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**COMMITTEE OF EXPERTS ON THE TRANSPORT OF
DANGEROUS GOODS AND ON THE GLOBALLY
HARMONIZED SYSTEM OF CLASSIFICATION
AND LABELLING OF CHEMICALS**

**Sub-Committee of Experts on the
Transport of Dangerous Goods**
(Twenty-fourth session, 1-10 December 2003,
agenda item 4 (b))

PACKAGINGS

Package testing -referencing ISO 16104 in the Model Regulations

Transmitted by the expert from the United Kingdom

Introduction

1. The expert from the United Kingdom refers to the discussions held during the 23rd session of the Sub-Committee in July on his proposal contained in ST/SG/AC.10/C.3/2003/10 to reference ISO 16104. The United Kingdom's proposal was not supported. In particular many experts feared that the Sub-Committee would lose control over the parameters for testing and the criteria for passing the tests to an outside body. At the end of the debate the expert from the United Kingdom undertook to present a new paper for the December session in the hope that the Sub-Committee can agree his proposals.
2. The proposal takes the comments made by the Sub-Committee into account and uses as its base, UN/SCETDG/23/INF 21 produced by the expert of France during the July 2003 session. The new proposal references the main parts of the ISO standard but leaves in place the test parameters and the pass/fail criteria.
3. During the debate in July a number of delegates commented either verbally or through Information papers about aspects of the standard. Some points raised are discussed below.

Discussion

1. The ISO work on this standard has been reported to the Sub-Committee on a number of occasions. For example at the December 1999 meeting of the Sub-Committee of Experts on the Transport of Dangerous Goods, the Secretariat circulated draft copies of ISO/EN 16104. ISO in its paper ST/SG/AC.10/C.3/2001/24 reported progress and identified issues in Section 6.1.5 and the use of the ISO standard. Similarly the UK in its paper UN/CETDG/21/INF.22 presented at the 21st session of the Committee in December 2000 sought to raise issues concerning the ISO standard. Finally in UN/SCETD/22/INF.55 during the July 2002 meeting the United Kingdom expert alerted the Sub-Committee to the completion of the standard.
2. The standard is no way intended to change the test regime- rather it is intended to achieve increased standardisation so that the tests can be repeated in the same manner without deviation. This is not always possible with present text in the Model Regulations, which is open to interpretation in some instances. As an example, by introducing optional information drops, see paragraph 7.1.4 of the ISO standard, it is possible to ascertain where the weakest point of a package may be. The current provisions only provide for five drops for a box but depending on how a box is constructed, whether with glue or staples, and its contents the weakest point will usually vary.
3. The standard contains Normative and Informative text just in the same way as the Model Regulations have mandatory text with advisory notes. No piece of Informative text conflicts with the current Recommendations.
4. The referencing of an ISO standard in the Model Regulations is not new. There are already nearly 30 standards mentioned in the 13th edition of the Model Regulations; most of these were written without the participation of members of the Sub-Committee. For packaging itself there are around 14 ISO references. There is the argument that the packaging Chapters are the most common and are in everyday use. It must be a minority of consignors of dangerous goods that use or need to use Chapter 6.1 on a daily basis. This Chapter, like the other Chapters in Part 6, is aimed at designers and testers of the various containment systems. The consignor's duty to ensure that the packaging is fit for its journey is set out in Part 4.1.1.
5. In paragraph 6.1 page 13 'General Requirements' of ISO 16104 the reference to ISO 17025 states quite clearly that the test facilities should be "capable of" meeting this requirement. A note states, "This does not imply third party certification". The current ISO 9000 recognises that for testing facilities ISO 17025 is the more appropriate standard. The term "capable of appears" nearly 50 times in Parts 1-6 of the Recommendations and does not appear to cause difficulties.

The expert from the United Kingdom on the basis of the discussion above believes that it is appropriate to make the following changes to Chapter 6.1.5 in the Model Regulations. Changes to the existing text are shown by shading.

Proposal

1) **AMENDMENTS TO 6.1.5**

6.1.5 Test requirements for packagings

6.1.5.1 *Performance and frequency of tests*

6.1.5.1.1 The design type of each packaging shall be tested as provided in 6.1.5 in accordance with procedures established by the competent authority. **Where applicable and unless otherwise specified the**

tests shall be carried out in accordance with procedures set out in ISO16104: 2003

Note: Packagings tested in accordance with ISO16104, 7.7 are subject to 6.1.1.2.

6.1.5.1.2 Tests shall be successfully performed on each packaging design type before such packaging is used. A packaging design type is defined by the design, size, material and thickness, manner of construction and packing, but may include various surface treatments. It also includes packagings which differ from the design type only in their lesser design height.

6.1.5.1.3 Tests shall be repeated on production samples at intervals established by the competent authority. For such tests on paper or fibreboard packagings, preparation at ambient conditions is considered equivalent to the requirements of ISO16104, 4.1 table 1 columns (G) and (L).

6.1.5.1.4 Tests shall also be repeated after each modification which alters the design, material or manner of construction of a packaging.

6.1.5.1.5 The competent authority may permit the selective testing of packagings that differ only in minor respects from a tested type, e.g. smaller sizes of inner packagings or inner packagings of lower net mass; and packagings such as drums, bags and boxes which are produced with small reductions in external dimension(s).

Note: ISO16104, 5.1 Annex F describes parameters for selective testing of some packaging types.

[Explanation: the ISO working group recognised that there could be many packagings suitable for selective testing procedures but it was not possible to agree parameters especially for combination packaging which could have many variations]

6.1.5.1.6 Where an outer packaging of a combination packaging has been successfully tested with different types of inner packagings, a variety of such different inner packagings may also be assembled in this outer packaging. In addition, provided an equivalent level of performance is maintained, the following variations in inner packagings are allowed without further testing of the package:

- (a) Inner packagings of equivalent or smaller size may be used provided:
 - (i) The inner packagings are of similar design to the tested inner packagings (e.g. shape - round, rectangular, etc.);
 - (ii) The material of construction of the inner packagings (glass, plastics, metal, etc.) offers resistance to impact and stacking forces equal to or greater than that of the originally tested inner packaging;
 - (iii) The inner packagings have the same or smaller openings and the closure is of similar design (e.g. screw cap, friction lid, etc.);
 - (iv) Sufficient additional cushioning material is used to take up void spaces and to prevent significant movement of the inner packagings; and
 - (v) Inner packagings are oriented within the outer packaging in the same manner as in the tested package.
- (b) A lesser number of the tested inner packagings, or of the alternative types of inner packagings identified in (a) above, may be used provided sufficient cushioning is

added to fill the void space(s) and to prevent significant movement of the inner packagings.

6.1.5.1.7 Articles or inner packagings of any type for solids or liquids may be assembled and transported without testing in an outer packaging under the following conditions:

- (a) The outer packaging shall have been successfully tested in accordance with 6.1.5.3 with fragile (e.g. glass) inner packagings containing liquids using the Packing Group I drop height;
- (b) The total combined gross mass of inner packagings shall not exceed one half the gross mass of inner packagings used for the drop test in (a) above;
- (c) The thickness of cushioning material between inner packagings and between inner packagings and the outside of the packaging shall not be reduced below the corresponding thicknesses in the originally tested packaging; and if a single inner packaging was used in the original test, the thicknesses of cushioning between inner packagings shall not be less than the thickness of cushioning between the outside of the packaging and the inner packaging in the original test. If either fewer or smaller inner packagings are used (as compared to the inner packagings used in the drop test), sufficient additional cushioning material shall be used to take up void spaces;
- (d) The outer packaging shall have passed successfully the stacking test in 6.1.5.6 while empty. The total mass of identical packages shall be based on the combined mass of inner packagings used for the drop test in (a) above;
- (e) Inner packagings containing liquids shall be completely surrounded with a sufficient quantity of absorbent material to absorb the entire liquid contents of the inner packagings;
- (f) If the outer packaging is intended to contain inner packagings for liquids and is not leakproof, or is intended to contain inner packagings for solids and is not siftproof, a means of containing any liquid or solid contents in the event of leakage shall be provided in the form of a leakproof liner, plastics bag or other equally efficient means of containment. For packagings containing liquids, the absorbent material required in (e) above shall be placed inside the means of containing the liquid contents;
- (g) For air transport, packagings shall comply with 4.1.1.4.1;
- (h) Packagings shall be marked in accordance with 6.1.3 as having been tested to Packing Group I performance for combination packagings. The marked gross mass in kilograms shall be the sum of the mass of the outer packaging plus one half of the mass of the inner packaging(s) as used for the drop test referred to in (a) above. Such a package mark shall also contain a letter "V" as described in 6.1.2.4.

Note: ISO16104, Annex C.

6.1.5.1.8 The competent authority may at any time require proof, by tests in accordance with this section, that serially-produced packagings meet the requirements of the design type tests.

6.1.5.1.9 If an inner treatment or coating is required for safety reasons, it shall retain its protective properties even after the tests.

6.1.5.1.10 Provided the validity of the test results is not affected and with the approval of the competent authority, several tests may be made on one sample.

6.1.5.1.11 *Salvage packagings*

Salvage packagings (see 1.2.1) shall be tested and marked in accordance with the provisions applicable to Packing Group II packagings intended for the transport of solids or inner packagings, except as follows:

- (a) The test substance used in performing the tests shall be water, and the packagings shall be filled to not less than 98% of their maximum capacity. It is permissible to use additives, such as bags of lead shot, to achieve the requisite total package mass so long as they are placed so that the test results are not affected. Alternatively, in performing the drop test, the drop height may be varied in accordance with 6.1.5.3.4 (b);
- (b) Packagings shall, in addition, have been successfully subjected to the leakproofness test at 30 kPa, with the results of this test reflected in the test report required by 6.1.5.8; and
- (c) Packagings shall be marked with the letter 'T' as described in 6.1.2.4.

Note: ISO 16104, Annex C.

6.1.5.2 *Preparation of packagings for testing (See ISO 16104, 5)*

6.1.5.2.1 Tests shall be carried out on packagings prepared as for transport in accordance with 6.1.5.

6.1.5.2.2 Additional steps shall be taken to ascertain that the plastics material used in the manufacture of plastics drums, plastics jerricans and composite packagings (plastics material) intended to contain liquids complies with the requirements in 6.1.1.2, 6.1.4.8.1 and 6.1.4.8.4. This may be done, for example, by submitting sample receptacles or packagings to a preliminary test extending over a long period, for example six months, during which the samples would remain filled with the substances they are intended to contain, and after which the samples shall be submitted to the applicable tests listed in 6.1.5.3, 6.1.5.4, 6.1.5.5 and 6.1.5.6. For substances which may cause stress-cracking or weakening in plastics drums or jerricans, the sample, filled with the substance or another substance that is known to have at least as severe a stress-cracking influence on the plastics material in question, shall be subjected to a superimposed load equivalent to the total mass of identical packages which might be stacked on it during transport. The minimum height of the stack including the test sample shall be 3 metres.

6.1.5.3 *Drop test (See ISO 16104, 7.1)*

6.1.5.3.1 *Number of test samples (per design type and manufacturer) and drop orientation*

The drop test shall be performed on all design types of packagings

6.1.5.3.2 *Target*

The target shall be a rigid, non-resilient, flat and horizontal surface.

6.1.5.3.3 *Drop height*

For solids and liquids, if the test is performed with the solid or liquid to be carried or with another substance having essentially the same physical characteristics:

Packing Group I	Packing Group II	Packing Group III
1.8 m	1.2 m	0.8 m

For liquids if the test is performed with water:

(a) Where the substances to be transported have a relative density not exceeding 1.2:

Packing Group I	Packing Group II	Packing Group III
1.8 m	1.2 m	0.8 m

(b) Where the substances to be transported have a relative density exceeding 1.2, the drop height shall be calculated on the basis of the relative density (d) of the substance to be carried, rounded up to the first decimal, as follows:

Packing Group I	Packing Group II	Packing Group III
$d \times 1.5$ (m)	$d \times 1.0$ (m)	$d \times 0.67$ (m)

6.1.5.3.4 *Criteria for passing the test:*

6.1.5.3.4.1 Each packaging containing liquid shall be leakproof when equilibrium has been reached between the internal and external pressures, except for inner packagings of combination packagings when it is not necessary that the pressures be equalized.

6.1.5.3.4.2 Where a packaging for solids undergoes a drop test and its upper face strikes the target, the test sample passes the test if the entire contents are retained by an inner packaging or inner receptacle (e.g. a plastics bag), even if the closure is no longer sift-proof.

6.1.5.3.4.3 The packaging or outer packaging of a composite or combination packaging shall not exhibit any damage liable to affect safety during transport. There shall be no leakage of the filling substance from the inner receptacle or inner packaging(s).

6.1.5.3.4.4 Neither the outermost ply of a bag nor an outer packaging may exhibit any damage liable to affect safety during transport.

6.1.5.3.4.5 A slight discharge from the closure(s) upon impact is not considered to be a failure of the packaging provided that no further leakage occurs.

6.1.5.3.4.6 No rupture is permitted in packagings for goods of Class 1 which would permit the spillage of loose explosive substances or articles from the outer packaging.

6.1.5.4 Leakproofness test (see also 16104, 7.3)

6.1.5.4.1 Packagings to be tested The leakproofness test shall be performed on all design types of packagings intended to contain liquids; however, this test is not required for the inner packagings of combination packagings.

The air pressure (gauge) to be applied shall be:

Packing Group I	Packing Group II	Packing Group III
Not less than 30 kPa (0.3 bar)	Not less than 20 kPa (0.2 bar)	Not less than 20 kPa (0.2 bar)

6.1.5.4.2 *Criterion for passing the test:* there shall be no leakage.

6.1.5.5 Internal pressure (hydraulic) test (See also 16104, 7.4)

6.1.5.5.1 Packagings to be tested: the internal pressure (hydraulic) test shall be carried out on all design types of metal, plastics and composite packagings intended to contain liquids. This test is not required for inner packagings of combination packagings.

6.1.5.5.2 *Criterion for passing the test:* no packaging may leak.

6.1.5.6 Stacking test (ISO16104, 7.2)

All design types of packagings other than bags are subject to a stacking test.

6.1.5.6.1 *Number of test samples:* three test samples per design type and manufacturer.

6.1.5.6.2 *Criterion for passing the test:* no test sample may leak. In composite packagings or combination packagings, there shall be no leakage of the filling substance from the inner receptacle or inner packaging. No test sample may show any deterioration which could adversely affect transport safety or any distortion liable to reduce its strength or cause instability in stacks of packages. Plastics packagings shall be cooled to ambient temperature before the assessment.

6.1.5.7 Test Report (See ISO16104, 4.6 and Annex E)

6.1.5.7.1 A test report containing statements that the packaging prepared as for transport was tested in accordance with the appropriate requirements of this Chapter and that the use of other packaging methods or components may render it invalid. A copy of the test report shall be available to the competent authority and to the users of the packaging.

2.) CONSEQUENTIAL AMENDMENTS

4.1.1.10

Table Column 8

delete “6.1.5.5.4.(c)” replace with “ISO 16104, 7.4.3 (c)”

Note 2

delete “6.1.5.5.4 (a)” replace with “ISO16104: 7.4.3 (a)”

Note 3

delete “6.1.5.5.5” replace with “ISO 16104, 7.4.3”

4.1.1.12

Amend the first sentence as follows:

“Every packaging, including IBCs, intended to contain liquids shall successfully undergo a suitable leakproofness test, (for packagings this test shall be at least as effective as the leakproofness test in ISO 16104 7.3.4.), and be capable of meeting the appropriate test level indicated in 6.1.5.4. or 6.5.4.7. for the various types of IBCs

4.1.1.16.1

Delete 6.1.5.1.11 and replace with ISO16104, 7.3

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Delete 6.1.5.4 replace with ISO 16104, 7.3
