

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

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PACKAGINGS (INCLUDING IBCS AND LARGE PACKAGINGS)

Vibration test for design types of IBC intended for the transport of dangerous goods

Comments on ST/SG/AC.10/C.3/2006/32

Transmitted by the expert from Germany

WP 32 reminds that the Subcommittee, during its last meeting in December 2006, had agreed that any proposal on the subject should only be studied under the following conditions (para. 38 of the report ST/SG/AC.10/C.3/56):

- Appropriate justification must be provided, bearing in mind that a broad consensus was necessary for introducing additional requirements that would significantly affect the packaging industry, while the case of packagings other than IBCs should not be addressed;
- The open issues mentioned in para. 10 of the report of the working group (INF.5) must be resolved;
 - . clarifying the methodology of the fixed frequency test (for example, see also ICPP paper in Annex 4)
 - . the place in the sequence of tests for the vibration test
 - . should there be a cut-off for the size of IBC to be tested
 - . reproducibility of the test between testing facilities
 - . should IBCs for solid cargoes be tested
 - . the relationship between the life time of the IBC and the test duration
 - . how should IBCs rated for high density substances be tested
 - . what are the acceptance criteria for the test
- Account must be taken of the availability and cost of test equipment worldwide, particularly with a view to the effective possibility of applying this test in developing countries.

Compared with these conditions, the proposal by France and the USA reveals some deficiencies, which need to be settled to become acceptable:

1 Justification

A single supportive point (point a) is mentioned in WP 32 in terms of failures to justify the introduction of an additional performance test. Moreover, this statement (“many lightweight IBCs have shown failures...”) is related to test and not to transport conditions.

Justification to support an additional design type test, e.g. in terms of failure rates, in form of some significant examples or by reasoned argument is still missing. Such justification is needed for the sake and guidance for any further major amendment to the test regime and as contribution to the UN Guiding Principles.

Justification should include arguments on

- character and intention of the test and
- limitation on containment systems with a higher potential risk (larger volumes, liquid contents, critical failure mode).

State of the art of demonstrating resistance to vibrations is the random vibration technique performed with shakers as laid down in various internationally available standards. It should be explained why the proposed test does not take account of these standards. However, the new test procedure may be considered as a tool to achieve an increased level of resistance against transport shocks and vibrations under simplified testing conditions¹.

Taking the very low figures of spillages reported in the USA and in Europe into account, caused by packaging failures, reasoned argument may only be found in the positive influence of the existing North- American vibration resistance requirement on large parts of the global market. The intention of the introduction of this requirement into the UN Model Regulations would then be to globalize the regional requirement and its positive effect on the design of this type of packaging.

The restriction on higher potential risk IBCs should be justified. Big damages and casualties may be caused in case liquid contents because even small cracks may lead to the complete loss and spillage of the contents. However, solid contents may not escape in its totality and will not pour into soil and canalization through openings caused by vibrations or repeated shocks.

2.1 Test procedure and reproducibility of the test results

The wording of the proposed test method gives reason for serious concerns with respect to its uniform application, reproducibility of test results and even to the occupational safety for the test personnel.

The main effect of the test as it is performed at present, is that the accelerated liquid contents tries repeatedly to transform the flat surfaces of the prismatic IBC into a cylinder which are then swinging back when being decelerated. This leads, sooner or later, to a low-cycle fatigue failure of the metallic framework. The limitation of the test period differentiates between good and bad designs, per definition.

The test level in terms of the frequency causing some part of the IBC to get lifted from the platform is very close to the natural frequency of the IBC. This is an area of instability of the whole system

¹ *Some issues, as put forward by the Paris WG (relationship of test duration/ contents versus transport time/ higher densities) would then no longer be relevant.*

of testing machine and IBC where very small additional impacts may cause abnormal deformations and movements, including the risk, that the IBC may jump off the platform, putting the test personnel at risk. Unfortunately, the method to demonstrate lifting, the insertion of the chime creates such an additional impact, it causes a rotational moment because a part the IBC outside the centre of gravity cannot return to its original position.

Lifting-off introduces an additional effect (repeated shocks) the magnitude of it is largely depending on the hardness and stiffness of the platform which is not specified in the proposal (we know metallic and wooden platforms), creating different results in this respect. Compared with the low-cycle fatigue effects, the repeated shocks have a minor effect on the design of prismatic IBCs.

It is therefore proposed to consider a test method without causing the IBC to lift off. It would be possible to specify the test frequency in terms of some percentage of the natural frequency (e.g. 95%) with the same result.

2.2 Test sequence

As indicated in 2.1 above, the proposed text is not seen to simulate real transport or incident conditions. The test sequence to be followed, therefore, should not be adapted to imaginations of real situations. Rather more, the provisions of test sequence and number of test samples should be specified along with reasons of practicability and reproducibility. From an ADR/RID point of view it needs to be seen that pre- storage with standard liquids or filling substances is an obligatory precondition for the performance tests and that a second pre- stored IBC is allowed to be used for the drop test.

The addition of a vibration test requirement would be the first significant change to the performance test regime. It would touch far more than 100 31HA1 design types, approved in Germany alone. It would certainly not be justified to repeat the full testing program for all those design types in combination with the new vibration test.

For both reasons the use of a separate test sample filled with water should be allowed to be used for the vibration test, independently from the other tests. It should also be noted that water should be used as testing contents irrespective of the density of the substance to be carried.

2.3 Test criteria

For the sake of a uniform interpretation of the test result the proposed criteria need to be distinct. The proposed wording is to be improved in this respect.

Whereas a complete rupture of a supporting structure or of the wall of the plastics container can easily be detected and interpreted, the detection of any tear is dependent from the method applied (visual, dye- penetrant, ultrasonic). Furthermore any tear in the typical spot-welded links between horizontal and vertical tubes/rods of the cage are very difficult to be detected.

The second phrase of the proposal (“...liable to affect safety during transport”) repeats the wording of existing text which was criticized by the Paris –Group for vagueness and reason for diverging interpretation.

It is therefore proposed to amend the criteria into “no rupture and no loss of contents”.

2.4 Availability of test installations; transitional period

Because random vibration testing is state of the art, the ancient shaking tables have been replaced by electro- dynamic or hydraulic shakers in many test houses and are no longer available. To some extent, exporting industry has re-equipped themselves with shaking tables to comply with US-provisions. However, publicly available test houses will need to invest in new shaking equipment, specifically for this purpose and designed for masses of about 1 ton.

This has adequately been considered by the proposed transitional period.
