
**Packaging — Transport packaging
for dangerous goods — Plastics
compatibility testing for packaging
and IBCs**

*Emballages — Emballages de transport pour marchandises
dangereuses — Essais de compatibilité des matières plastiques pour
emballages et GRVs*

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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 13274 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 261, *Packaging*, 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).

This first edition of ISO 13274 cancels and replaces ISO 16101:2004¹⁾ and ISO 23667:2007²⁾, which have been technically revised.

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1) ISO 16101:2004, *Packaging* — *Transport packaging for dangerous goods* — *Plastics compatibility testing*.

2) ISO 23667:2007, *Packaging* — *Transport packaging for dangerous goods* — *Rigid plastics and plastics composite IBCs* — *Compatibility testing*.

Introduction

This International Standard was developed to provide requirements and test procedures to meet the compatibility provisions for plastics packagings and Intermediate Bulk Containers (IBCs) to contain liquids as set out in:

- The European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) (covering most of Europe) [1] and
- Regulations concerning the International Carriage of Dangerous Goods by Rail (RID) (covering most of Europe, parts of North Africa and the Middle East) [2].

This procedure is an alternative option to that set out in the UN Recommendations on the Transport of Dangerous Goods.

Plastics packaging/IBC material can be attacked by the chemical contents of the package. Such effects are caused by different mechanisms such as environmental stress cracking (ESC) chemical degradation and/or swelling.

The UN Recommendations and the associated modal regulations require that all packagings/IBCs be assessed for compatibility with the substances which they are to contain. The UN text makes special reference to plastics packagings/IBCs for liquids. The procedure therein contains details of testing for six months at ambient temperature with the liquid to be carried. RID/ADR permits as an alternative the use of standard liquids to which this International Standard refers.

The UN Recommendations are given legal entity not only to ADR and RID but also to:

- The International Civil Aviation Organisations Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO Tis) (worldwide) [3] and
- The International Maritime Dangerous Goods Code (IMDG Code) (worldwide) [4].

The application of this International Standard will need to take account of the requirements of these international agreements and the relevant national regulations for domestic transport of dangerous goods as required by Directive 2008/68/EC of the European Parliament and council, as modified by Commission Directive 2012/45/EU of 3 December 2012 [5].

Although not stipulated in the UN Recommendations or the model regulations, these tests may be applied, where deemed appropriate, to polyethylene inner packaging of combination packaging.

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Packaging — Transport packaging for dangerous goods — Plastics compatibility testing for packaging and IBCs

WARNING — The use of this International Standard could involve hazardous materials and equipment. This International Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this International Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This International Standard specifies the requirements and test methods for compatibility testing of plastics packagings/Intermediate Bulk Containers (IBCs) and composite packagings/IBCs with plastics inners containing liquids. The testing involves storage with the liquid to be transported. For polyethylene-based packaging, testing with a standard liquid as defined in *The European Agreement concerning the International Carriage of Dangerous Goods by Road* may be undertaken. [Annex B](#) describes small-scale laboratory tests that may be used to determine the assimilation of those products to be carried with the standard liquids.

Where there is any contradiction between this International Standard and any applicable regulation, the regulation always takes precedence.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method*

ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method*

ISO 1628-3, *Plastics — Determination of the viscosity of polymers in dilute solution using capillary viscometers — Part 3: Polyethylenes and polypropylenes*

ISO 1872-2:2007, *Plastics — Polyethylene (PE) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 2818, *Plastics — Preparation of test specimens by machining*

ISO 11403-3, *Plastics — Acquisition and presentation of comparable multipoint data — Part 3: Environmental influences on properties*

ISO 11542-2:1998, *Plastics — Ultra-high-molecular-weight polyethylene (PE-UHMW) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 16495:2013, *Packaging — Transport packaging for dangerous goods — Test methods*

ISO 13274:2013(E)

ISO 16770, *Plastics — Determination of environmental stress cracking (ESC) of polyethylene — Full-notch creep test (FNCT)*

UNITED NATIONS. The United Nations Recommendations on the transport of dangerous goods — Model Regulations. ST/SG/A.C. 10/1/Rev.17: United Nations

3 Terms and definitions

For the purposes of this document, the terms and definitions given in the UN Recommendations, ST/SG/A.C.10/1Rev17 and the following apply .

3.1 plastics packaging

drum and jerrican made from plastics material and composite packaging with inner plastics receptacles

3.2 plastics IBC

rigid plastics intermediate bulk container and composite intermediate bulk container with inner plastics receptacle

3.3 packaged substance

<chemical product> dangerous liquid to be transported in the packaging/IBC

Note 1 to entry: Packagings/IBCs used for solid packaged substances, which can become liquid at temperatures encountered during transport, also meet the requirements of packagings/IBCs for liquids.

3.4 standard liquid

defined liquid that is representative in its effect of a specific kind of interaction between a packaged substance and the plastics packagings/IBCs.

4 Test requirements

4.1 General

Plastics packagings/IBCs selected in accordance with [Clause 5](#) shall be conditioned with the packaged substance or a standard liquid, to which the packaged substance is assimilated.

NOTE Standard liquids and their assimilations can be found in ADR [1] and RID [2].

For packaged substances which are not assimilated to a standard liquid, small scale laboratory tests (see [Annex B](#)) may be used to compare their impacts to those of standard liquids.

The packaged substance shall be less aggressive than the standard liquid to which it will be assimilated. In the event the effect is more aggressive than that of the standard liquids, the six month procedure shall be followed as given in [8.2](#), or alternatively, and with the exception of nitric acid > 55 %, the accelerated procedure, in accordance with [8.3](#). Where the six-month procedure is carried out the specifications of the packaged substance are recorded.

When the standard liquid is water, proof of chemical compatibility is not required.

4.2 Conditioning

Plastics packagings/IBCs shall be conditioned in accordance with [Clause 8](#).

4.3 Post-conditioning inspection

At the end of the conditioning period the packagings/IBCs shall be inspected for leakage. Where no leakage is apparent testing in accordance with 8.4 shall be performed.

4.4 Drop test

The drop test shall be performed in accordance with Annex F of ISO 16495:2013.

4.5 Stacking test

The stacking test shall be performed in accordance with Annex I of ISO 16495:2013.

4.6 Hydraulic pressure test

The hydraulic pressure test shall be performed in accordance with Annex H of ISO 16495:2013.

4.7 Leakproofness test

The leakproofness test shall be performed in accordance with Annex G of ISO 16495:2013.

4.8 Bottom lift test

The bottom lift test shall be performed in accordance with Annex K of ISO 16495:2013.

4.9 Top lift test

The top lift test shall be performed in accordance with Annex L of ISO 16495:2013.

4.10 Vibration test

The vibration test shall be performed in accordance with Annex Q of ISO 16495:2013.

4.11 Permeability testing

With the exception of composite packagings having a plastics receptacle with outer steel drum, plastics packaging shall be tested for permeability. A suitable test method can be found in ADR and RID. This test is only required when the packagings described above are intended to transport benzene, toluene, xylene or mixtures and preparations containing these substances.

NOTE Some substances can lead to permeation of the product through the (plastics) wall of the packaging. In some cases these substances give such a high degree of swelling that the required performance of the packaging is not met. In other cases the performance criteria are met, but the high degree of permeation could lead, besides the loss of product, to a dangerous situation because of vapours with dangerous explosive or toxic concentrations. Barrier materials or surface modifications can be used to decrease the amount of permeation and thus the risk of a dangerous situation.

4.12 Equivalent testing

The test methods described in this International Standard shall be considered to be the reference test methods.

Alternative methods may be used to demonstrate compliance with relevant regulations provided that:

- their equivalency to the reference method can be demonstrated;
- their use is recorded in the test report;
- prior approval is obtained from the competent authority.

5 Selection and preparation of packagings/IBCs

Packagings and IBC's shall be selected and prepared for testing as specified in ISO 16495:2013, Clause 5. Concerning closure applications all tests for a particular liquid shall be carried out at the same torque.

NOTE 1 The closure torque can vary for different seals.

NOTE 2 If application of the specified closure torque affects the subsequent performance of the seal during the packaging testing then the specified closure torque can be applied after the conditioning period.

NOTE 3 When mechanical tests have been successfully performed, the stacking test can be waived for standard liquids on composite packagings with plastic inner receptacles and non-plastics outer packaging.

NOTE 4 When mechanical tests, in accordance with ISO 16495:2013 have been successfully carried out, it is not necessary to carry out bottom lift test, top lift test and vibration test, for all IBC types. The stacking is also not necessary for composite IBCs having a non-plastics outer structure that supports the stacking load.

6 Additional information to be provided for assimilation

The packagings/IBCs user (with the assistance, where appropriate, of the packagings/IBCs manufacturer and the test laboratory) shall identify the packaged substance. The assimilation process shall consist of identifying the plastics material concerned and its possible interactions, such as swelling, environmental stress cracking (ESC) and molecular degradation.

The specification forms for plastics packagings/IBCs should identify the material by polymer type and grade.

NOTE Where tests are carried out using the packaged substance, the test report can be applicable for other substances having equivalent or lesser chemical effects.

7 Facilities for testing

See ISO 16495:2013, Clause 7

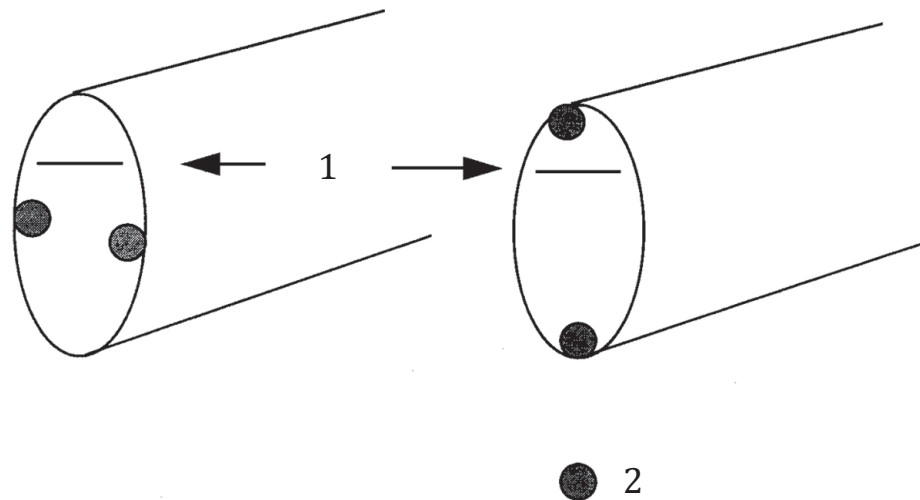
8 Conditioning procedures

8.1 General

After filling, the packagings shall be inverted for 24 h or 5 min if fitted with a vented closure and then restored to the normal standing position. At the end of the conditioning period as defined in 8.2 and 8.3, this inversion process shall be repeated.

The inversion process is not applicable for IBCs.

As an alternative to complete inversion the packaging may be laid on its side such that all closures are below the level of the substance being tested in accordance with [Figure 1](#).



Acceptable

Unacceptable

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Key

- 1 liquid level
2 closure

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Figure 1 — Explanatory diagram of alternative inversion method

8.2 Ambient conditioning

This test shall be carried out at ambient temperature for a period of 6 months.

For the purposes of this International Standard, ambient temperature, which shall be monitored and recorded, is considered to be not less than 15 °C.

NOTE The competent authority might, however, allow an extended period of test for temperatures below 15 °C.

8.3 Accelerated conditioning

The packagings/IBCs for test shall be conditioned for 21 days at a minimum temperature of 40 °C with each standard liquid, or a packaged substance, as relevant.

8.4 Procedure following the conditioning period

Following the conditioning period, all packagings/IBCs, except those intended to withstand the stacking test, shall be emptied, rinsed, inspected for damage and prepared for test in accordance with the test procedures for plastics packagings/IBCs for liquids specified in ISO 16495:2013. Testing shall commence within 21 days of the end of the conditioning period. If emptied the packagings/IBCs shall be kept closed until testing commences.

Packagings/IBCs which have been conditioned with standard liquid, *N*-butyl acetate, shall be emptied and refilled with a mixture of 1 %–10 % aqueous wetting agent solution and 2 % of *N*-butyl acetate for the stacking test.

NOTE 1 Where the closure elements (for example heat or induction seals) would have to be destroyed to empty the packaging after conditioning; the packaging is to be emptied through an additional opening drilled into the package. Such an opening is to be made so that the results of the other tests (drop, hydraulic pressure and leakproofness tests) are not affected.

NOTE 2 For substances presenting an unacceptable safety risk at 40 °C, it might be necessary to replace the filling substance by another substance where at least the same chemical interaction has been demonstrated and the agreement of the competent authority has been obtained.

The same closures and gaskets used during the conditioning of the packagings/IBCs shall be used for all of the testings, i.e. gaskets and closures shall not be replaced.

8.5 Reuse of standard liquids

The standard liquids shall be checked periodically in accordance with [Table 1](#) as their effectiveness can be reduced over a period of time.

Table 1 — Reuse of standard liquids

Standard liquid	Specification
Wetting solution	New solution for each test or check surface tension against specification.
Acetic acid	Concentration (99 ± 1) %
Normal butyl acetate	≥ 98 % a)
Mixture of hydrocarbons	(16–21) % aromatic content a)
Nitric acid	Concentration ≥ 55 %
<p>a) It is recommended that the absorption of these standard liquids is periodically checked with a control specimen of polyethylene of defined type and grade, in accordance with B.4.1 The used standard liquid is no longer fit for purpose when the determined absorption deviates by more than 5 % from the original determined value.</p>	

Tests to monitor the quality of the standard liquids shall be done by appropriate means at intervals according to the frequency of usage.

9 Test report

The test report shall be written in accordance with Clause 4 of ISO 16495:2013.