or packages held together by one or more means and shaped or fitted for handling, transporting, stacking and storing as a unit. The term is also used to describe a single item adapted for the same purpose.

3.2 clamp handling: Handling method using a special fork-lift clamping attachment for applying sufficient compression to opposite sides of unit loads such that complete loads can be stored, handled and transported.

3.3 push/pull handling: Handling method using a special fork-lift gripper attachment or other suitable means for pushing/pulling loaded slipsheets onto a

load plate such that complete loads can be stored, handled and transported.

4 General

The unit load shall be subjected to tests as specified in this International Standard. The nature of the means of handling will dictate the specific handling test required as part of the simulated distribution sequence.

The occurrence of failure at any point during the tests shall result in cessation of further testing and redesign of the unitizing technique. Any subsequent changes require retesting, recommencing with the first test method of the sequence.

Observations of failure during testing, indicating load instability, may include deformation, creep, collapse, material fatigue or shifting of packages comprising the load.

NOTE 1 The effects of temperature and humidity in the testing environment may vary greatly and thus may affect the strength of the unit load.

5 Apparatus

5.1 Equipment for compression and vibration tests shall be as specified in the appropriate International Standard listed in table 1. Equipment for the horizontal impact test shall be as specified in ISO 2244, except for the inclined plane test (see 7.2.2.1).

5.2 In making the drop test, the unit load may be handled with any convenient equipment, such as a block and tackle, a hoist, or jacks with release mechanism such that the fall of the unit load is not obstructed by any part of the apparatus before striking the impact surface.

5.3 In making the clamp lift test, use an actual lift truck equipped with the appropriate load clamping device to lift the unit load. Provision shall be made to measure the clamp force between the platens, using a load cell or other suitable device.

5.4 In making the push/pull pack test, use an actual lift truck equipped with an appropriate push/pull attachment for pulling the load onto the load plate by the slipsheet tab. Alternatively, any suitable pulling device equipped with a gripper jaw may be used.

6 Conditioning

As it is practically impossible to condition a complete unit load to such an extent that all goods and packaging materials are brought and kept in equi-

librium with the climate applied without detaching the packaging materials, conditioning of the unit load is omitted.

However, when composing the unit load for testing, the goods and the packaging materials should be subject to the same conditions as for normal transportation.

After testing, moisture determinations may be carried out on the packaging materials, in order to apply corrections if necessary.

7 Procedure

7.1 General

Tests shall be conducted under ambient conditions of temperature and humidity as specified in table 1 and in the sequence shown.

Test intensities shall be chosen according to the general principles specified in ISO 4180-1 and their values shall be as specified in ISO 4180-2.

7.2 Pallet handling tests

7.2.1 Drop test

Test the ability of the palletized load to withstand accidental drops, using the two following methods.

7.2.1.1 Drop flat on base by tilting on one edge

With one edge of the unit load supported by a hard, solid surface (e.g. concrete), raise the other end 20 cm and release to fall freely. See figure 1.

7.2.1.2 Bottom edge impact

With the unit load on a hard, solid surface (e.g. concrete), raise one end of the surface load and set upon a timber or other support 5 cm high so that the edge of the load is at most 10 cm from the corner of the support [see figure 2 a)]. Raise the other end of the load till the base of the load is 20 cm above floor level [see figure 2 b)] and release the load to fall freely. Where loads are tall or top-heavy, provision must be made to prevent the load from tipping over after the drop is made.

7.2.2 Horizontal impact test

NOTE 2 This test is optional (see table 1).

The ability of the palletized load to withstand repeated horizontal impacts against its base edges shall be evaluated using one of the tests specified in 7.2.2.1 to 7.2.2.3.

Table 1 — Unit load tests

Test No.	Environmental factor	Tests			
		Unit load handling method			
		Pallet		Clamp	Push/pull pack
Restrained load	Unrestrained load				
1	Storage	Static compression, as specified in ISO 2234 or ISO 2874	Static compression, as specified in ISO 2234 or ISO 2874	Static compression, as specified in ISO 2234 or ISO 2874	Static compression, as specified in ISO 2234 or ISO 2874
2	Handling	Drop flat on base by tilting on edge (see 7.2.1.1) and either drop on base edge ¹⁾ (see 7.2.1.2) or run test course Optional test: Horizontal impact against block (see 7.2.2)	Run test course	Run test course	Run test course
3	Transportation	Vibration ²⁾ , as specified in ISO 8318 or ISO 2247	Vibration ²⁾ , as specified in ISO 8318 or ISO 2247	Vibration ²⁾ , as specified in ISO 8318 or ISO 2247	Vibration ²⁾ , as specified in ISO 8318 or ISO 2247

1) Edge drops stress unit load stability to a greater degree, while flat drops more closely simulate most actual conditions.
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2) Where test facilities permit, use full height loads as actually encountered in transportation.

Dimensions in centimetres

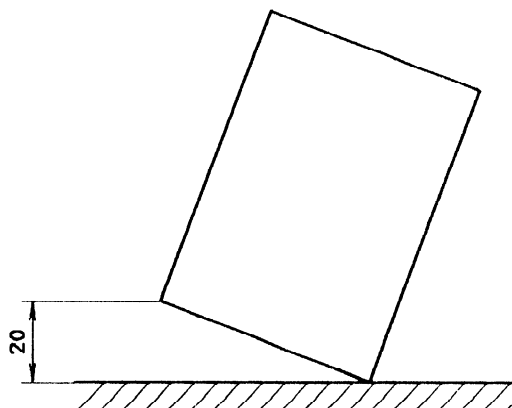


Figure 1 — Drop flat on base test

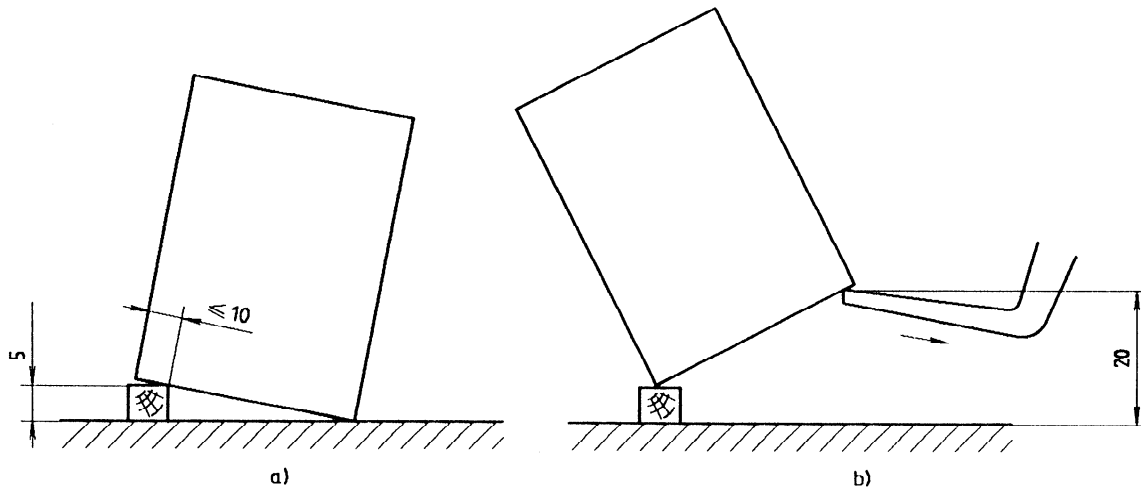


Figure 2 — Bottom edge impact test

7.2.2.1 Inclined plane test

Use a modified inclined plane (10°) tester as shown in figure 3 to support the load and provide the horizontal impacts. Place the palletized load on the sled and against the stop block. Draw the sled up the incline for 4 m and allow it to roll freely down the slope, striking against the rigid backstop.

7.2.2.2 Pendulum impact test

Use the method described in ISO 2244:1985, 7.3, with the optional hazard at the base of the pallet (see ISO 2244:1985, 4.2).

7.2.2.3 Horizontal plane test

Use the method described in ISO 2244:1985, 7.2, with the optional hazard at the base of the pallet (see ISO 2244:1985, 4.2).

7.3 Clamp handling test

7.3.1 General

7.3.1.1 This test is carried out to evaluate the ability of the unit load to withstand repeated side compressions.

7.3.1.2 A lift truck as specified in 5.3 shall be used. If the unit loads are normally handled two-high, a second equivalent load should be placed on the unit to be tested prior to clamping.

7.3.1.3 Provision shall be made for measuring the total force applied to the load using the equipment described in 5.3 placed at critical locations. The clamp force between the platens and the hydraulic pressure at all available clamp settings shall be measured.

7.3.2 Procedure

7.3.2.1 Clamp the unit load in a manner typical of current or expected practice, starting with the lowest clamp force and increasing the clamp setting until the load can be successfully transported without damaging the contents (product). For the handlings to follow, clamp the unit load at the next higher clamp setting on the truck.

7.3.2.2 Clamp, lift and transport the unit load over a test course as described in A.1 under conditions identical to those specified in A.2.

7.3.2.3 If the unit load is normally clamped from both directions, distribute the test cycles based on the probability of clamping from each direction.

7.3.2.4 The test can be repeated for a predetermined number of handlings, or until failure occurs.

7.4 Push/pull handling test

7.4.1 General

7.4.1.1 This test is carried out to evaluate the ability of the unit load to withstand repeated handlings using a lift truck equipped with a push/pull pack device.

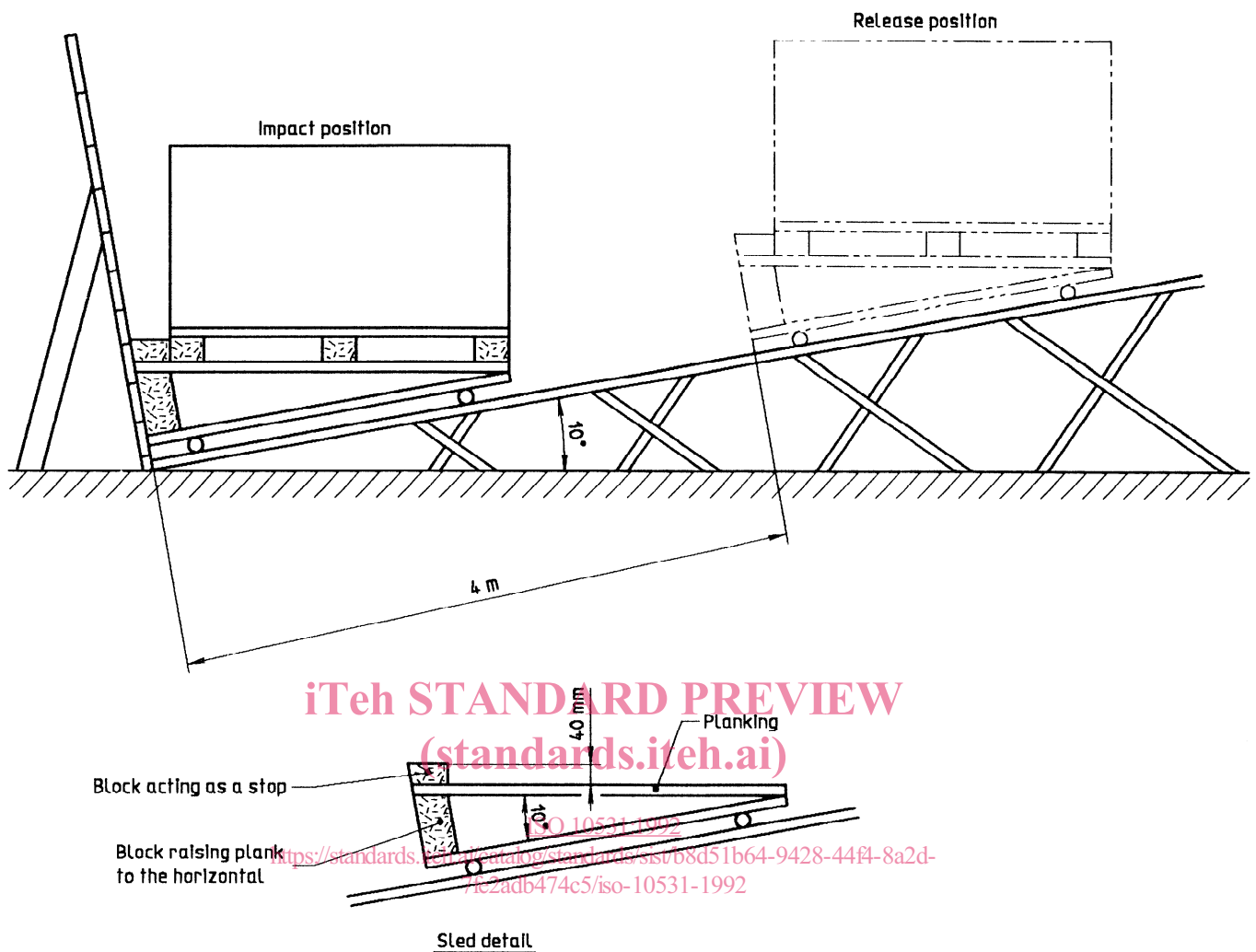


Figure 3 — Modified incline impact test for horizontal impacts on base edges of unit loads

7.4.1.2 A lift truck as specified in 5.4 shall be used. If the unit loads are normally handled two-high, a second equivalent load should be placed on the unit to be tested prior to testing.

7.4.2 Procedure

7.4.2.1 Pick up, lift and transport the unit load over the test course as described in A.1 under conditions identical to those specified in A.2.

7.4.2.2 If the unit load is normally picked up from both directions, distribute the test cycles accordingly based on the probability of picking up from each direction.

7.4.2.3 The test can be repeated for a predetermined number of handlings, or until failure occurs.

7.5 Examination of failure

After each test in 7.2 or each handling cycle (pickup/transport/setdown) in 7.3 and 7.4, examine the unit load to determine if failure has occurred. Failure is defined as any of the following.

- Package damage resulting in the inability of the product to sustain further distribution, storage or handling.
- Integrity of the unit load has been degraded to such an extent as to risk instability on further handling.

8 Test report

The test report shall include the following particulars:

- a) reference to this International Standard;
- b) number of replicate unit loads tested;
- c) full description, including unitizing techniques, dimensions in accordance with ISO 3676, structural and material specifications of the unit load;
- d) description of contents, whether simulated or dummy contents were used and, if so, a full description of the load design;
- e) gross mass of unit load and net mass of contents, in kilograms;
- f) temperature and relative humidity of test area at time of test;
- g) which test method(s) was (were) used;
- h) any deviations from the test method(s);
- i) a record of the results, with any observations which may assist in correct interpretation;
- j) date of the test;
- k) signature of tester.

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Annex A (informative)

Lift truck handling tests

A.1 Test course

A.1.1 A standard "L"-shaped test course should be established on a flat rigid surface, and include 3 m to 3,5 m wide aisles with a 90° turn, appropriate acceleration/deceleration zones and observation points (OP1 to OP5) (see figure A.1).

A.1.2 User-defined obstacles may be placed on the test course. Obstacles such as railway tracks set flush with the road surface, ramps, gratings etc. should be crossed perpendicularly and also, other than the ramps, at an angle.

A.2 Test conditions

A.2.1 Lift truck velocity through the test area, with or without obstacles, should be at uniform "walking" rate of $1,5 \text{ m/s} \pm 0,3 \text{ m/s}$.

A.2.2 The maximum velocity of the lift truck in the turn should be 1 m/s.

A.2.3 A minimum deceleration of 2 m/s^2 should be reached in the deceleration zones as part of the emergency stop test.

A.2.4 The unit load under test should be examined after each cycle of handling (pickup/transport/setdown)

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Dimensions in metres

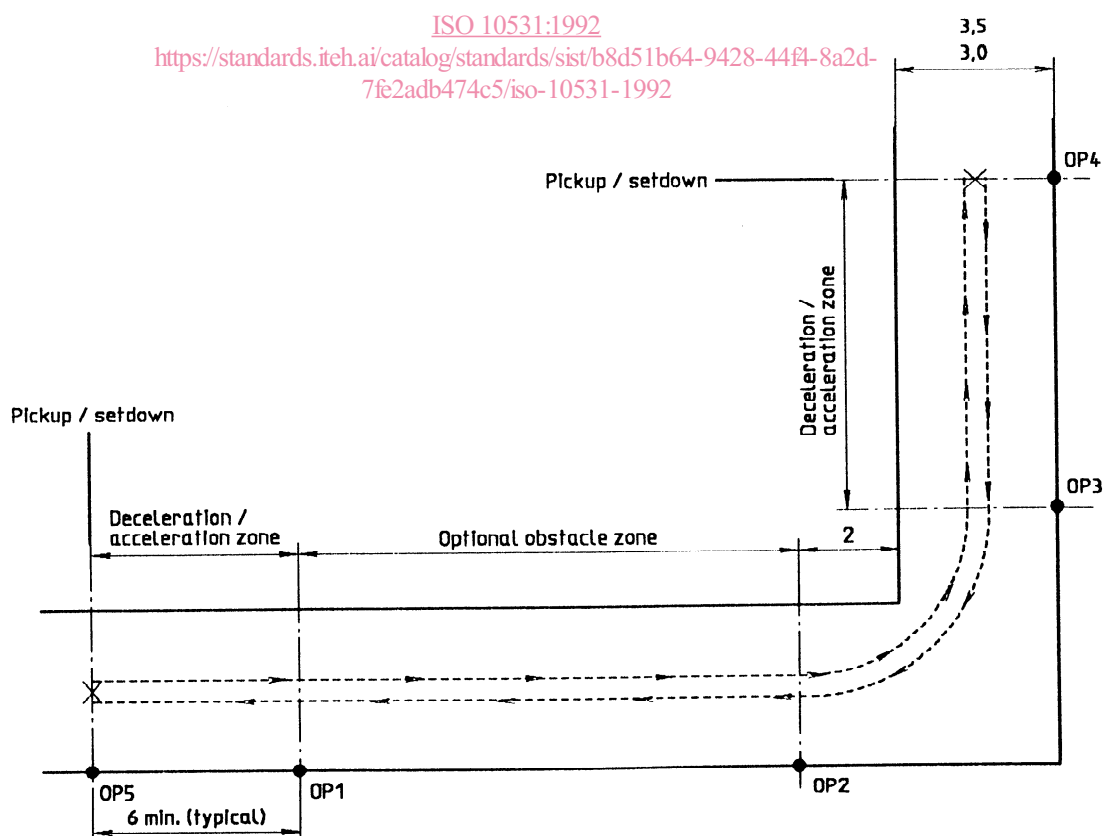


Figure A.1 — Sample test course