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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-ninth session
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Item 4(b) of the provisional agenda

PACKAGINGS (INCLUDING IBCS AND LARGE PACKAGINGS)

Hydraulic pressure test for IBCs

Submitted by the expert from Germany

Introduction

1. Reference is made to item 11 of the report of the Working Group on IBCs session held in Paris in 2005 (informal document INF.5 of the 28th Sub-Committee's session), to informal document INF.32 of the 28th Sub-Committee's session and to paragraph 40 of the report of the Sub-Committee on its 28th session (ST/SG/AC.10/C.3/56), related to the leakproofness test, but which, to the judgement of the expert of Germany, should rather be dealt with under hydraulic pressure test.
2. The expert from Germany suggests that this document be discussed in the context of other papers concerning the limitation of permanent deformations as a result of design type tests.
3. This proposal is intended to set a limit for the design of composite IBCs with plastics inner receptacles with respect to the preservation of its capability to withstand normal conditions of transport. The limit does reflect the technical standard represented by the vast majority of design types used worldwide for the shipment of dangerous goods (state of the art). It is

thought to be the better alternative to similar approaches on a limitation of deformations as a result of the leakproofness test.

4. The intention is to introduce an additional performance level to the hydraulic pressure test, representing internal pressures under normal conditions of transport in combination with a new pass/ fail criterion. This new test shall complement the existing hydraulic pressure test which demonstrates safety margins well above normal conditions of transport. It needs also to be implemented in the sequence of performance tests in 6.5.6.3.5.
5. The introduction of a second pressure level for rigid and composite IBCs representing another test-criteria is an alignment with the requirements on metal IBCs in 6.5.6.8.4.1 (c), where an additional test level is also required.
6. Despite the fact that this new test level was originally intended for composite IBCs only, it is proposed to introduce it also for rigid plastics IBCs, because they are similarly sensible to internal pressure.
7. With respect to the deformation criterion, a limitation is proposed, which characterises normal conditions of transport, including stacking, loading and unloading out of closed vehicles or freight containers. The condition of the IBC after the test shall allow for the continued use of the IBC under normal conditions of transport. A descriptive definition for permanent deformation in form of examples was selected, clear enough for a uniform interpretation by test houses but independent from individual dimensions and constructions.
8. The new test criterion gives reason to simplify the criterion for the existing hydraulic pressure test, the wording of which was a main reason for discussion. It is proposed to restrict it to the no-leakage requirement.
9. Because of its importance to the users, it is proposed to add the new test pressure (called “deformation test pressure”) to the elements of the secondary marking. This is also necessary because the new pressure level may be selected according to the capability of the IBC, however with a lower limit.

Background

10. The following aspects were essential for the proposed amendments:
 - (a) The approach to align the provisions to the state of the art is based on a recently performed evaluation of representative design types with respect to its reactions on filling, lifting, stacking and pressurizing;
 - (b) As a basic finding, it is essential to learn that state of the art-composite IBCs experience an initial permanent deformation by its first filling in the range of 2% of its overall dimensions. After this shaping they are then prepared for further uses without significant additional permanent deformation;
 - (c) Major aspects of normal conditions of transport were assumed to be:

- (i) Preservation of the stability of stacks of IBCs in the pressurised condition, which could be lost by deformation in vertical direction and or the loss of the buckling stability of the vertical structures of the outer framework. The loss of the nesting of stacked IBC would be critical in combination with the roll and pitch movement of seagoing vessels;
- (ii) Preservation of the overall geometry of IBCs within some margin in order to allow for the unhindered unloading of IBCs under pressure from freight containers or other rigid conveyances;
- (iii) For the vast majority of substances allowed to be carried in composite IBCs in terms of vapour pressure, the figure of 10 kPa is a realistic figure, which takes also account of the pressure rise of the ullage air enclosed.

Proposals

11. Minor proposed amendments concern the replacement of the term “designed” by “constructed” to overcome its arbitrary meaning (intended or built/constructed), having been raised as a difficulty for test houses to enforce the related performance of tests. The replacement of this term will be necessary elsewhere, for consistency.
12. Additional minor amendments concern the printing of the first column of the table under 6.5.6.3.5. with respect to the proper allocation of IBC types and tests.
13. The following amendments are proposed:
 - (a) Amend 6.5.6.3.5 to read as follows:

“6.5.6.3.5 *Design type tests required and sequential order*

Type of IBC	Bottom lift	Top lift ^a	Stacking ^b	Leak-proof - ness	Deformation test pressure	Hydraulic pressure	Drop	Tear	Topple	Righting ^c
Metal: 11A, 11B, 11N 21A, 21B, 21N, 31A, 31B, 31N	1st ^a 1st ^a	2nd 2nd	3rd 3rd	- 4th	= =	- 5th	4th ^e 6th ^e	- -	- -	- -
Flexible ^d	-	x ^c	x	-	=	-	x	x	x	x
Rigid plastics: 11H1, 11H2 21H1, 21H2. <u>31H1, 31H2</u>	1st ^a 1st ^a <u>1st^a</u>	2nd 2nd <u>2nd</u>	3rd 3rd <u>3rd</u>	- 4th <u>5th</u>	= = <u>4th</u>	- 5th <u>6th</u>	4th 6th <u>7th</u>	- - -	- - -	- - -
Composite: 11HZ1, 11HZ2 21HZ1, 21HZ2. <u>31HZ1, 31HZ2</u>	1st ^a 1st ^a <u>1st^a</u>	2nd 2nd <u>2nd</u>	3rd 3rd <u>3rd</u>	- 4th <u>5th</u>	= = <u>4th</u>	- 5th <u>6th</u>	4th ^e 6th ^e <u>7th</u>	- - -	- - -	- - -
Fibreboard	1st	-	2nd	-	=	-	3rd	-	-	-
Wooden	1st	-	2nd	-	=	-	3rd	-	-	-

^a When IBCs are ~~designed~~ constructed for this method of handling.

^b When IBCs are ~~designed~~ constructed to be stacked.

^c *When IBCs are ~~designed~~ constructed to be lifted from the top or the side.*

^d *Required test indicated by x; an IBC which has passed one test may be used for other tests, in any order.*

^e *Another IBC of the same design may be used for the drop test”.*

(b) Amend 6.5.6.8.4.2 by adding a new sub-paragraph as follows:

“6.5.6.8.4.2 Rigid plastics and composite IBCs:

- (a) For IBCs of types 21H1, 21H2, 21HZ1 and 21HZ2: 75 kPa (0.75 bar) (gauge);
- (b) For IBCs of types 31H1, 31H2, 31HZ1 and 31HZ2: whichever is the greater of two values, the first as determined by one of the following methods:
 - (i) 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 4.1.1.4 and a filling temperature of 15 °C;
 - (ii) 1.75 times the vapour pressure at 50 °C of the substance to be transported minus 100 kPa, but with a minimum test pressure of 100 kPa;
 - (iii) 1.5 times the vapour pressure at 55 °C of the substance to be transported minus 100 kPa, but with a minimum test pressure of 100 kPa; and the second as determined by the following method:
 - (iv) twice the static pressure of the substance to be transported, with a minimum of twice the static pressure of water.
- (c) In addition, for rigid and composite IBCs of types 31H1, 31H2, 31HZ1 and 31HZ2 shall be subjected to a deformation test pressure of not less than 10 kPa (0.10 bar). This test shall be performed before the test under (b) and loaded with an IBC of the same design type filled with water stacked on it, provided they are constructed as stackable”.

(c) Amend 6.5.6.8.5 as follows:

“6.5.6.8.5 Criteria for passing the test(s):

- (a) For IBCs of types 21A, 21B, 21N, 31A, 31B and 31N, when subjected to the test pressure specified in 6.5.6.8.4.1 (a) or (b) and for rigid plastics and composite IBCs, when subjected to the test pressure specified in 6.5.6.8.4.2 (a) or (b): no leakage;

(b) For IBCs of types 31A, 31B and 31N, when subjected to the test pressure specified in 6.5.6.8.4.1 (c) and for rigid and composite IBCs of types 31H1, 31H2, 31HZ1 and 31HZ2, when subjected to the test pressure specified in 6.5.6.8.4.2 (c): no permanent deformation which would render the IBC unsuited for routine transport and no leakage: neither permanent deformation which would render the IBC unsafe for routine transport, nor leakage.

~~(c) For rigid plastics and composite IBCs: no lifting of the upper IBC, no permanent deformation which would render the IBC unsafe for transport and no leakage.~~

Note: IBCs should be considered as unsafe for routine transport, if the nesting of stacked IBC or the stability of loads stacked on it would be lost or when the unloading of IBCs under pressure from standard dimension freight containers would be hindered, as examples.”

(d) Amend the table under 6.5.2.2.1 as follows:

Additional marking	Category of IBC				
	Metal	Rigid Plastics	Composite	Fibreboard	Wooden
Capacity in litres* at 20°C	X	X	X		
Tare mass in kg*	X	X	X	X	X
Test (gauge) pressure, in kPa or bar, if applicable		X	X		
<u>Deformation test pressure, in kPa or bar, if applicable</u>		X	<u>X</u>		
Maximum filling/discharge pressure in kPa or bar*, if applicable	X	X	X		
Body material and its minimum thickness in mm	X				
Date of last leakproofness test, if applicable	X	X	X		
Date of last inspection (month and year)	X	X	X		
Serial number of the manufacturer	X				

* The unit used shall be indicated.”