



**International
Standard**

ISO 7965-1

Packaging — Drop test —

**Part 1:
Paper sacks**

*Emballages — Essai de chute —
Partie 1: Sacs en papier*

**Second edition
2024-04**

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document 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)*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 261, *Packaging*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 7965-1:1984), which has been technically revised.

The main changes are as follows:

- ISO 6599-1 has been added to [Clause 2](#), replacing ISO 2233;
- two additional subclauses have been added to [Clause 5](#) to include information on ensuring correct drop height and placement of the sack, respectively;
- a new subclause has been added to [Clause 7](#) for information on testing in non-laboratory situations;
- the limit height method has been deleted from [Clause 9](#), keeping only the progressive- and constant drop height methods, respectively;
- the principle of testing for the constant drop method in [9.3](#) has been changed to exclude the side constant height drop test;
- Annex C has been deleted and [Clause 10](#) has been added to outline the information that the test report shall include;
- some editorial changes have been made to the document in line with ISO/IEC Directives, Part 2.

A list of all parts in the ISO 7965 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Packaging — Drop test —

Part 1: Paper sacks

1 Scope

This document specifies a method of vertical impact testing on a filled paper sack by dropping. It is performed either as a single test to investigate the effects of vertical impact or as part of a sequence of tests designed to measure the ability of a sack to withstand a distribution system that includes a vertical impact hazard.

This document specifies the testing procedure and how the results of tests are presented. It is based on ISO 2248 but is specifically related to paper sacks.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 6590-1, *Packaging — Sacks — Vocabulary and types — Part 1: Paper sacks*

ISO 6599-1, *Packaging — Sacks — Conditioning for testing — Part 1: Paper sacks*

ISO 7023, *Packaging — Sacks — Method of sampling empty sacks for testing*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6590-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 Principle

The filled sack is raised above a rigid plane surface and released to strike this surface after a free fall, with the height of drop and the position of the package being set in advance.

5 Apparatus

5.1 General

This document stipulates that an appropriate drop test apparatus shall be used to ensure that a drop can be performed according to the described procedure. An example of apparatus for drop testing is provided in [Annex A](#).

The usual laboratory apparatus and, in particular, the following shall be used.

5.2 Drop height, ensuring that the drop test can be correctly performed in accordance with the selected testing method.

5.3 Lifting arrangement, which will not damage the sack during either lifting or release.

5.4 Platform, where the sack can be placed prior to release in its predetermined position.

5.5 Release mechanism, in such a way that the fall of the sack is not obstructed by any part of the apparatus before striking the impact surface (5.6).

5.6 Impact surface, horizontal and flat, massive enough to be immovable and rigid enough to be non-deformable under test conditions.

6 Sampling

For assessing an average quality of a consignment, sampling shall be carried out in accordance with the procedure in ISO 7023.

7 Test conditions

7.1 General

Since paper is a hygroscopic material, it will change some of its mechanical properties, like paper strength (tensile energy absorption), with the moisture content of the paper. This will vary according to the ambient atmospheric conditions and the temperature of the filling content. Hence, it is very important to register and record the conditions in which the drop test is performed continuously throughout the test; the ambient temperature and relative humidity (RH) as well as the temperature of the filling content.

7.2 Conditioning for testing of paper sacks

Separate tests can only be directly compared if all conditions are the same in the respective test. For direct comparisons, it is essential that the sack is conditioned in a laboratory according to the requirements of ISO 6599-1.

7.3 Testing in non-laboratory situations

In a situation where a laboratory is not available, the methodology in this document can still be followed. In this case, the temperature and the humidity shall be recorded and reported.

7.4 Surface conditions

Ensure that the platform and impact surface are clean and free from any objects, particles or contamination that can affect the testing procedure.

A thin and clean plastic film may be used on the impact surface to not damage the sack while moving it.

In normal circumstances, the impact surface provided should be:

- a) one piece, with a mass at least 50 times that of the heaviest sack to be tested;
- b) flat, such that no two points on its surface differ in level by more than 2 mm;
- c) rigid, such that it will not be deformed by more than 0,1 mm when an area of 100 mm² is loaded statically with 10 kg anywhere on the surface;
- d) sufficiently large to ensure that the sack falls entirely upon the surface.

8 Procedure

8.1 General

Prior to the test, it shall be ensured that:

- a) The empty sacks are properly inspected, cured and ready to be used. Further, the empty sack shall be conditioned in accordance with the procedure in ISO 6599-1.
- b) The apparatus is in accordance with [Clause 5](#) and in good condition.
- c) The ambient temperature and relative humidity are recorded and registered.

8.2 Filling

Fill the sacks with the intended commodity or, if this is not possible, with similar material, taking into account the type and size of granules, angle of repose etc., to give the same degree of filling. The mass of filling material shall be within $\pm 0,5$ % of that of the nominal mass of the intended contents of the sack.

The temperature of the filling goods shall preferably be ambient temperature, but if that is not possible the temperature shall be registered and recorded for every sack in the test.

Position the sack on the trap door of the apparatus before the drop.

8.3 Dropping

8.3.1 General

Place the filled sack centrally on the platform which is then raised to a height that is within ± 2 % of the predetermined drop height as defined by the distance between the lowest point of the sack at the time of release and the nearest point of the impact surface.

The sack shall be released from its predetermined position, with a variation of no more than 2° between the impacting surface of the sack and the impact surface immediately prior to release.

8.3.2 Dropping procedure

8.3.2.1 General

Drops can be performed on all sides of the sack. The definition of the sack sides is described in [Annex B](#).

Each sack side shall be tested separately.

8.3.2.2 Flat dropping

Drop the sack only on the face side (1) or only the back side (3), until it breaks. See [Figure B.1](#).

8.3.2.3 Butt dropping

Drop the sack only on the bottom (5) or only top side (6), until it breaks. See [Figure B.1](#).

The difference in performance of a sack suspended from the top or supported underneath in a butt drop can be significant. The method of placing the sack before dropping shall be included in the test report.

8.3.2.4 Side dropping

Drop the sack only on the right side (2) or only the left side (4), until it breaks. See [Figure B.1](#).

This type of test is relatively seldom performed and will not be further described in this document.

8.4 Sack breakage

A sack shall be considered broken when either of the following conditions occur:

- a) content spillage occurs through a visible failure on the sack; or
- b) the contents are exposed due to breakage of the paper plies; or
- c) contents are withheld only by the plastic film or another non-paper film if such is used.

9 Test methods

9.1 General

There are two methods described in this document.

- Progressive drop height, where the height is incrementally increased to add energy and stress for every drop making this method more challenging and preferred when very high demands are put on the sacks.
- Constant drop height, where the sacks are dropped from a selected constant height. This is an easier method, with a simpler apparatus and is better at simulating a supply chain where sacks tend to be exposed to a number of similar drops and handlings.

Either of these methods can be used for any application. However, it is important to clearly state in the test report which method is used.

9.2 Progressive drop height method

9.2.1 General

This method shall be performed from a drop height which is incrementally increased for each drop where the sack is dropped against the impact surface. The progressive drop height method may be used for flat (9.2.2) or butt drop testing (9.2.3).

The breaking height is recorded for each sack, from which an average breaking height is calculated. The test result can be reported as the average breaking height, h , and/or the corresponding number of drops, n .

9.2.2 Flat progressive height drop test

The flat drop test is where the face and/or the back of the sack is dropped against the surface.

The drop height, h , is given by [Formula \(1\)](#):

$$h = h_0 + [(n-1) \times \Delta h] \quad (1)$$

where

h is the height;

h_0 0,85 m is the value of the initial drop height;

n is the number of drops;

Δh 0,15 m is the value of the increment.

The drop test shall be initiated at 0,85 m height, h_0 . After each drop without any visible breakage on the sack, an increment of 0,15 m in drop height, Δh , is made.

Continue to drop the sack until breakage.

The number of drops and the final drop height at break shall be recorded as part of the test result.

In addition, the average breaking height, h , and/or the corresponding number of drops, n , can be calculated and reported.

9.2.3 Butt progressive height drop test

The butt drop test is where the top and/or the bottom of the sack is dropped against the surface.

The drop height, h , is given by [Formula \(2\)](#):

$$h = h_0 + [(n-1) \times \Delta h] \quad (2)$$

where

h is the height;

h_0 0,30 m is the value of the initial drop height;

n is the number of drops;

Δh 0,05 m is the value of the increment.

The number of drops and the final drop height at break shall be recorded as part of the test result.

In addition, the average breaking height, h , and/or the corresponding number of drops, n , can be calculated and reported.

9.3 Constant drop height method

9.3.1 General

This method shall be performed from a constant drop height and may be used for flat ([9.3.2](#)) or butt drop testing ([9.3.3](#)). The sack is dropped until breakage according to [8.4](#). The number of drops is registered and recorded for each sack in the test series, from which an average breakage number is calculated.

NOTE The constant drop height method has a special application when testing paper sacks intended for the transport of dangerous goods. See the recommendations by the United Nations. [\[2\]](#)

9.3.2 Flat constant height drop test

The flat drop test is where the face and/or the back of the sack is dropped against the surface.

Depending on the size of the sack, the nature of the filling content and the actual conditions the sack is facing in its life cycle, the height can be selected to either 0,8 m or 1,2 m. For more challenging applications, the 1,2 m drop height is recommended.

9.3.3 Butt constant height drop test

The butt drop test is where the top and/or the bottom of the sack is dropped against the surface.

Depending on the size of the sack, the nature of the filling content and the actual conditions the sack is facing in its life cycle, the height can be selected to either 0,3 m or 0,5 m. For more challenging applications, the 0,5 m drop height is recommended.

10 Test report

The test report shall include at least the following information:

- a) a reference to this document, i.e. ISO 7965-1:2024;
- b) the date and place of testing;
- c) the responsible body or person who conducted the testing;
- d) the description and identification of the sample, including full details of size, construction and type of all sacks tested, together with information on the type and weight of contents and type of closure;
- e) the description of contents – whether actual or dummy contents were used, full details shall be given;
- f) the conditioning atmosphere used, as well as the temperature of the filling contents;
- g) the method used, constant drop height or progressive drop height; if the constant drop height method is used, the selected drop height shall also be stated;
- h) in case of butt drop testing, the method of placing the sack before dropping shall be stated;
- i) the required results, as specified in [9.2](#) and [9.3](#) including details of location and type of breakages;
- j) the number of tested sacks;
- k) any deviations from the procedure or unusual features observed.

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Annex A
(informative)

Example of apparatus for drop testing

For an example of apparatus for flat and side drop testing, see [Figure A.1](#).

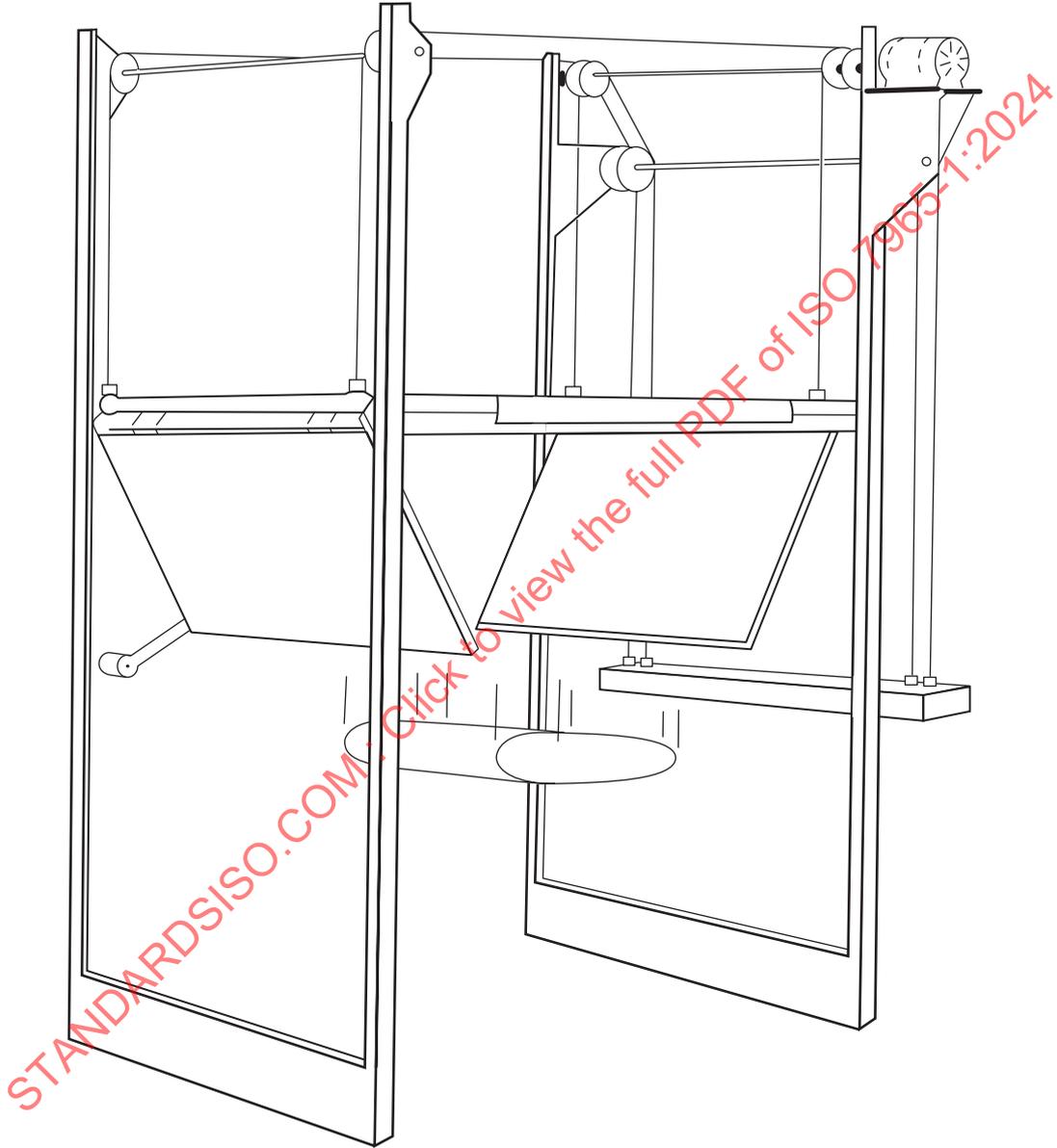


Figure A.1 — Apparatus suitable for flat and side dropping