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Packaging — Transport packaging for dangerous goods — Compatibility testing of polyethylene, fluorinated polyethylene and co-extruded plastic

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **2**
4 Apparatus **2**
5 Test liquids **4**
5.1 PFL-FR 2344 4
5.2 PFL-FR 2323 4
6 Test requirements **5**
6.1 General 5
6.2 Procedure D — Resistance to absorption 6
6.2.1 Principle 6
6.2.2 Selection and preparation of the test bottles 6
6.2.3 Determination of the tare mass 6
6.2.4 Filling the test bottles 6
6.2.5 Storage of the test bottles 6
6.2.6 Determination of the absorption 7
6.3 Procedure E – Determination of the tensile impact strength 7
6.3.1 Principle 7
6.3.2 Selection and preparation of the test bottles 7
6.3.3 Filling the test bottles 7
6.3.4 Deformation of the test bottles 7
6.3.5 Storage of the test bottles 7
6.3.6 Test specimens for determination of the tensile impact strength 7
6.3.7 Determination of the tensile impact strength 8
7 Test report **9**
Bibliography **10**

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

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This document was prepared by Technical Committee ISO/TC 122, *Packaging*, Subcommittee SC 3, *Performance requirements and tests for means of packaging, packages and unit loads*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 261, *Packaging,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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

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Introduction

This document was developed to provide requirements and test procedures which are aligned with the United Nations Recommendations on the Transport of Dangerous Goods — Model Regulations[1], referred to as "UN Recommendations" throughout this document. This document can be used in the evaluation of the chemical compatibility of packaging and intermediate bulk containers (IBC) made from plastics material, with multilayer structures. This document provides a test method for the compatibility testing of packaging/IBC made of polyethylene, fluorinated polyethylene and co-extruded plastics.

According to paragraphs 6.1.5.2.4 and 6.5.6.3 of the UN Recommendations,[1] the chemical compatibility for packaging and IBC made from plastics material is required for packaging of dangerous goods.

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

The UN Recommendations and the associated modal regulations require that all packaging/IBCs be assessed for compatibility with the substances which they are to contain. The UN text makes special reference to plastics packaging/IBCs for liquids. The procedure therein contains details of testing for six months at ambient temperature with the liquid to be carried.

According 6.1.5.2.4 or 6.5.6.3 of the UN Recommendations, the compatibility can be verified using other procedures if these are at least equivalent to the above procedure and are recognized by the competent authority.

For example, References [2] and [3] permit, as an alternative, the method based on the concept of accelerated conditioning and test liquids (ISO 13274).

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)[4]; and

— The International Maritime Dangerous Goods Code (IMDG Code) (worldwide).[5]

This document provides requirements and test procedures which are aligned with the compatibility provisions for plastics packaging and 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)[2]; and

— Regulations concerning the International Carriage of Dangerous Goods by Rail (RID) (covering most of Europe, parts of North Africa and the Middle East).[3]

Note The test methods described in RID are called test procedure A (swelling), test procedure B (stress-cracking) and test procedure C (molecular degradation). The procedures given in this document is an alternative option to RID and in logical continuation referred to as test procedure D (resistance to absorption) and test procedure E (determination of the tensile impact strength).

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Packaging — Transport packaging for dangerous goods — Compatibility testing of polyethylene, fluorinated polyethylene and co-extruded plastic

1 Scope

This document specifies test methods for the determination of the chemical compatibility of packaging/ IBC made from polyethylene (PE), fluorinated polyethylene and co-extruded plastics. It covers the determination of adequate plastics compatibility against the following processes of deterioration:

— softening due to absorption (swelling);

— stress cracking;

— combinations thereof.

This document is applicable to:

— drums and jerricans made from plastics;

— composite packaging (plastics) with inner receptacle made from plastics;

— rigid plastics IBCs (types 31H1 and 31H2);

— composite IBCs with rigid plastics inner receptacles (type 31HZ1);

used for the transport of liquid dangerous goods.

Proof of adequate plastics compatibility obtained using the test procedures specified in this document is only applicable to the above packaging and IBC types of the following materials and material specifications:

— packaging and IBCs made from PE;

— packaging and IBCs made from PE, whose internal surfaces are fluorinated; and

— packaging and IBCs which are coextrusion blow moulded and have walls with the following multilayer structure (from inside to outside):

  — polyamide (PA), bonding agents, PE, or

  — ethylene vinyl alcohol (EVOH), bonding agents, PE.

Note Packaging and IBCs made from PE and packaging and IBCs made from PE with fluorinated internal surfaces, deteriorate additionally due to molecular degradation reactions with the corresponding packaged substances. For this, the chemical compatibility can also be verified by the type tests described in ISO 13274:2013, Annex B, B.2.3, using the standard liquid nitric acid (55 %) or appropriate original packaged substances. Packaging made from Coex PE/PA and Coex PE/EVOH is not resistant to polar acid molecularly degrading substances such as nitric acid, with the result that a corresponding method is not considered for this process of deterioration in this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8256, *Plastics — Determination of tensile-impact strength*

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ISO 13274:2013, *Packaging — Transport packaging for dangerous goods — Plastics compatibility testing for packaging and IBCs*

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

ISO 2768-1:1989, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13274 and ISO 16495 apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

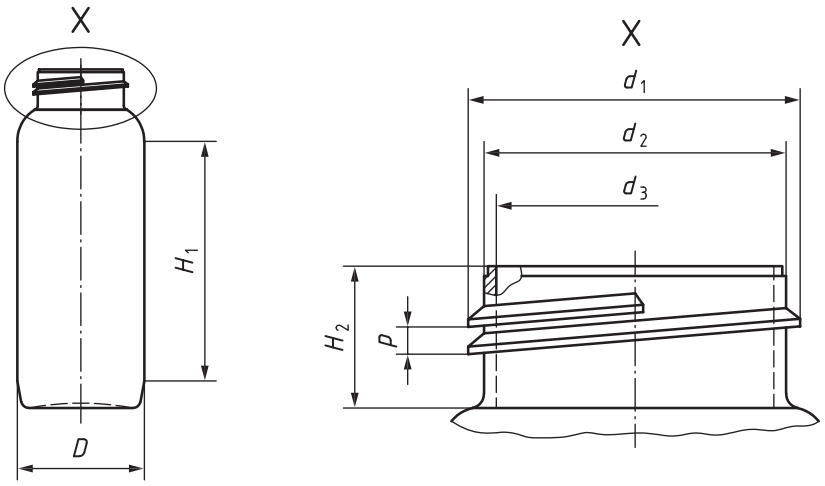
— IEC Electropedia: available at https://www.electropedia.org/

4 Apparatus

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

4.1 Test bottles shall be manufactured by blow moulding. They shall be from the same material (PE) or the same composite material (Coex PE/PA or Coex PE/EVOH) as the packaging / IBC intended for transport of the packaged substances to be tested. The packaging or IBC must be approved for a test liquid according to 6.1. If internally fluorinated packaging or IBCs are used for transport, the test bottles shall also be internally fluorinated. The dimensions of the test bottle are shown in Figure 1.

The test bottles shall not be stored for longer than 5 years. If storage extends beyond this period, the suitability of the test bottles shall be checked and verified. The test bottles shall be stored in the dark at room temperature. The test bottles shall all be manufactured from the identical PE material batch. The test bottles shall have been produced by the same manufacturer as part of one production batch.



Key

d_1	nominal diameter of thread
d_2	diameter of thread core
d_3	inner neck diameter
H_1	height of cylindrical shell
H_2	neck height
p	pitch of thread
D	external bottle diameter

Figure 1 — Test bottle

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