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Packaging — Transport packages for dangerous goods — Test methods for IBCs

Emballage — Emballages d'expédition de marchandises dangereuses — Méthodes d'essai pour Grands Récipients en Vrac (GRV)

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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 16467 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 122, *Packaging*, Subcommittee SC 3, *Performance requirements and tests for means of packaging, packages and unit loads*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

Contents

Foreword

This document (EN ISO 16467:2003) has been prepared by Technical Committee CEN/TC 261, "Packaging", the secretariat of which is held by AFNOR in collaboration with Technical Committee ISO/TC 122 "Packaging".

This European Standard EN ISO 16467:2003 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2004, and conflicting national standards shall be withdrawn at the latest by April 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports the objectives of the framework Directives on Transport of Dangerous Goods.

This European Standard has been submitted for reference into the RID and/or in the technical annexes of the ADR. Therefore in this context the standards listed in the normative references and covering basic requirements of the RID/ADR not addressed within the present standard are normative only when the standards themselves are referred to in the RID and/or in the technical annexes of the ADR.

Annexes A, D and E are informative. Annexes B and C are normative.

This document includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This 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 can lead to the allocation of an appropriate UN IBC 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 to 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 (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 Standard will need to take account of 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 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 an IBC for any dangerous goods. There are other regulatory provisions that have to be taken into account in each instance.

This European Standard is based on Revision 12 of the UN Recommendations.

1 Scope

This European Standard specifies the design type test requirements for Intermediate Bulk Containers (IBCs) as described in 3.2 of this standard and intended for use in the transport of dangerous goods.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

ISO 6789, *Assembly tools for screws and nuts — Hand torque tools — Requirements and test methods for design conformance testing, quality conformance testing and recalibration procedure*

EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:1999).*

3 Terms and definitions

For the purposes of this European Standard the following terms and definitions apply.

3.1
competent authority
any national regulatory body or authority designated or otherwise recognized as such for any purpose in connection with the regulations specified in the Bibliography.

3.2
Intermediate Bulk Containers (IBCs)
rigid or flexible portable packagings, other than those specified in Chapter 6.1 of the UN Recommendations, that:

— have a capacity of:

i) not more than 3,0 m^3 (3,000 l) for solids and liquids of Packing Groups II and III;

ii) not more than 1,5 m^3 for solids of Packing Group I when packed in flexible, rigid plastics, composite, fibreboard and wooden IBCs;

iii) not more than 3,0 m^3 for solids of Packing Group I when packed in metal IBCs.

iv) not more than 3,0 m^3 for radioactive material of class 7

— are designed for mechanical handling;

— are resistant to the stresses produced in handling and transport, as determined by tests.

3.3
IBC design type
IBC of one design, size, material and thickness, manner of construction and means of filling and discharging, including various surface treatments, together with IBCs which differ from the design type only in their lesser external dimensions

NOTE 1 Attention is drawn to the fact that, when the IBC design type has a maximum capacity greater than 450 l and IBCs of that type with lesser dimensions bring the capacity below 450 l, additional tests can be necessary.

NOTE 2 For flexible IBCs the design type is specified by the grammage per square metre not by the thickness.

3.4
liquids
dangerous goods which at 50 ^{o}C have a vapour pressure of not more than 300 kPa (3 bar), which are not completely gaseous at 20 ^{o}C and at a pressure of 101,3 kPa, and which have a melting point or initial melting point of 20 ^{o}C or less at a pressure of 101,3 kPa

NOTE An expansion of this definition can be found in annex A

3.5
solids
dangerous goods, other than gases, that do not meet the definition of liquids

3.6
capacities

3.6.1
brimful (overflow, maximum) capacity
maximum volume of water in litres held by the IBC when filled through the designed filling orifice to the point of overflowing in its normal position of filling

3.6.2
nominal capacity
capacity in litres which, by convention is used to represent a class of packagings of similar brimful capacities

3.7
packing groups
group to which substances of most classes of dangerous goods are assigned according to the degree of danger presented:

Packing Group I	**Packing Group II**	**Packing Group III**
high danger	medium danger	low danger

NOTE The severity of an IBC test (e.g. the drop height) varies with the packing group of the substance.

3.8
types of IBCs
NOTE Further definitions are found in UN 6.5.1.3:

3.8.1
Rigid IBCs (RIBCs)
metal, rigid plastics, composite, fibreboard and wooden IBCs

3.8.2
Flexible IBCs (FIBCs)
paper, plastics and textile IBCs

3.9
maximum net mass
maximum mass of contents in one IBC expressed in kilograms

3.10
maximum permissible gross mass (for all RIBCs)
mass of the IBC and any service or structural equipment together with the maximum net mass

3.11
filling

3.11.1
under pressure
filling under a pressure of more than 10 kPa (0,1 bar)

3.11.2
under gravity
filling under gravity alone or a pressure of not more than 10 kPa (0,1 bar)

3.12
discharging

3.12.1
under pressure
discharging under a pressure of more than 10 kPa (0,1 bar)

3.12.2
under gravity
discharging under gravity alone or a pressure of not more than 10 kPa (0,1 bar)

4 Test requirements

4.1 Test and sequence requirements

4.1.1 Table 1 sets out the test requirements for IBCs

NOTE 1 The tests required in Table 1 correspond to the applicability provisions of the UN Recommendations but not necessarily to the tabulation therein.

NOTE 2 Successful design type tests as described in this standard normally lead to the allocation of a UN IBC mark by the competent authority. It is a requirement of the regulations listed in the Biliography that, before the IBC is used for dangerous goods, tests are carried out successfully on each IBC design type (see 3.3). It is also a requirement of those regulations that the tests are successfully repeated after any modification that alters the IBC design type, however the Competent Authority can waive testing. Some examples of where testing may be waived are given in annex D.

NOTE 3 Where an inner treatment or coating is applied for safety reasons it should retain its protective properties even after the tests.

NOTE 4 A design type not designed for bottom or top lifting does not meet the definition of an IBC [see 3.2] because, unless otherwise approved by the competent authority, it is not considered to be suitable for mechanical handling.

4.1.2 One sample RIBC shall be tested in accordance with the relevant test sequence in Table 1 and shall meet the applicable criteria in 4.2 to 4.7.

4.1.3 FIBCs shall be tested in accordance with Table 1 and shall meet the applicable criteria in 4.2 to 4.10. For any one design type, the tests shall be carried out using a different sample for each test, or with a sample which has passed one test being used for other tests.

NOTE 1 IBCs for solids, which are likely to become liquid during transport, should be tested as for liquids, RIBCs for solids can also be tested for liquids, specifically leakproofness and / or hydraulic tests.

NOTE 2 IBCs being tested for solids which require phlegmatizing with a liquid for safe transport, such that there is free liquid in the packaging, should be subjected to the appropriate tests for liquids with the test contents being a representative mixture of solids and liquids.

Table 1 — Design type tests required and sequential order

Metal IBCs				**Test required when contents are:**	
	Sequential order	**Requirement clause**	**Testing clause**	**Solids filled or discharged by gravity**	**Solids filled or discharged by pressure and liquids**
Bottom lift	1	**4.2**	**7.1**	Yes[a)]	Yes[a)]
Top lift	2	**4.3**	**7.2**	Yes[b)]	Yes[b)]
Stacking	3	**4.4**	**7.4**	Yes[c)]	Yes[c)]
Leakproofness	4	**4.5**	**7.5**	N/A	Yes
Hydraulic pressure	5	**4.6**	**7.6**	N/A	Yes
Drop [f)]	6	**4.7**	**7.7**	Yes[d)]	Yes[d)]
Rigid plastics IBCs				**Test required when contents are:**	
	Sequential order	**Requirement clause**	**Testing clause**	**Solids filled or discharged by gravity**	**Solids filled or discharged by pressure and liquids**
Bottom lift	1	**4.2**	**7.1**	Yes[a)]	Yes[a)]
Top lift	2	**4.3**	**7.2**	Yes[b)]	Yes[b)]
Stacking	3	**4.4**	**7.4**	Yes[c)]	Yes[c)]
Leakproofness	4	**4.5**	**7.5**	N/A	Yes
Hydraulic pressure	5	**4.6**	**7.6**	N/A	Yes
Drop [f)]	6	**4.7**	**7.7**	Yes	Yes
Composite IBCs				**Test required when contents are:**	
	Sequential order	**Requirement clause**	**Testing clause**	**Solids filled or discharged by gravity**	**Solids filled or discharged by pressure and liquids**
Bottom lift	1	**4.2**	**7.1**	Yes[a)]	Yes[a)]
Top lift	2	**4.3**	**7.2**	Yes[b)]	Yes[b)]
Stacking	3	**4.4**	**7.4**	Yes[c)]	Yes[c)]
Leakproofness	4	**4.5**	**7.5**	N/A	Yes
Hydraulic pressure	5	**4.6**	**7.6**	N/A	Yes
Drop [f)]	6	**4.7**	**7.7**	Yes[d)]	Yes[d)]
Fibreboard and wooden IBCs				**Test required when contents are:**	
	Sequential order	**Requirement clause**	**Testing clause**	**Solids filled or discharged by gravity**	
Bottom lift	1	**4.2**	**7.1**	Yes	
Top lift	2	**4.3**	**7.2**	Yes[b)]	
Stacking	3	**4.4**	**7.4**	Yes[c)]	
Drop [f)]	4	**4.7**	**7.7**	Yes	

Table 1 (Continued)

Flexible IBCs				Test required when contents are:	
	Sequential order	**Requirement clause**	**Testing clause**	**Solids filled or discharged by gravity**	
Bottom lift	N/A	**4.2**	**7.1**	Yes[a)d)]	
Top lift	N/A	**4.3**	**7.3**	Yes[d)e)]	
Stacking	N/A	**4.4**	**7.4**	Yes[c)d)]	
Drop [f)]	N/A	**4.7**	**7.7**	Yes[d)]	
Tear	N/A	**4.8**	**7.8**	Yes[d)]	
Topple	N/A	**4.9**	**7.9**	Yes[d)]	
Righting	N/A	**4.10**	**7.10**	Yes[d)]	

a) When IBCs are fitted with means of lifting from the base.

b) When IBCs are designed to be lifted from the top.

c) When IBCs are designed to be stacked on each other during transport.

d)The test is required but another IBC of the same design may be used

e)For FIBCs designed to be lifted from the top or the side

f)See 7.7.3 for additional drop tests for IBCs of 0,45m^3 capacity or less

4.2 Criteria for passing the bottom lift test

When tested in accordance with 7.1 there shall be no permanent deformation which renders the IBC, including the base pallet, if any, unsafe for transport and no loss of contents.

4.3 Criteria for passing the top lift test

4.3.1 When tested in accordance with 7.2 there shall be no permanent deformation which renders the RIBC, including the base pallet, if any, unsafe for transport and no loss of contents.

4.3.2 When tested in accordance with 7.3 there shall be no damage to the FIBC or its lifting devices which renders the FIBC unsafe for transport or handling and no loss of contents.

4.4 Criteria for passing the stacking test

4.4.1 When tested in accordance with 7.4 there shall be no permanent deformation which renders the RIBC, including the base pallet, if any, unsafe for transport and no loss of contents.

4.4.2 When tested in accordance with 7.4 there shall be no deterioration of the body which renders the FIBC unsafe for transport and no loss of contents.

4.5 Criteria for passing the leakproofness test

When tested in accordance with 7.5 there shall be no leakage of air.

4.6 Criteria for passing the hydraulic pressure test(s)

When tested in accordance with 7.6 there shall be no leakage of liquid.

When a pre-test at 65 kPa is required for metal IBCs there shall be neither permanent deformation which would render the IBC unsafe for transport nor leakage of liquid.

For rigid plastics and composite IBCs when tested in accordance with 7.6 there shall be no permanent deformation which would render the IBC unsafe for transport and no leakage.

4.7 Criteria for passing the drop test

4.7.1 For metal IBCs, when tested in accordance with 7.7 there shall be no loss of contents.

4.7.2 For rigid plastics, composite, fibreboard and wooden IBCs when tested in accordance with 7.7 there shall be no loss of contents. A slight discharge from a closure upon impact shall not be considered to be a failure of the IBC provided that no further leakage occurs.

4.7.3 For FIBCs when tested in accordance with 7.7 there shall be no loss of contents. A slight discharge, e.g. from closures or stitch holes, upon impact shall not be considered to be a failure of the FIBC provided that no further leakage occurs after the FIBC has been lifted clear of the ground.

4.8 Criteria for passing the tear test

Following the test, which shall be carried out in accordance with 7.8, the original 100 mm long cut shall not have extended by more than 25 % of its original length.

4.9 Criteria for passing the topple test

When tested in accordance with 7.9, there shall be no loss of contents. A slight discharge, e.g. from closures or stitch holes, upon impact shall not be considered to be a failure of the FIBC provided that no further leakage occurs.

4.10 Criteria for passing the righting test

When tested in accordance with 7.10 there shall be no damage to the FIBC or its lifting devices which renders the FIBC unsafe for transport or handling.

4.11 Equivalent testing

The test methods described in this standard shall be considered to be the reference test methods. Alternative methods may be used provided that:

their equivalence to the reference test method can be demonstrated;

their use is recorded in the test report;

prior approval is obtained from the competent authority.

4.12 Test report

All IBCs tested for conformity with this standard shall be the subject of a test report and specification check prepared in accordance with annexes B and C. It shall be possible to specifically identify the IBC relative to each test report, either by the retention of uniquely referenced IBCs or by inclusion of sufficient photographs and/or drawings with unique references to enable identification of the IBC and all its components.

NOTE 1 Each test report should be available to the users of the IBC.

NOTE 2 Retention and/or disposal procedures for test IBCs can be established by the competent authority.

5 Selection and preparation of test IBCs

5.1 Selection of IBCs

Sufficient IBCs per design type shall be submitted for testing in accordance with Table 1 and shall be:

a) marked with a test reference which shall also be entered on the test record and later used in the test report;

b) individually weighed to establish the tare or filled mass.

NOTE 1 The form of such weighing can be varied to correspond with whether the IBCs have been supplied full or empty to the test station. Where the tare masses of individual IBCs are recorded it is recommended to record only a typical filled mass (or vice-versa).

c) examined for damage which might invalidate the tests, in which event the IBC shall be replaced.

NOTE 2 Under some circumstances it can be desirable to have a range of IBCs tested, for example:
— in a number of different sizes but of the same construction;
— with a variety of closures;
— for use with a range of solid contents.
In such situations it may not be necessary to carry out testing for every possible permutation. This selective testing procedure is recognized but only after agreement with the competent authority who will advise on options available. Guidelines are set out in annex D.

5.2 Information to be provided with IBCs

5.2.1 General

Each IBC type shall be accompanied by specification(s) for that design type containing the information set out in annex C and by the additional information in 5.2.2 to 5.2.6 as relevant.

5.2.2 Water and other non-dangerous substances as test contents

Where the tests are to be carried out using water or other non-dangerous substances a statement of the packing group for which the IBC is to be tested together with data enabling appropriate selection of inert test contents and levels shall be provided. 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 characteristic, for example, bulk density, angle of repose etc., to clearly show equivalence of physical characteristics.

5.2.3 The dangerous substance as test contents

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 the 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 B).

NOTE Where tests are carried out using the actual substance to be transported then the test report is applicable for other substances having the same or equivalent characteristics.

5.2.4 Vapour pressure

For liquids, the vapour pressure of the substance to be carried or the hydraulic pressure to be achieved during the tests shall be stated.

5.2.5 Special instructions

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

5.2.6 Handling characteristics

Each IBC design type shall be accompanied by a statement of its mechanical handling characteristics. This shall relate to bottom lift, top lift or both as applicable.

EXAMPLE A composite IBC with a pallet base has an outer casing with each side formed from metal mesh within a metal frame. Where the mesh is complete the IBC is unlikely to be lifted from the top and the accompanying statement covers bottom lifting only. Where, however, the mesh is cut away in places under the upper frame members for convenience in lifting from the top, it is appropriate for a top lift characteristic to be included in the statement unless otherwise explained.

5.3 Selection of test contents and filling of IBCs prior to testing

5.3.1 General

NOTE Further specific requirements for preparation are given in clause 7.

5.3.1.1 RIBCs

For the bottom and top lift tests, IBCs shall be prepared as set out in 7.1 and 7.2

For the stack test, IBCs shall be prepared as set out in 7.4.

For the hydraulic pressure and leakproofness tests, IBCs shall be prepared as set out in 7.5 and 7.6.

For the drop test, IBCs shall be filled in accordance with 5.3.3.1 for liquids, or 5.3.3.2 for solids.

IBCs for liquids, or those capable of containing them, shall have their capacity determined as in 5.3.3. Otherwise the capacity shall be determined by other suitable means e.g. by calculation.

5.3.1.2 FIBCs

For the bottom and top lift tests, IBCs shall be prepared as set out in 7.1 and 7.3.

For the stack test, drop, tear, topple and righting tests IBCs shall be prepared as set out in 5.3.4.

5.3.2 Test contents

Where non-dangerous substances are to be used as test contents, they shall be selected to accord with the data in 5.2.2. Water or a water/anti-freeze mixture may be used to represent any liquid.

For solids, additives, such as bags of lead shot, may be used to adjust the mass if required, but if used they shall be placed in such a manner that the test results are not affected. The test contents used shall be recorded in the test report.

5.3.3 Filling

5.3.3.1 RIBCs to contain liquids – filling for the drop test

An RIBC intended to contain liquids, shall be filled for the drop test to not less than 98 % of the brimful capacity.The brimful (overflow) capacity is determined by weighing the empty RIBC and then weighing the RIBC full, filling the RIBC with water until the water just overflows and then fitting the closure. Any surplus water is mopped up. No steps shall be taken, e.g. by tilting or tapping the RIBC, to enable water to penetrate into a hollow lifting feature or other design feature above the closure.

5.3.3.1.1 The following formula expresses the brimful capacity:

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

where

b is the brimful capacity in litres (l);

d is density of water (=1) (in kg per litre)

W is the brimful mass in kilograms;

m is the empty mass in kilograms

5.3.3.1.2 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

5.3.3.2 RIBCs to contain solids – filling for the drop test

5.3.3.2.1 RIBCs intended to contain solids shall be filled to not less than 95 % of the brimful capacity. Where the IBC is capable of containing liquids the capacity shall be determined as defined in 5.3.3.The calculation of required mass of solids for testing shall be:

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

where

M = the required mass of solids in kilograms

d = the bulk density of the test contents in grams per cubic centimetre (g/cm^3).

b = the brimful capacity in litres

Alternatively, for cylindrical IBCs the level of fill required to fill the IBC to not less than 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.

5.3.4 Flexible IBCs to contain solids: filling for stack, drop, tear, topple and righting tests.

Flexible IBCs shall be filled to the required testing mass at which the designer of the packaging 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.

5.4 Closing IBCs

IBCs shall be closed as for transport and in accordance with any special instructions. Screw type closures shall be tightened to the recommended torque where appropriate. The torque applied shall be recorded in the test report.

Closure torque shall not differ from one test to another in the test report. If it is necessary to revise a closure torque following a failure in one test, then all tests shall be completed using the revised torque setting.

5.5 Conditioning

Fibreboard IBCs and composite IBCs with fibreboard outer casings and IBCs made of paper shall be conditioned before test for at least 24 h in an atmosphere having a controlled temperature and relative humidity (r.h.) There are three options, one of which shall be chosen. The preferred atmosphere is (23 ± 2) °C and (50 ± 2) % r.h. The two other options are (20 ± 2) °C and (65 ± 2) % r.h., and (27 ± 2) °C and (65 ± 2) % r.h.

NOTE 1 These values correspond to average values. In the short term the r.h. values can vary by ± 5 % without this having an influence on the test.

NOTE 2 The purpose of conditioning in this way is not to replicate any ambient condition likely to be met during actual transport. The purpose is to standardize the tests and enable them to be reproducible by stabilizing the moisture content of the paper or fibreboard. It is further noted that:

a) the IBC should be relatively dry before being placed in the controlled atmosphere;

b) the minimum of 24 h can be insufficient to stabilize the moisture content of thick material even if the IBC is open so that moisture can be transferred via outer and inner faces;

c) the moisture content of the paper or fibreboard can be significantly affected by the moisture content and temperature of the test contents.

5.6 Check of IBC specification against constructional requirements

Following receipt of the sample(s) and their specification (see 5.2.1), a check shall be made that the design type corresponds with the definition of an IBC and the constructional requirements set out for that type of IBC in the UN Recommendations.

5.7 Check of IBC specification against sample

The specification of the IBC to be tested shall be checked by visual inspection and actual measurements as detailed in annex C. Aspects such as external dimensions shall be checked at this preparatory stage. A record of each specification check shall be included in the test report.

NOTE Aspects (other than external dimensions) - such as measurement of material thickness requiring sectioning, can be carried out on completion of the test(s).

6 Facilities for testing

6.1 Testing of design types

Tests shall be carried out at a testing facility capable of meeting the operational provisions of EN ISO/IEC 17025.

NOTE 1 This does not imply a requirement for third party certification or accreditation but if appropriate such external approval can be obtained from either a national accreditation body or from the competent authority.

NOTE 2 Testing staff should have knowledge of the principles of the dangerous goods regulations as set out in the UN Recommendations.

6.2 Accuracy of measurement equipment

The accuracy of measurement equipment shall be more precise than the accuracy of the measurements in testing as specified in 6.3, unless otherwise approved by the competent authority. The measurement equipment shall be calibrated in accordance with the relevant provisions of EN ISO/IEC 17025.

6.3 Accuracy of measurements in testing

Measurement equipment shall be selected such that individual measurement results, including errors in reading and calibration, shall not exceed the following:

- Mass in kilograms (kg): ± 2 %
- Pressure in kilopascals (kPa): ± 3 %
- Distance/length in millimetres (mm) ± 2 %
- Temperature in degrees Celsius (°C) ± 1 °C
- Humidity in percentage (%) Tolerances are as specified in 5.5
- Time in minutes (min): ± 3 %
- Torque in newton metres (Nm) ± 3 Nm or 10 %, whichever is the greater in accordance with ISO 6789

NOTE For some measurements the tolerances can be lower in order to have meaningful measurements, e.g. when measuring masses or dimensions of empty packagings. Where only maximum or minimum values are specified in the text, tolerances are one-sided e.g. 7.5.2 requires that the leakproofness test be carried out for a period of at least 10 min. The period should be equal to or greater than 10 min.

6.4 Climatic conditions

There shall be adequate climatic facilities to meet the requirements in 5.5 and clause 7.

6.5 Impact surfaces for drop and topple tests

The drop and/or topple area impact surface shall be horizontal and flat, massive enough to be immovable and rigid enough to be non-deformable under test conditions and sufficiently large to ensure that the test IBC falls entirely upon the surface.

7 Testing procedures

7.1 Bottom lift test

7.1.1 Special preparation of IBCs for the test

The IBC shall be filled as for transport. A load shall be added and evenly distributed. The mass of the filled IBC and the load shall be 1,25 times its maximum permissible gross mass.

7.1.2 Method of testing

The IBC shall be raised and lowered twice by a lift truck with the forks centrally positioned and spaced at three quarters of the dimension of the side of entry (unless the points of entry are fixed). The forks shall penetrate to three-quarters the depth of the IBC in the direction of entry. The test shall be repeated from each possible direction of entry.

NOTE 1 Failure, when it occurs, often takes place during the initial acceleration of a lift. Neither the height nor the rate of elevating is specified. It is normally adequate (taking safety into account) to raise the IBC for a distance of some 200 mm. A convenient rate of lifting results in a 200 mm lift being completed in between 5 s and 10 s. It is recommended that, after the final test, the IBC should then be lowered, the forks placed fully underneath it and the IBC lifted to a convenient height for examination of the base.

NOTE 2 When a design of rectangular pallet can be entered from each of four sides a total of eight elevations and lowerings is undertaken.

7.2 Top lift test for RIBCs

7.2.1 Special preparation of the IBC for the test

The IBC shall be filled as for transport and then be loaded to a total of twice its maximum permissible gross mass, the load being evenly distributed.

7.2.2 Method of testing

7.2.2.1 The rigid plastics or composite IBC shall be lifted:

a) by each pair of diagonally opposed lifting devices, so that the hoisting forces are applied vertically, for a period of 5 min; and

b) by each pair of diagonally opposed lifting devices, so that the hoisting forces are applied towards the centre at 45° to the vertical, for a period of 5 min.

On each of the four lifts the IBC shall be maintained in that position for 5 min.

7.2.2.2 All other RIBCs shall be lifted in the manner for which they are designed until clear of the floor and maintained in that position for 5 min.

7.2.2.3 When equivalence can be demonstrated from previous tests on IBCs of similar design and with the approval of the competent authority, the test on rigid plastics and composite IBCs shall be carried out in accordance with 7.2.2.1 b) only. Two lifts shall be carried out using each pair of lifting devices in turn to make four lifts in all. The use of this method shall be recorded in the test report.

7.3 Top lift test for FIBCs

7.3.1 Special preparation of the IBC for the test

The IBC shall be filled to six times its maximum permissible load, the load being evenly distributed.

NOTE When using this method, rather than an equivalent one, primary attention often needs to be directed towards obtaining test contents of sufficient bulk density; it may not be possible to fully take account of other important characteristics such as the angle of repose of dangerous solids to be transported. The filling level cannot normally be controlled.

EXAMPLE An FIBC 1,2 m x 0,9 m x 0,9 m is designed to transport 1 000 kg of fine granules, so for test the FIBC is filled with 6 000 kg of test contents. Using 1 mm diameter lead shot with a bulk density of 7,6 g/cm^3 and 3 mm diameter polyethylene granules with a bulk density of 0,54 g/cm^3, an 80/20 mixture is required as test contents to give the correct load.

7.3.2 Method of testing

The FIBC shall be lifted in the manner for which it is designed until clear of the floor and maintained in that position for 5 min.

NOTE With the approval of the competent authority, an equivalent method related to national standards and international industry standards can be used. It can involve the use of a specialized tensile or compression test machine. The method is described in annex E.

7.4 Stacking test

7.4.1 Special preparation of the IBC for the test

RIBCs shall be filled as for transport and then loaded to their maximum permissible gross mass.

FIBCs shall be filled in accordance with 5.3.4.

7.4.2 Method of testing

The IBC shall be placed on its base on level hard ground and subjected to a uniformly distributed superimposed load.

The test load shall be calculated as 1,8 times the combined maximum permissible gross mass of the number of similar IBCs that may be stacked on top of the IBC during transport.

7.4.2.1 The test load shall be applied by any one of the following:

a) for RIBCs, one or more RIBCs of the same type filled to the maximum permissible gross mass and stacked on the test RIBC;

b) for FIBCs, one or more FIBCs of the same type filled to the maximum permissible load and stacked on the test FIBC;

c) appropriate weights loaded on to either a flat plate or a reproduction of the base of the IBC, which is stacked on the test IBC;

d) an appropriate compression test machine.

7.4.2.2 Metal IBCs shall be stacked for 5 min in ambient conditions.

Rigid plastics IBCs and composite IBCs where the stack load is supported entirely by plastics material shall be stacked for a period of 28 days at a temperature of not less than 40 °C.

NOTE Temperatures outside the range 40° C – 44° C should be pre-arranged and recorded in the test report.

7.4.2.3 Other types of IBC shall be stacked for 24 h in ambient conditions.

7.5 Leakproofness test

7.5.1 Special preparation of the IBC for the test

Vented closures shall either be replaced by similar non-vented closures or the vent shall be sealed.

The design type leakproofness test shall be carried out on the complete IBC and before the fitting of any thermal insulation equipment.

Alternatively, for composite IBCs, the inner receptacle may be tested without the outer casing provided the test results are not affected. When the test is carried out on the inner receptacle in this way, the fact shall be recorded in the test report.

7.5.2 Method of testing

The test shall be carried out for a period of at least 10 min using air at a constant gauge pressure of not less than 20 kPa.The airtightness of the IBC shall be determined by one of the three following methods:

a) by immersing the IBC under water and observing air bubbles. A correction factor shall be applied to the test pressure to take account of the hydrostatic pressure as illustrated in the example following.

EXAMPLE After immersion, the total depth of water is 2,5 m when the hydraulic pressure is 25 kPa the test pressure is therefore not less than 45 kPa.

NOTE 1 Air bubbles considered to arise from entrained air (e.g. air held initially in seams or in the thread of closures) should not be considered as leakage — this includes any bubbles produced which do not appear regularly. If necessary the test period can be extended to allow entrained air to be expelled.

b) by covering the seams and joints with a suitable soap solution and observing any air bubbles released;

NOTE 2 When using this method it is desirable to take special care with closures.

c) by using an air-pressure differential test.

The method used and the pressure differential shall be documented in the test report.

7.6 Hydraulic pressure test(s)

The IBCs shall be pressurized continuously and gradually up to the required test pressure.

NOTE This should be within the time of not less than 5 min and not more than 30 min.

7.6.1 Special preparation of the IBC for the test

The test shall be carried out before the fitting of any thermal insulation material. Any pressure relief devices shall be removed and their apertures plugged or they shall be rendered inoperable.

7.6.2 Method of testing and pressures to be applied

The IBCs shall be pressurised continuously and gradually up to the required test pressure.

NOTE This should be within the time of not less than five minutes and not more than 30 min.

The IBC shall be subjected to one or two hydraulic pressure tests each for a period of at least 10 min. The IBC shall not be mechanically restrained during the test. The test pressures and number of tests are as follows:

— metal IBCs for Packing Group I solids loaded or discharged at a pressure of more than 10 kPa shall be subjected to one test at a gauge pressure of 250 kPa;

— metal IBCs for Packing Group II or III solids loaded or discharged at a pressure of more than 10 kPa shall be subjected to one test at a gauge pressure of 200 kPa;

— metal IBCs for Packing Group II or III liquids shall be subjected to two tests in sequence, the first at a gauge pressure of 65 kPa and the second at a gauge pressure of 200 kPa;

— rigid plastics or composite IBCs for solids loaded or discharged at a pressure of more than 10 kPa shall be subjected to one test at a pressure of 75 kPa; corrected for temperature as specified in 7.6.4.

— rigid plastics or composite IBCs for liquids shall be subjected to one test using a test pressure determined as in 7.6.3 following. Rigid plastics and composite IBCs for liquids shall have the pressure determined from 7.6.3 corrected for temperature as specified in 7.6.4.

7.6.3 Determination of test pressure for rigid plastics and composite IBCs

The test pressure to be applied is the greater of two values, the first as determined by one of the following methods:

a) the total gauge pressure measured in the IBC (i.e. the vapour pressure of the filling substance and the partial pressure of the air or other inert gases , minus 100 kPa) at 55 °C multiplied by a safety factor of 1,5. This total

gauge pressure shall be determined on the basis of a maximum degree of filling in accordance with UN Recommendations Part 4.1.1.4 and a filling temperature of 15 °C;

b) 1,75 times the vapour pressure of the substance to be transported at 50 °C minus 100 kPa but with a minimum test pressure of 100 kPa;

c) 1,5 times the vapour pressure of the substance to be transported at 55 °C minus 100 kPa but with a minimum test pressure of 100 kPa.

and the second as determined by the following method:

d) twice the static pressure of the substance to be transported, with a minimum of twice the static pressure of water.

EXAMPLE An IBC with a depth of fill of 1 m is used to illustrate the calculations:

— a depth of 1 m of water produces a static pressure of 9,81 kPa. For an IBC with that depth the minimum test pressure is therefore 20 kPa.

— for a dangerous liquid with a relative density of 1,8 the calculated static pressure is (9,81 × 1,8) kPa or 17,658 kPa. For an IBC with a depth of 1 m the minimum test pressure would therefore be 36 kPa.

7.6.4 Adjustment of test pressure: rigid plastics and composite RIBCs for liquids

The IBC for liquids shall be filled with water and the temperature of the water measured. Water at the same temperature shall be used to pressurize the IBC. If the water temperature is outside the limits (12 ± 2) °C, a pressurization factor shall be applied to adjust the test pressure.

Where the water temperature is (12 ± 2) °C the pressurization factor is 1,000.

Outside these limits the temperature shall be rounded to the nearest 1 °C (0,5 °C goes up to the next whole number) and the pressurization factor shall be read from Table 2 following:

EXAMPLE For a required test pressure of 100 kPa, tested at 6,1 °C:

Applied test pressure = 100 × 1,078 kPa

= 108 kPa

The temperature of the water from one sample and the applied test pressure shall be recorded in the test report.

Table 2 — Water temperature adjustment factors

Test temperature °C	Pressurization factor
2	1,132
3	1,119
4	1,105
5	1,092
6	1,078
7	1,065
8	1,051
9	1,038
<10	1,025
12 ± 2	1,000
>14	0,976
15	0,964
16	0,952
17	0,940
18	0,928
19	0,917
20	0,906

7.7 Drop test

7.7.1 Preparation

7.7.1.1 General

IBCs shall be filled in accordance with 5.3.

7.7.1.2 Special preparation of RIBCs for the test

For metal IBCs, pressure relief devices shall be removed and their apertures plugged or shall be rendered inoperative.

For rigid plastics and composite IBCs, arrangements provided for pressure relief may be removed and plugged or rendered inoperative.

Testing of rigid plastics and composite IBCs with plastics inner receptacles or frames shall be carried out when the temperature of the test sample and its contents has been reduced to minus 18 °C or lower. Test liquids shall be kept in the liquid state, if necessary by the addition of anti-freeze.

Where the composite IBC to be tested has an outer casing of fibreboard and is prepared in this way, the conditioning specified in 5.5 may be waived.

7.7.2 Drop height

For solids and liquids, where the test is performed with the solid or liquid to be transported or with another substance having essentially the same characteristics, the drop height shall be that specified below:

Packing Group I	Packing Group II	Packing Group III
Solids only 1,8 m	1,2 m	0,8 m

For liquids, where the test is performed with water:

a) Where the liquids to be transported have a relative density not exceeding 1,2, the drop height shall be that specified below:

Packing Group I	Packing Group II	Packing Group III
-Not applicable	1,2 m	0,8 m

NOTE The term water includes water/antifreeze mixtures for testing at –18 °C.

b) Where the liquids to be transported have a relative density d) exceeding 1,2, the drop height shall be calculated on the basis of the relative density of the liquid to be transported, rounded up to the first decimal. The drop height shall be that specified below:

Packing Group I	Packing Group II	Packing Group III
-Not applicable	$d \times 1{,}0$ m	$d \times 0{,}67$ m

NOTE There is no correction of drop height with density of solids.

7.7.3 Method of testing

IBCs shall be dropped on an impact surface as defined in 6.5, once onto their base in such a manner as to ensure that the point of impact is on that part of the base considered to be the most vulnerable.

IBCs of 0,45 m^3 capacity or less shall also be dropped:

— metal IBCs: once onto the most vulnerable part other than the part of the base tested in the first drop;

— FIBCs: once onto the most vulnerable side;

— rigid plastics, composite, fibreboard and wooden IBCs: flat on a side, flat on the top and on a corner.

NOTE The same or different IBCs can be used for each drop.

7.8 Tear test for FIBCs

7.8.1 Special preparation of the IBC

The IBC shall be filled in accordance with 5.3.4, the load being evenly distributed.

7.8.2 Method of testing

The IBC is placed on the ground. A 100 mm long cut, completely penetrating the wall of a wide face, is made at a 45° angle to the principal axis of the IBC, halfway between the bottom surface and the top level of the contents. Each end of the cut shall be clearly marked e.g. with a marking pen. The IBC shall then be subjected to a uniformly distributed superimposed load equivalent to twice the maximum permissible load. The load shall be applied for at

least 5 min. After removal of the load the IBC shall be lifted clear of the floor and maintained in that position for a further period of 5 min. The maximum length of any extension to the original cut shall be measured.

7.9 Topple test for FIBCs

7.9.1 Special preparation of the IBC

The IBC shall be filled in accordance with 5.3.4, the load being evenly distributed.

7.9.2 Method of testing

The IBC shall be caused to topple on to any part of its top on to an impact surface as defined in 6.5. The topple height shall be that specified below:

Packing Group I	Packing Group II	Packing Group III
1,8 m	1,2 m	0,8 m

7.10 Righting test for FIBCs

7.10.1 Special preparation of the IBC

The IBC shall be filled in accordance with 5.3.4, the load being evenly distributed.

7.10.2 Method of testing

The filled IBC, lying on its side shall be lifted to an upright position clear of the floor. The top lift device(s) uppermost and most accessible shall be used. Lifting shall take place at a speed of at least 0,1 m/s. Where the IBC has fewer than four lifting devices, it shall be lifted using one of the lifting devices. Where the IBC has four lifting devices it shall be lifted using two.

Annex A
(informative)

Guidance on liquids and solids

Unless there is an explicit or implicit indication to the contrary in the UN Recommendations, liquids are dangerous goods which at 50 ^{o}C have a vapour pressure of not more than 300 kPa (3 bar), which are not completely gaseous at 20 ^{o}C and at a pressure of 101,3 kPa, and which have a melting point or initial melting point of 20 ^{o}C or less at a pressure of 101,3 kPa. A viscous substance for which a specific melting point cannot be determined is subjected to the ASTM D 4359 test; or, to the test for determining fluidity (penetrometer test) prescribed in the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), Annex A, Appendix A.3, with the modifications that the penetrometer conforms to ISO 2137, and that the test shall be used for viscous substances of any class. Solids are dangerous goods, other than gases, that do not meet the definitions of liquids.

The substances packed in IBCs include free-flowing liquids, pastes, viscous substances, powders and granules. The choice of tests for any IBC depends crucially on whether the design type is to be tested for liquids or solids; however, there is no simple, absolute and natural distinction between the two. Moreover, some substances which are solids at say 20 °C become liquid at 55 °C which is the reference temperature for that which may be experienced in transport.

As indicated, the UN Recommendations and the international agreements contain definitions making the distinction between liquids and solids from measurements of specific melting point or by penetrometer testing. Such measurements are rarely necessary in relation to IBC testing; also the tests can be carried out in a facility not equipped to make such measurements. In most instances there will be little difficulty in choosing between testing for liquid or for solid contents. In many instances an IBC will be designed for liquids and tested using water as contents without reference to any specific dangerous liquid to be carried. Similarly, an IBC will be designed for solids and tested using, for example, a mixture of plastics granules and fine powder without reference to any specific dangerous solid to be carried. In such circumstances it is appropriate for each user of the IBC to check that the testing has been suitable for the dangerous substance. In other instances however the design type tests for an IBC will be undertaken in relation to a specific dangerous substance; should that substance be borderline between a liquid and a solid then it is recommended that the appropriate data on it is obtained before tests are selected and commenced.

Annex B
(normative)

Test report

B.1 Introduction

Every test shall be accompanied by a test report the minimum contents of which are set out as follows.

B.2 Test facility (name and address)

This shall be the organization that undertook the actual testing. The front page of the report shall be on the headed paper of the test facility. If headed paper is not available the report shall be clearly traceable to its author and the test facility.

B.3 Applicant (name and address)

The applicant can be the manufacturer, the user of the IBC or any person in the packaging chain.

NOTE In some instances the address of the test facility and the applicant can be the same.

B.4 Report number

This shall be a number which enables full traceability back to the original working documents that refer to the original test. The number shall appear on every page of the report and any annexes. Any subsequent amendments shall include the number and clearly show it is an amendment or addition to the original report.

B.5 Date

This shall be the date the report was completed, rather than the date that testing was completed. The report shall also include the dates of the receipt of test samples, the start of the tests and their completion and the date of receipt of test items.

B.6 Manufacturer

Because IBC specifications (see annex C) are a part of the report, the manufacturer's name in the body of the test report is not necessary, provided this is clearly stated in one of the annexes which can be clearly linked to the main report.

B.7 IBC description

The description of the IBC design type (e.g. dimensions, materials, closures, thickness, etc.,) including the method of manufacture (e.g. welded, blowmoulded, etc.).

The main report shall include a general description of the IBC. Full details of its components and material shall be included either in the specification (see annex C) (provided there is a clear link between it and the main report) or in the main report. A check for conformity with the relevant definition in the regulations shall be included.

NOTE It can also include drawings and photographs.

B.8 Capacities

For RIBCs the report shall include the nominal capacity and the maximum capacity (brimful capacity) as defined in 3.6.1 in either litres (or cubic metres).

The specifications for FIBCs shall include the maximum permissible load in kilograms.

B.9 Test contents

Characteristics of test contents shall include the following for example: viscosity and relative density for liquids; and bulk density, particle size and angle of repose for solids.

B.10 Test description and results

The report shall identify the number of IBCs. Each IBC shall have its own identification number. At least one IBC shall be weighed full or empty.

The sequence and performance of tests undertaken on each IBC shall be clearly described. For FIBCs there shall be a description of each test and how it was performed.

The report shall include a conclusion clearly indicating the packing group to which the tests belong and the test levels achieved, particularly hydraulic pressure for liquid containers.

Where a competent authority has agreed to deviations from the standard methods set out in this standard, reference to such authorization shall be included in the test report.

B.11 Signature

The test report shall be signed with the name and status of the signatory.

The person who was responsible for the testing, shall sign the report against his or her typed name and position in the test facility.

NOTE That person might be the tester or his or her supervisor.

The test report shall include statements that the IBC, prepared as for transport, was tested in accordance with the appropriate provisions of Chapter 6.5 of the UN Recommendations and that the use of other packing methods or components shall render it invalid.

NOTE The competent authority can require the test report to be retained for a specified period of time.

Annex C
(normative)

IBC Specifications

C.1 Specification data

To assist in the identification of an IBC, following the issue of a test report, it is necessary to have a detailed specification.

The attached matrix correlates the different IBC types with data that are necessary for the identification of test IBCs by users, test facilities and competent authorities.

There are two parts to this annex:

1) Metal IBCs, rigid plastics IBCs, wooden and fibreboard IBCs – Tables C.1.1 and C.1.2;

2) Flexible IBCs – Tables C.2.1 and C.2.2.

Tables C.1 and C.2 are in two parts. The first shall apply to all IBCs in that category. The second shall be applicable only to particular IBC types when indicated by an “S”.

Each item in the table is numbered and in C.2 at the end of this annex there are explanatory notes for many of the numbers to assist in interpretation.

The following symbols relate to procedures in relation to checking specifications on completion of testing by the test laboratory:

* = item to be checked;

A = thickness only;

B = combined grammage;

S = technical data.

The specification check shall be done visually and, where relevant, by measuring main dimensions and thicknesses.

NOTE The specification check data as measured on the test samples should be recorded and compared with the design type specification including manufacturing tolerances. The measured data of the test samples should fall within these tolerances.

Because of the range and variety of IBCs there may be additional items that should be specified and specification checked for a particular IBC and similarly some items shown as required on the specification may not be present. Users should endeavour to ensure all the required data (where appropriate) is given.

TABLE C.1.1 - Metal IBCs, rigid plastics IBCs, composite IBCs with rigid receptacles, wooden and fibreboard IBCs – IBC specification detail applicable to all

No	Specification check requirement ↓			Specification check requirement ↓	
1	IBC description, proposed code and trade name		22	Filling aperture closure manufacturer, address and identity/part number	
2	Manufacturers names and address's		23	Filling closure, closure torque	
3	Method(s) of construction		16	Discharge aperture(s), internal diameter and design	*
4	Nominal capacity		17	Discharge aperture(s) position	
5	Brimful capacity	*	18	Discharge aperture closure material and grade	
6	Diameter, nominal (cylindrical) internal	*	19	Discharge aperture closure type and identification	
92	Diameter, external (at widest point) of receptacle	*	20	Discharge aperture closure thread type and pitch	*
93	Diameters, external conical type receptacles	*	21	Discharge aperture closure mass	*
94	Cross section dimensions non-round receptacles	*	22	Discharge aperture closure manufacturer, address and identity/part no	
9	Overall cross section (non round)	*	16	Pressure relief fittings, internal diameter and design	*
95	Position and types of seam in receptacle		17	Pressure relief fittings position	*
96	Number of top lift points	*	18	Pressure relief fittings material and grade	
97	Number of bottom lift points or access directions	*	20	Pressure relief fittings thread type and pitch	*
11	Overall height	*	21	Pressure relief fittings mass	*
12	Number to be stacked on top during transport		22	Pressure relief fittings manufacturer and manufacturers identity/part no	*
16	Filling aperture(s), internal diameter and design	*	98	Other fittings in body of receptacle, type, number, location and identity	*
17	Filling aperture(s), position		31	Tare mass	*
18	Filling aperture material and grade		99	Details of any liner, material type, thickness, grammage, tare weight	*
19	Filling aperture closure type and identification	*	100	Details of any coatings, material type gm m^3	
20	Filling aperture closure thread type and pitch	*	101	Type of base, material and means of attachment (where appropriate)	*
21	Filling aperture closure mass	*	102	Compliance to drawings	*

Table C.1.2 — Metal IBCs, rigid plastics IBCs, wooden and fibreboard IBCs — IBC specification detail applicable as indicated

No.		Specification check requirement	Metal IBCs	Plastics IBCs	Natural wood (Wooden) IBCs	Plywood IBCs	Reconstituted wood IBCs	Fibreboard IBCs
32	Nominal thickness and material type and grade head or lid	*A	S		S	S	S	S
33	Nominal thickness and material type and grade body	*A	S		S	S	S	S
34	Nominal thickness and material type and grade base	*A	S		S	S	S	S
35	Material type, grade (polymer) body			S				
36	Material type, grade (polymer) base			S				
37	Material type, grade (polymer) lid/head			S				
38	Material lid gasket		S	S	S	S	S	S
42	Closing ring type	*	S	S	S	S	S	S
43	Closing ring material		S	S	S	S	S	S
44	Closing ring thickness	*	S	S	S	S	S	S
45	Number of plies	*				S		S
46	Grammage of material per square metre	*B					S	S
47	Inner lining or coating material				S	S	S	S
49	Method of lid retention (other than closing ring)		S	S	S	S	S	S
53	Fastening system: Number, position, material	*			S	S	S	S
54	Reinforcements Type, position, material	*			S	S	S	S
56	Method of joining panels	*			S	S	S	
59	Corrugated flute type	*						S
60	Corrugated combined grammage	*						S
61	Edge compression test (ECT)	*						S
62	Burst strength	*						S
91	Puncture resistance	*						S

NOTE * = required on specification checks (see C.2); A = thickness to be measured for specification check ; B = combined grammage shall be checked; S = required data for that IBC type.

Table C.2.1 - Flexible IBCs - IBC specification detail applicable to all

No.	Specification check requirement ↓			Specification check requirement ↓	
1	IBC description (code and trade name)		19	Filling aperture closure type	*
2	Manufacturer's name and address		16	Discharge aperture, internal diameter and design	*
3	Method of construction		17	Discharge aperture position	*
4	Nominal capacity		18	Discharge aperture closure material and grammage	
12	Stacking capability, number		19	Discharge aperture closure type	*
15	Top lift devices: Number, material, position	*	75	Sewing: Style and density of stitches	*
31	Tare mass	*	76	Type of thread and minimum breaking load	
51	Design standard or drawing		77	Filter cord	
52	Dimensions of the empty IBC	*	78	Adhesive, type	
16	Filling aperture, internal diameter and design	*	103	Statement of compliance to appropriate UN design type	
17	Filling aperture position	*	104	Seams: Type	*
18	Filling aperture closure material and grammage				

Table C.2.2 – Flexible IBCs — IBC specification detail applicable as indicated

No.		Specification check requirement	Unlined/uncoated woven plastics	Other woven plastics	Plastics film	Unlined/uncoated textile	Other textile	Paper
32	Material type and grade		S	S		S	S	S
33	Nominal thickness, material type and grade	*A			S			
35	Type of film grade				S			
45	Number of plies	*						S
46	Grammage of material per square meter	*	S	S				S
79	Fabric (warp/weft), tapes per 100 mm	*	S	S		S	S	
82	Coating, material, thickness/weight			S			S	S
83	Liner, material, thickness	*		S			S	S
84	Material strength elongation		S	S	S			
85	Material strength tensile (energy absorption)							S

NOTE * = required on specification checks (see C.2); A = thickness to be measured for specification check; S = required data for that IBC type.

C.2 Notes to IBC specification detail applicable to Tables C.1.1 to C.2

1. IBC description i.e. metal IBC made of steel for liquids, code where appropriate i. e. 31A (see ADR/RID 6.1.5.4) and trade name

2. Name and address of manufacturer of IBC and major components if different

3. Method of construction of receptacle and framework (where appropriate), i.e. welded, glued, stitched; nailed, etc.

4. Volume declared by the manufacturer (smaller than brimful capacity)

5. Maximum volume of water in litres held by the IBC when filled through the designed filling orifice to the point of overflowing in its normal position of filling

6. If cylindrical: internal diameter; if conical: 2 internal diameters; if angular: length x breadth

8. Conical shaped IBCs: Smallest and largest external diameter

11. From ground to highest point (incl. framework and fittings, if existing)

12 Number to be stacked on top during transport

15 Notice: Fibreboard or wooden IBCs shall not incorporate top lifting devices

16 Required for each closure and variant

18. Required for each one and variant, including plastics polymer details

19. May include trade name and any features or marks on closure

20. If fitted

21. Mass of individual closure with gasket/wad

22. For each closure

23. For each closure

24 If fitted

42 If fitted

43 If fitted

61, 62, and 91. These are capability requirements and are not supported by required tests. These specification check fields need only be completed where the appropriate test has been done.

Annex D
(informative)

Selective testing and variations from a tested design type

D.1. Selective testing (Note 2 to 5.1)

D.1.1

With the approval of the competent authority, IBC's can be selected for testing from a range of IBC designs having the same material of construction and fabrication process but with differences in design e.g., size, closure(Note 2 to 4.1.1).

EXAMPLE An RIBC is fitted with two alternative designs of base pallet.

Examination indicates that the bottom lift and stack performances will be the same but that the drop test performance can alter. The full tests are undertaken with one design. A second IBC with the alternative pallet is subjected to the drop test only.

D.1.2 With the approval of the competent authority, a Code 11, 13 or 21 IBC can be tested with selected media that is representative of a range of solid contents (Note 2 to 4.1.1).

EXAMPLE A design of IBC is used for contents varying from fine powder to a substance that is filled hot into the IBC and sets on cooling.

A full set of tests is carried out using test contents comprising plastics granules and fine powder. A drop test is also carried out using, with appropriate safety precautions, the actual hot filling substance.

D.2. Variations from a tested design type

D.2.1 With the approval of the competent authority, the following changes can be made to a tested IBC design type without re-testing the IBC if other design specifications remain unchanged. The description of the IBC design in the IBC Test Report should be revised to show the changes and, where applicable, the changes should be registered with the approving authority**.**

D.2.1.1 An interior or exterior surface treatment can be added to an IBC, e.g. protective coating, galvanizing, fluorination, provided the treatment does not affect the mechanical properties of the treated surface.

D.2.1.2 A non-integral interior liner that is made of a material that is more flexible than the body can be added to an RIBC provided the mass of the liner is less than 2% of the tare mass and the liner does not affect the performance of the closure system.

D.2.1.3 Non-structural accessories can be added to an IBC e.g., placard holders, protective plates provided the change in tare mass of the IBC does not exceed 5%.

D.2.1.4 Additives can be included in the composition of the plastic material of an IBC to improve resistance to ageing or ultraviolet radiation. The chemical and physical properties of the plastic material should not be adversely affected

Annex E
(informative)

Top lift test for FIBCs using specialized apparatus

E.1 Principle

The filled FIBC is suspended by its lifting devices with a flat pressure plate positioned on top of the test contents. A force is effectively applied to the pressure plate in one of two ways.

a) the fixed pressure plate is restrained either from above or below. The FIBC is suspended from a movable frame to which an upward force is applied progressively against the resistance of the pressure plate; or

b) the FIBC is suspended from a frame fixed at the time of test and a downward force is applied progressively to the pressure plate.

The total force on the lifting devices of the FIBC should be at least 6 times the maximum permissible load. This total force is made up of two components: firstly, the mass of the filled FIBC; and, secondly, the force on the pressure plate. The total force should be exerted for a period of at least 5 min.

E.2 Apparatus

E.2.1 Flat pressure plate, of such a size that it covers between 60 % and 80 % of the surface area of the cross section of the FIBC. The pressure plate (and any restraint) should be capable of resisting the forces applied during the test with minimal deformation.

NOTE Flanges can be fitted to the underside of the pressure plate for prevention of lateral displacement.

E.2.2 Suspension frame, such that the filled FIBC can be suspended clear of the ground with its lifting devices positioned as recommended by its manufacturer. The suspension frame shall have a rectangular cross-section. The upper edges should have a radius of 1 mm with a tolerance of $^{+0,5}_{0}$ mm. The horizontal dimension of the cross-section should be 25 mm with FIBCs designed for one- or two- point lifting; and 50 mm with FIBCs designed for four-point lifting. The tolerance should be $^{+0,5}_{0}$ mm in both instances. The suspension frame should be capable of resisting the forces applied during the test with minimal deformation.

E.2.3 Means of applying the force (upward or downward):

— capable of at least the required test load;

— capable of being operated at a rate of (70 ± 20) kN/min;

— fitted with means for registering the mass of the FIBC when suspended and of registering the total applied force.

E.2.4 Rods with screw connections, as a suitable means of restraint from above or below the flat plate when the apparatus is set up and an upward force is applied to the plate. When restraint is from below, the rods pass through the body of the FIBC and its test contents. Considerable care should be taken to ensure that, with woven fabrics, threads are separated rather than cut. Rods should not pass through the base within 20 mm of a seam or join and a multiplicity of rods may be needed to ensure this.

NOTE When a rod is passed through fabric it is recommended that a conical adapter be screwed to the end and removed once the FIBC is in position for the test. It is also recommended that nuts be used to connect the rod(s) to the pressure plate and to a restraint.

E.3 Procedure

E.3.1 Fill the FIBC to the height recommended by the manufacturer. Plastics granules with a bulk density of 1 g/cm^3 are typically used. Record details of the filling height and the contents used in the test report.

NOTE The total downwards force on the FIBC is made up of two components. Firstly, there is the force of gravity acting on the test contents. Secondly, there is the force applied to the test contents by the flat plate. The mass of the contents therefore, in itself , is not critical; should it be less than the maximum permissible load this will be made up by an additional force from the flat plate.

E.3.2 Suspend the filled FIBC from the frame of the test apparatus. Select an appropriate size of pressure plate and place on top of the test contents such that during the test there will be no contact between the edge of the plate and the material of the FIBC. When an upward force is to be used restrain the plate from above or below.

NOTE Any top panel not designed to contribute to the overall strength of the FIBC can be removed to allow passage of connecting rods when an upward force is used with restraint from above, or of the entry of the plate when a downward force is used. The area removed is the minimum commensurate with efficient operation.

E.3.3 Apply an upward or downward force at a rate of 70 ± 20 kN/min until a total force equivalent to 6 times the maximum permissible load has been achieved. Maintain the force constantly for a period of 5 min. Assess the results against the criteria in 4.3.2.

NOTE Following the assessment there is no objection to the force being increased until failure of the FIBC occurs.

Bibliography

Standards publications

ISO 2137, *Petroleum products — Lubricating grease and petrolatum — Determination of cone penetration.*

ASTM-D-4359-90, Standard Test method for determining whether a material is a liquid or a solid.

Other documents

The UN Recommendations have been developed by the United Nations Committee of Experts on the Transport of Dangerous Goods 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 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 (in particular Class 1 Explosives).

Though written in technical terms, the testing procedures set out in the UN Recommendations include areas of interpretation which may lead to international inconsistencies in application. This standard series is deemed to give guidance with respect to uniform interpretation and application of the UN testing procedures.

The following regulations are referred to in the text of the standard. Each edition is revised regularly and the latest one should be used. Test facilities should be in possession of at least one of the documents or alternatively their national law where it includes the relevant UN provisions.

[1] The United Nations Recommendations on the Transport of Dangerous Goods — Model regulations. ST/SG/A.C.10/1/Rev. 12. Geneva: United Nations ISBN 92-1-139074-5.

[2] The European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR). Geneva: United Nations ISBN 92-1-139071-0

[3] Regulations concerning the International Carriage of Dangerous Goods by Rail (RID). Berne: Organisation intergouvernmentale pour les transports ferroviaires (OTIF), 2001.

[4] The International Maritime Dangerous Goods (IMDG) Code. London: International Maritime Organization, ISBN 92-801-5090-1.

[5] Technical Instructions for the Safe Transport of Dangerous Goods By Air (ICAO). I DOC 9284. AN/905. Montreal: International Civil Aviation Organization, 2001.

The following directives of the European Community require member states to apply the provisions of RID/ADR to all dangerous goods traffic in their territories:

Council Directive 94/55EC on the approximation of the laws of the Member States with regard to the transport of dangerous goods by road (OJL319).

Council Directive 96/49EC on the approximation of the laws of the Member States with regard to the transport of dangerous goods by rail (OJL 235).

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