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Packaging — Transport packaging for dangerous goods — Test methods

Emballages — Emballages de transport pour marchandises dangereuses — Méthodes d'essai

ICS 13.300; 55.020

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the European Committee for Standardization (CEN), and processed under the **CEN-lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five-month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

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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 16495 was prepared by Technical Committee ISO/TC 122, *Packaging*, Subcommittee SC 3, and by Technical Committee CEN/TC 261, *Packaging* in collaboration.

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Introduction

This International Standard was developed to provide requirements and test procedures to meet the multi-modal United Nations Recommendations on the Transport of Dangerous Goods [1] and successful passing of the tests may lead to the allocation of an appropriate UN packaging mark. The UN Recommendations have been developed by the United Nations Committee of Experts on the Transport of Dangerous Goods as a 'model regulation' (referred in this document as the UN Recommendations) in the light of technical progress, the advent of new substances and materials, the exigencies of modern transport systems and, above all, the need to ensure the safety of people, property and the environment. Amongst other aspects, the UN Recommendations cover principles of classification and definition of classes, listing of the principal dangerous goods, general packing requirements, testing procedures, marking, labelling or placarding, and shipping documents. There are in addition special recommendations related to particular classes of goods.

The UN Recommendations are given legal entity by the provisions of a series of international modal agreements and national legislation for the transport of dangerous goods. The international agreements include:

- The European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) (covering most of Europe). [2]
- Regulations concerning the International Carriage of Dangerous Goods by Rail (RID) (covering most of Europe, parts of North Africa and the Middle East). [3]
- The International Maritime Dangerous Goods Code (IMDG Code) (worldwide). [4]
- The International Civil Aviation Organization's Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO TIs) (worldwide). [5]

The application of this International Standard will need to take account the requirements of these international agreements and the relevant national regulations for domestic transport of dangerous goods.

It is important to note that there will be certain modal differences from the UN Recommendations and that the schedule for revision of the Recommendations and modal provisions may lead to temporary inconsistencies with this International Standard, which is regularly updated to the latest version of the UN Recommendations.]

It is noted that success in the tests and the allocation of an official UN mark do not on their own authorize the use of a packaging for any dangerous goods, which are subject to the packing instructions published in the various modal regulations.

This International Standard is based on Revision 17 of the UN Recommendations.

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Packaging — Transport packaging for dangerous goods — Test methods

1 Scope

This International Standard specifies the general information needed for the design type testing of packaging, Intermediate Bulk Containers (IBCs) and large packaging intended for use in the transport of dangerous goods.

NOTE This International Standard can be used in conjunction with one or more of the international regulations set out in the Bibliography.

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 2206:1987, Packaging — Complete, filled transport packages — Identification of parts when testing

ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories

United Nations Recommendations on the Transport of Dangerous Goods — Model Regulations.

3 Terms and definitions

For the purposes of this document, in addition to the definitions in The UN Recommendations chapter 1.2.1, the following terms and definitions apply.

3.1

brimful capacity

overflow capacity

maximum capacity

volume of water in litres held by the packaging, IBC, inner or outer packaging of a combination packaging and/or large packaging, when filled through the designed filling orifice to the point of overflowing in its normal position of filling, and considered for testing purposes as maximum capacity

3.2

nominal capacity

capacity in litres which, by convention, is used to represent a class of packaging of a similar brimful capacity

3.3

single packaging

means of packaging that does not require an inner packaging to be capable of performing its containment function and it includes composite packaging

4 Test report

All packaging, IBCs and large packaging tested for conformity with the UN Recommendations shall be the subject of a test report (in accordance with Annex A) which should include a specification check prepared in accordance with Annex B, C or D. It shall be possible to specifically identify the packaging, IBC and large packaging relative to each test report, either by the retention of uniquely referenced packaging, IBCs and large packaging or by inclusion of sufficient photographs and/or drawings with unique references to enable identification of the packaging, IBCs and large packaging and all its components.

5 Selection and preparation of packaging, IBCs and large packaging for testing

For the selection and preparation of packaging, IBCs and large packaging for testing the type of contents, (liquid, viscous or solid) is decisive.

NOTE Guidance on the determination of the type of contents given in Annex E.

5.1 Selection of packaging, IBCs and large packaging

Sufficient numbers of packaging, IBCs and large packaging per design type shall be selected for testing and shall be:

- a) marked with a test reference which shall also be entered on the test record and later used on the test report;
- b) marked on each face in accordance with ISO 2206 where the packaging, IBC and large packaging is in the shape of a rectangular box;
- c) individually weighed to establish the tare or filled gross mass.

NOTE 1 The form of such weighing can vary according to whether the packaging, IBCs and large packaging has been supplied full or empty to the test station. Where the masses of individual empty packaging, IBCs and large packaging are recorded, it is necessary to record only a typical filled gross mass (or vice versa).

- d) examined for damage which might invalidate the tests, in which event the packaging, IBCs and large packaging shall be replaced.

NOTE 2 Under some circumstances it can be desirable to have a range of packaging, IBCs and large packaging tested. In such situations selective testing procedure can be used to avoid testing of every possible permutation. The competent authority can allow this procedure after consultation.

Examples include:

- in a number of different sizes but of the same construction
- with variety of closures
- for use with a range of solid contents

5.2 Information to be provided with packaging, IBCs and large packaging

5.2.1 General

Each packaging, IBCs and large packaging type shall be accompanied by a specification for that design type containing the data set outlined in Annex B, C or D and by the following additional information contained in 5.2.2 to 5.2.6 as appropriate.

5.2.2 Test contents - Using water and non-dangerous substances

Where the tests are to be carried out using water or other non-dangerous substances, a statement of the packing group for which the packaging is to be tested shall be provided, together with data, enabling appropriate selection of inert test contents. For liquids, such data shall include the required maximum relative density for the tests together with data on, for instance, the internal pressure test required. For solids, such data shall include mass, grain size and any other relevant characteristics, for example, bulk density, angle of repose etc., to clearly show equivalence of physical characteristics.

5.2.3 Test contents - Using the dangerous substance

Where the tests are to be carried out using the dangerous substance(s) to be transported, a statement of their packing group and their physical characteristics shall be provided. Liquids shall be defined by their relative density together with viscosity and method of determination. Solids shall be defined by their mass and grain size and any other relevant characteristic, for example, bulk density, angle of repose etc. to ensure physical characteristics are sufficiently identified and included. This data shall be recorded in the test report (see Annex A).

5.2.4 Vapour pressure

For liquids, the vapour pressure (at a given temperature) of the substance to be carried or the hydraulic pressure to be achieved during the tests shall be provided.

5.2.5 Test contents - Using articles

Where the packaging and large packaging is intended for the transport of (an) article(s), a statement of the packing group, an appropriate description and drawing(s) of the article(s) and or photographs and details of the way in which dummy articles were filled for the purpose of testing shall be provided.

5.2.6 Closing instructions

Any special filling or closing instructions including, where relevant, the closure torque, or taping patterns shall be provided.

5.2.7 Handling characteristics of IBCs and large packaging

Each IBC and large packaging design shall be accompanied by a statement of its mechanical handling characteristics. This shall relate to bottom lift, top lift or both, as applicable, and number of identical items to be stacked during transport.

5.3 Selection of contents and filling of packaging, IBCs and large packaging prior to testing

5.3.1 General

Single packaging, IBCs, the inner packaging of combination packaging and large packaging shall be filled for drop and stacking tests to not less than:

- 98 % of brimful capacity for liquids;
- 95 % of brimful capacity for solids.

NOTE There can be exceptions, some flexible packaging (see 5.3.5) and some packaging designed to be transported part full (see 5.3.6).

Packaging, IBCs, the inner packaging of combination packaging and large packaging for liquids, or those capable of containing liquids, shall have their capacity determined as in 5.3.3. Other packages the capacity shall be determined by other suitable means e.g. by calculation.

5.3.2 Test contents

5.3.3 Packaging, IBC, inner packaging of combination packaging and large packaging to contain liquids

5.3.3.1 Determination of brimful capacity

A packaging, RIGID IBC, inner packaging of combination packaging and large packaging intended to contain liquids shall be filled to not less than 98 % of the brimful capacity. The brimful capacity is determined for example by: weighing the empty packaging/IBC/inner packaging including closures (mass empty (m) in kg) and weighing the packaging/IBC/inner packaging full (mass brimful (W) in kg). The packaging/IBC/inner packaging shall be filled with water until the water just overflows and then fitting the closure and any surplus mopped up. No steps shall be taken, e.g. by tilting or tapping the packaging/IBC/inner packaging, to enable water to penetrate into a hollow handle/lifting feature or other design feature above the closure.

The following formula expresses the brimful capacity:

$$b = \frac{W - m}{d}$$

where:

b is the brimful capacity in litres

W is the mass in kilograms, of packaging/IBC/inner packaging when brimful with water

m is the mass in kilograms, of the empty packaging/IBC/inner packaging

d is the density of water (=1) in kg/l

5.3.3.2 Filling of the packaging/IBC/inner packaging

When filling test samples of the above with liquids, at least one sample shall have its capacity and filling level determined as below. Further samples of that design type shall be filled using a dipstick calibrated on the first sample or by mass or volume. The calculation of required volume of liquids for testing shall be:

$$C = \frac{b \times 98}{100}$$

where:

C is the required volume of water in litres;

b is the brimful capacity in litres

5.3.4 Rigid packaging, RIGID IBCs, inner packaging of combination packaging and large packaging to contain solids

Packaging, RIGID IBCs, inner packaging of combination packaging and large packaging intended to contain solids shall be filled to not less than 95 % of the brimful capacity. Where the packaging/IBC/inner packaging is capable of containing liquids the capacity shall be determined as in 5.3.3.1

The calculation of required mass of solids for testing shall be:

$$M = \frac{(b \times d) \times 95}{100}$$

where:

M is the required mass in kilograms, of solids;

b is the brimful capacity either measured or calculated in litres ;

d is the bulk density of the test contents in kg/l

Alternatively, for cylindrical packaging/IBC/inner packaging the level of fill required to fill the packaging/IBC/inner packaging to at least 95 % of its brimful capacity shall be calculated from its internal height, taking into account any reduction in height caused by the fitting of the closure.

This procedure is not suitable for bags (see 5.3.5).

5.3.5 Flexible packaging, flexible inner packaging and flexible IBCs to contain solids

Flexible packaging/ flexible inner packaging (bags) and flexible IBCs shall be filled to the required testing mass at which the designer of the flexible packaging/ flexible inner packaging and flexible IBCs intends it to be used or, if known, to the capacity which the user intends to employ using either the substance to be transported or solids of similar characteristics in respect of mass, grain size and flow characteristics; the test contents used shall be recorded in the test report.

5.3.6 [Packaging/inner packaging designed to be used part full

Packaging/inner packaging designed to be transported with filling test levels less than 98 % for liquids or less than 95 % for solids shall be filled as prepared for transport to the capacity the user intends to employ. The filled volume and mass shall be recorded in the test report.]

5.4 Closing packaging, IBCs and large packaging

5.4.1 Drums, jerricans, composites and inner packaging, IBCs

Screw type closures shall be tightened to the torque specified by the applicant where appropriate before conditioning, or when specified during or after the conditioning period and shall be recorded in the test report.

Closure torque shall be the same for all tests. If it is necessary to revise a closure torque following a failure in one test, then all tests shall be completed using that torque setting.

Where vented closures are intended for use in the packaging, they shall be fitted for drop and stacking tests. Packaging fitted with vented closures shall be filled and after closing be inverted or laid on their side (see Figure 1) and observed for leakage for a period of 5 min. Leakage from the closure vent will result in termination of the test.

