Dangerous Goods Office

Dangerous Goods Guidance Note No. 002

LEAKPROOFNESS TESTING OF UN APPROVED PACKAGING & IBCs

Guidance for GB Certificate Holders

This guidance note is intended to help producers and users of UN certified packaging and IBCs to understand the requirements of the dangerous goods transport regulations with respect to mandatory leakproofness testing of new and reconditioned packagings for liquids and new, repaired and remanufactured IBCs for liquids or solids discharged under pressure. It sets the out the best practice for compliance and identifies certain test methods which should be avoided.

1. Background

UN certified packagings are packaging and IBC design-types which have been successfully tested in accordance with the UN Recommendations on the Transport of Dangerous Goods[1] and have been allocated a unique authorised marking (a UN mark) under procedures established by the Competent Authority. In the UK, Certificates of Performance and UN marks are issued by the VCA Dangerous Goods Office. A certificate holder, who is often the package manufacturer or reconditioner, may apply the authorised UN mark to each packaging or IBC which conforms to the approved specification and which meets other requirements of the UN Recommendations.

The UN Recommendations require:

4.1.1.12 *Every packaging as specified in Chapter 6.1 intended to contain liquids shall successfully undergo a suitable leakproofness test, and be capable of meeting the appropriate test level indicated in 6.1.5.4.3:*

(a) before it is first used for carriage;

(b) after remanufacturing or reconditioning of any packaging, before it is re-used for carriage.

4.1.2.2 *Every metal, rigid plastics and composite IBC, shall be inspected and tested, as relevant, in accordance with 6.5.4.4 or 6.5.4.5:*

(a) before it is put into service;

(b) thereafter at intervals not exceeding two and a half and five years, as appropriate;

(c) after the repair or remanufacture, before it is re-used for carriage.

1. *Transport of Dangerous Goods – Model Regulations (16th edition)*

6.5.4.4.2 Every metal, rigid plastics and composite IBC for liquids, or for solids which are filled or discharged under pressure, shall undergo a suitable leakproofness test at least equally effective as the test prescribed in 6.5.6.7.3 and be capable of meeting the test level indicated in 6.5.6.7.3:

(a) Before it is first used for transport;

(b) At intervals of not more than two and a half years.

For this test the IBC shall be fitted with the primary bottom closure. The inner receptacle of a composite IBC may be tested without the outer casing, provided that the test results are not affected.

These requirements are reproduced in the regulations governing the transport of dangerous goods by road, rail, sea and air[2].

The duty to ensure that every example of the approved packaging and IBC passes the leak test usually rests with the approval holder, since it is they who would apply or authorise the application the UN approval mark.

2. Suitable Test Methods

The test method for packaging, described in paragraph 6.1.5.4.3 of the UN Recommendations require that they be totally immersed in water, pressurised with air and observed for the appearance of bubbles. For IBCs, in addition to the immersion method, paragraph 6.5.6.7.3 allows the use of other suitable methods. Total immersion is without doubt the most effective method of leak detection for a 'design-type' test in a laboratory environment but it is time consuming and impractical for production line leakproofness testing in all but very low manufacturing volumes.

Neither paragraph 4.1.1.12 nor 4.1.2.2. require a fully immersed leak test in production, and other methods may be employed, providing they are suitable and equally effective. Alternative techniques which may be capable of meeting the requirements are:

- Pressure decay detection
- Pressure rise detection (vacuum chamber test)
- Ultrasonic leak detection
- Gas leak detection (e.g. Helium testers)
- Soap solution applied to the entire packaging

2. *The European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR), Regulations Concerning the International Carriage of Dangerous Goods by Rail (RID), The International Maritime Dangerous Goods Code (IMDG) & The Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO TIs)*

Producers of UN certified packaging and IBCs who employ an alternative test method must be able to demonstrate that their leak detection system complies with the regulations. This may be done, for example, by compiling documented evidence to show that it will effectively detect at the same level of sensitivity as the fully submerged leak test. Such evidence should include:

- supplier's specifications
- a description of it's principles of operation
- detection capabilities
- performance limitations
- information pertinent to it's effectiveness
- results of comparative trials between the equipment used at the production facility and the fully submerged test method.

3. Unsuitable Test Methods

Some methods will not satisfy the UN leakproofness test requirements. For example, the practice of checking metal drums and jerricans for leakage with soap solution applied only to the side seam and its intersection with the end seams (often called the 'T-test) is unsuitable, since it fails to examine the entire seam structure or any other part of the packaging's surface. Leakage emanating from those areas would not be detected using this method and it can not be considered equivalent to that described in 6.1.5.4.3. In some circumstances, the application of soap solution to all seams and joints may be effective, but this will only be considered appropriate for metal packagings and IBCs of substantial body and end thickness (i.e. 2mm or more), and plastics IBCs of 5mm thickness or greater, where the risk of undetected flaws or pin-holing through the surfaces is insignificant.

4. Pressure Differential Methods

Normally, when pressure decay, pressure rise, ultrasonic or fully submerged production leakproofness test methods are employed, the pressure differential developed between the inside of the packaging or IBC and the atmosphere in which testing takes place should be at least 20 kPa (or 30 kPa for packaging approved to PG I level). A lower pressure may be acceptable, but only if it can be demonstrated that the test is equally effective as pressurising at the required level. It is anticipated that this will mainly apply to highly sensitive gas detection equipment. In all cases, the minimum pressure that the test equipment must apply in order to perform an effective test should be documented and the information made available to line operators/setters for consistent set-up and monitoring.

5. Test Duration

The period over which the test is conducted must be sufficient to detect leaks that would be identified by the design-type test method. As a rule, larger packagings and IBCs tested by the pressure decay method will require a longer test period than smaller ones and it is likely that the test duration will need to be adjusted if the equipment is used for testing packagings of different sizes. It may also be necessary to increase the test pressure from the minimum value to compensate for shorter test durations. The duration required for each type/size of packaging or IBC tested on the equipment should be documented and the information made available to line operators/setters for consistent set-up and monitoring.

6. Applying Air Pressure

When a positive air pressure is used to test non-removable head packaging, it should be applied via a device which seals against the rim of the closure aperture. Where a packaging has more than one closure, it is preferable to use the smallest aperture and seal any remaining apertures with suitable closures. A system which seals against the chimb or edge of a of non-removable head packaging e.g. a metal drum, applying pressure across its entire end surface, is not capable of detecting leaks from the end or any closure flanges fitted to it. This procedure must therefore be confined to full aperture, removable head types.

7. Monitoring

Each leak detection system should be fitted with a gauge or other device, with which the operator can monitor the pressure being applied to every packaging or IBC under test on each test cycle. Monitoring devices should be kept in good working order at all times and should be calibrated at least once a year. Calibration should have an unbroken chain of traceability to the national weights and measures system.

8. Verification Of Function

The performance of every leak detection system, except those employing the design-type (under water) test method, shall be verified regularly throughout the production period. This must be accomplished by introducing a specially prepared leaking test pack ('leaker') into the production line, upstream of the leak detector. The 'leaker' should be a fault -free example of the packaging or IBC design-type that is being produced at the time, into which a hole of no greater than 0.4mm diameter has been precision drilled. The size of the hole must be confirmed by a certificate of conformity or calibration provided by a recognised measurement calibration body. In some instances, it may be difficult to make a hole with any precision in the packaging itself. This may be overcome by drilling the required hole in a metal adaptor (preferably brass) or a closure, which itself can then be fitted to the package in an appropriate manner.

The 'leaker' must be identified every time it is presented to the leak detector. Failure to detect would be a reason to halt production unless alternative, equally effective leak detection arrangements are employed. In the case of multi-station systems,

capable of leakproofness testing two or more packagings simultaneously, each station shall be verified separately.

The use of a restrictor or orifice in the air feed line as an alternative to a 'leaker' packaging is strongly discouraged, since this does not verify the performance of the entire circuit, which in normal use includes the packaging under test. This is critical to the performance of equipment testing larger sizes of packaging and IBCs, when the volume of air contained in the packaging may act as a reservoir, making the detection of small leaks more difficult.

9. Frequency of Verification

The intervals at which the leak detector verification described above is performed should be proportional to the volume of production. As a very minimum, it must be conducted at the start and end of each shift but it is recommended that it be repeated during production at intervals proportional to the production volume. As a guide, once per 500 production units for packages of 5 litres capacity or less, once per 100 units for packages of over 200 litres and once per 50 units for IBCs is considered appropriate unless special considerations dictate otherwise. Less frequent verification may be conducted where statistical significance can be demonstrated. A note of the date and time of each leak detector verification run should be kept as part of the production record.

10. **Verification Failure**

Should the leak detection system fail to identify the 'leaking' pack, every production packaging or IBC checked by that system since the previous successful verification should be considered suspect and must be quarantined. Quarantined production must be retested using equipment known to be operating correctly and may not be released until proved to be leak free. The policy and procedures for handling suspect production should be documented.

11. Leaking Packs.

Production packaging or IBCs which fail the leakproofness test or are otherwise rejected by the leak detection system shall be marked, segregated from general production and either destroyed or quarantined for further investigation and/or repair.

Due to their inherent sensitivity, some leak detector systems may occasionally reject containers which do not actually leak and in most cases it is desirable to confirm the test result before destroying what might otherwise be good production output. When a second leak test is performed for this purpose, it should ideally be accomplished off-line using a different method, preferably under water. If this is not possible and retesting is performed using the same or a similar production line leak detector, the packaging or IBC shall be passed through at least twice with no further indication of

leakage before the initial result is disregarded. It is very bad practice to disregard the initial rejection on the basis of a single retest result using the same equipment.

The policy and procedures for handling leaking packaging, covering identification, marking, segregation, retesting and disposal shall be documented.