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Standard Guide for Conducting Internal Hydrostatic Pressure Tests on United Nations (UN) IBC Design Types[1]

This standard is issued under the fixed designation D8134; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide is intended to provide a standardized method and a set of basic instructions for performing hydrostatic pressure testing on Intermediate Bulk Containers (IBCs) designs as required by the United States Department of Transportation Title 49 Code of Federal Regulations (CFR) and the United Nations Recommendations on the Transport of Dangerous Goods (UN).

1.2 This guide focuses on composite and rigid plastic IBCs and is suitable for testing IBCs of any design or material type.

1.3 This guide provides information to help clarify various terms used as part of the United Nations (UN) certification process that may assist in determining the applicable test.

1.4 This guide provides the suggested minimum information that should be documented when conducting pressure testing.

1.5 This guide provides information for recommended equipment and fittings for conducting pressure tests.

1.6 This guide is based on the current information contained in 49 CFR 178.814.

1.7 When testing packaging designs intended for hazardous materials (dangerous goods), the user of this guide shall be trained in accordance with 49 CFR 172.700 and other applicable hazardous materials regulations such as the International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air, the International Maritime Dangerous Goods Code (IMDG Code), and carrier rules such as the International Air Transport Association (IATA) Dangerous Goods Regulations.

1.8 *Units*—The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this guide.

1.9 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.10 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4919 Guide for Testing of Hazardous Materials (Dangerous Goods) Packagings

D7660 Guide for Conducting Internal Pressure Tests on United Nations (UN) Packagings

2.2 *Federal Standards:*[3]

U.S. Department of Transportation Code of Federal Regulations Title 49 Transportation (49 CFR) Parts 100-1993

2.3 *UN Standard:*[4]

United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations

2.4 *IMDG Standard:*[5]

International Maritime Dangerous Goods Code (IMDG Code)

3. Terminology

3.1 *Definitions:*

3.1.1 *bar, n*—metric unit of atmospheric pressure equal to 14.50 psi (lb/in.^{2}), 1.02 kg/cm^2, 29.53 in.-Hg, or 0.9869 atmosphere.

[1] This guide is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.22 on Hazardous Materials.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9371 (website: phmsa.dot.gov/hazmat).

[4] Available from the UN Economic Commission for Europe, Information Service, Palais des Nations, CH-1211 Geneva 10 Switzerland (website: http://www.unece.org/trans/danger/danger.htm).

[5] Available from the International Marine Organization (IMO, 4 Albert Embankment, London, SE1 7SR United Kingdom (website: http://www.imo.org/)

3.1.2 *hydrostatic pressure test, n*—internal pressure test conducted on a container or packaging filled with water and pressurized with water or other suitable means; regulatory reference sections: 49 CFR 178.814, UN 6.5.6.8, and IMDG 6.5.6.8.

3.1.3 *kilopascal, kPa, n*—unit of pressure in the SI system of international units, the primary standard system used by the United Nations (UN) and the U.S. Department of Transportation (DOT) throughout their respective regulations per 49 CFR 171.10.

3.1.3.1 *Discussion*—To convert kPa to psi, multiply by 0.1450377 (95 kPa × 0.1450377 = 13.8 psi).

3.1.4 *intermediate bulk container (IBC), n*—rigid or flexible portable packaging, other than a cylinder or portable tank, which is designed for mechanical handling (as defined by 49 CFR 171.8).

3.1.5 *pounds per square inch, psi, n*—unit of measure in the inch–pound (English) measurement system.

3.1.5.1 *Discussion*—To convert psi to kPa, multiply by 6.89 (13.8 psi × 6.89 = 95 kPa).

4. Significance and Use

4.1 Dangerous goods (hazardous materials) regulations require performance tests to be conducted on packaging or IBC designs before being authorized for use. The regulations do not include standardized procedures for conducting performance tests and, because of this, may result in a non-uniform approach and differences in test results between testing facilities.

4.2 The purpose of this standard is to provide guidance and to establish a set of common practices for conducting hydrostatic pressure tests on IBC designs subjected to UN certification testing.

4.3 Intermediate bulk container designs are required to be tested in a sequence. This guide focuses on conducting the hydrostatic pressure test, which is preceded in the test sequence by the leakproofness test. The fittings and adaptors applied to the container for the hydrostatic pressure test may also be used for the leakproofness test.

5. Equipment

5.1 *Recommended Test Equipment:*

5.1.1 *Appropriate Packaging Closing Equipment (Calibrated as Applicable)*—Closing equipment, such as torque wrench, cover/closure crimping tools, and so forth, to prepare the IBC design for transport.

5.1.2 *Water Supply Source:*

5.1.2.1 Water supply source system should be designed to minimize water pressure fluctuations during the test.

5.1.2.2 The water source can be building supplied water provided fluctuations in pressure do not occur during the test.

5.1.2.3 It is recommended to have a separate water supply tank assembly to enable the use of air pressure over the top of the water supply. Air pressure may be used to pressurize the water supply tank to provide adequate water pressure to the test container in a timely fashion. Refer to Fig. 1.

5.1.3 *Regulator Valve,* used to maintain an even pressure throughout the duration of the test and to maintain proper water pressure to test container.

5.1.4 *Pressure Station* to distribute water from water supply source through the regulator to the test container. Refer to items (**6**) and (**7**) in Fig. 1.

5.1.5 *Hose or Piping,* as required.

5.1.6 *Pressure Gauge(s),* psi/kPa dual marked and calibrated (digital preferred).

5.1.6.1 *Gauge,* to monitor water supply pressure.

5.1.6.2 *Gauge,* to monitor pressure inside the test container.

5.1.6.3 All gauges used should be calibrated and have an accuracy in the appropriate range.

5.1.7 *Connections (Fitting/Valves, Adaptors, Gaskets, and Bushings)* or other equally effective means, as needed.

5.1.7.1 *Fitting/Valve,* for water inlet to test container.

5.1.7.2 *Fitting/Valve,* for air release, drainage, and pressure monitoring.

5.1.7.3 *Fitting/Valve,* for pressure monitoring (if this is not combined with air release fitting).

NOTE 1—When combining fittings and valves, take care to make sure the assembly does not interfere with the reading on the gauge. A long extension of the fitting may not provide an accurate pressure reading of the test container. Fittings extending above or beyond the test container should be kept as short as possible to maintain accurate values and stable fittings.

5.1.8 *Drill* and appropriate drill bit.

5.1.9 *Temperature Measuring Device,* appropriately calibrated.

5.1.10 *0 to 60 min Timer with Audible Alarm.*

5.2 *Safety Equipment,* recommended.

5.2.1 *Safety Glasses with Side Shield.*

5.2.2 *Gloves,* fabric leather or rubber slip resistant, as appropriate.

6. Sample Size

6.1 One sample is required for IBC designs. Reference 49 CFR 178.814.

7. Container

7.1 *Selection:*

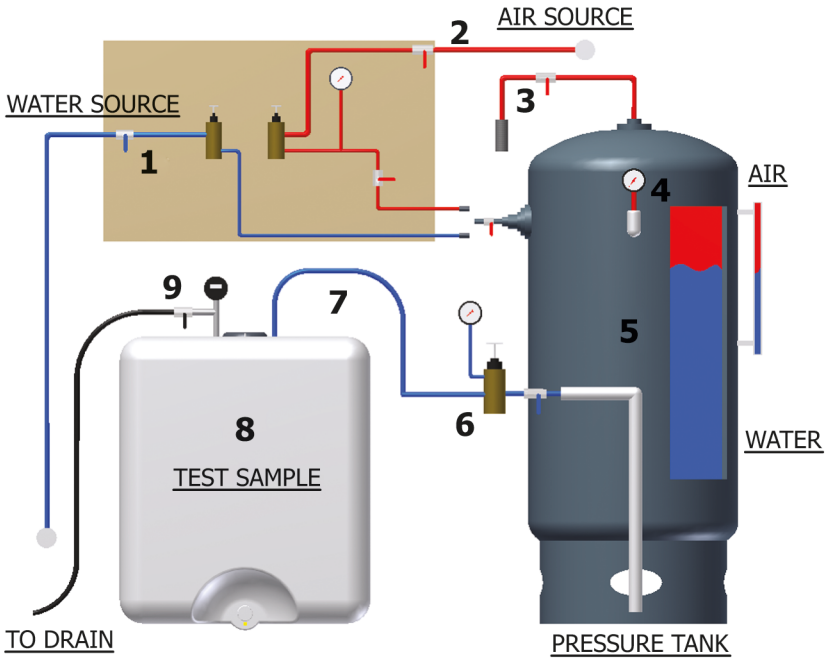
7.1.1 Randomly select an appropriate container to be tested.

7.1.2 Visually inspect container to verify that all closures, plugs, gasket, accessories, and so forth match the closing instructions and to determine if the container has any blemishes or defects that would affect a proper seal (record any observations). If necessary, clean off gaskets and other closure surfaces to ensure a proper seal is accomplished.

7.2 *Preparation:*

7.2.1 *Location of Fittings and Gauges*—Care should be taken not to attach fittings to container embossments or other geometries that could possibly compromise the integrity of the container or invalidate the test. The report should describe in general how many fittings are used and where fittings and gauges are located. Photo documentation is recommended.

NOTE 2—To reduce the possibility of inconsistent results between test samples, gauges and fittings should be in the same location.



Component ID	Description
1	Water supply (to pressure tank) with regulator and shut off valve. Hose quick-connects to pressure tank when used.
2	Air supply (to pressure tank) with regulator and shut-off valve. Hose quick-connects to pressure tank when used.
3	Tank pressure relief with shut-off valve.
4	Gauge to monitor the pressure inside the tank.
5	Pressure tank (recommended minimum size of 80 gal) with air over water.
6	Water supply with regulator and gauge to the test container from the pressure tank.
7	Water supply hose (¾ in.) with quick-connect to attached to test container.
8	Test container (IBC sample).
9	T-connection with gauge to monitor pressure in test sample and vent relief for container with hose (½ to ¾ in.). Hose should extend to drain or water recovery container.

FIG. 1 Internal Hydrostatic Pressure Station

7.2.1.1 *IBC Designs*—The pressure gauges and fittings should be located in the highest possible point of the test orientation.

7.2.2 *Container Setup:*

7.2.2.1 Drill an appropriate size hole in the test container for a water inlet fitting then install the fitting and snug tight with a wrench (see Fig. 2).

7.2.2.2 Drill a second hole of appropriate size in the test container for a pressure-monitoring fitting then install the fitting and snug tight with a wrench (see Fig. 2).

NOTE 3—Both holes and fittings should be installed near the top opening to allow for access through the opening. Make sure you leave enough room to allow for the closing tool to be used to torque the fill port cap of the IBC (see Fig. 3).

7.2.2.3 Connect the pressure gauge assembly to this fitting and remember to place it at the highest point of container test orientation (see Fig. 3 and Fig. 4).

7.2.2.4 Connect the water supply line to the water inlet fitting (see Fig. 3 and Fig. 4).

FIG. 2 Water Inlet Quick Connect Fitting

FIG. 3 Quick Connect Fitting Locations

FIG. 4 Fitting and Closure Final Assembly

7.2.2.5 Fill the container as full as possible without the closure in place (see Fig. 5).

7.2.2.6 When the water has reached a level just under the opening, discontinue filling. Dry the sealing area and thread area to ensure there is no trapped water after the closure is applied (see Fig. 5).

7.2.2.7 Measure and record the temperature of the water inside the test container before sealing the packaging. It is recommended the water temperature be in the range of 12-23°C (see Fig. 5).

7.2.2.8 Insert the top closure and secure. All test samples shall have their fittings, covers, and closures prepared for transportation in accordance with the manufacturer's recommended closing instructions (see Fig. 4).

7.2.2.9 Vented closures shall be replaced with non-vented closures of the same specification or the vent shall be sealed. Pressure-relief devices shall be removed and their apertures plugged or shall be rendered inoperative (see Fig. 4).

NOTE 4—All containers should be prepared completely full with water before starting the test. This may be accomplished by venting the container through a fitting while pressurizing the container and allowing the air to be released.

NOTE 5—Care should be taken not to cause damage to any part of the sealing surface or thread areas while filling the container.

7.2.2.10 When samples are prepared by the client or third party, a note should be added to the report to indicate who sealed the containers.

7.3 Reference Appendix X2 for pressure station preparation prior to starting the test.

8. Rate of Pressurization

8.1 Test pressure should be determined based on the pressures required by the regulations.

8.2 After the container has been sealed (in accordance with the proper closing instructions) and as much air as possible has been removed from the test sample, start pressurizing.

FIG. 5 Sample Fill Level and Preparation

8.3 The container shall be gradually pressurized to the required test pressure using a continuous supply of water through a regulator. The continuous supply of water should remain open to the test sample throughout the entire test duration to allow for the necessary water supply if container expansion occurs.

8.4 The required test pressure should be accomplished within a suitable length of time based on the IBC design type. It is recommended to be achieved in less than 10 min.

8.5 The rate of pressurization is dependent on the container design (rigid or composite), size, and its material of construction.

8.5.1 The pressure should be applied continuously and evenly and at a rate that will not affect the results of the test.

8.5.1.1 The rate should not be too fast that it would cause undo expansion (shock) to the test sample.

8.5.1.2 The rate should not be too slow to cause undo stressing over an extended period of time before the required test pressure is reached.

8.5.2 *Example for Composite IBC with Blow Molded Receptacle*—Using a supply tank pressure of 100 psi and a water supply hose size of ¾ in. to the test sample a typical 275 gal or 330 gal composite IBC should take approximately 7-9 min to reach the required test pressure.

8.6 For all design types, record the elapsed time to reach the required test pressure. If your pressure station incorporates a flow meter, the rate of flow (L/s) should be documented.

NOTE 6—After the test sample has been closed and sealed for transport, the pressure test should be started within 15 min. If the time exceeds 15 min, it is permissible to reseal all closures and fittings. If the test is conducted after 15 min and the closures and fittings are not resealed, a note should be made in the report.

9. Test Duration

9.1 The test time begins when the specimen stabilizes at the minimum required test pressure.

9.2 The test pressure shall be held continuously and evenly throughout the test. The test pressure shall remain at or slightly above the required level throughout the test duration.

9.3 The test duration shall be the minimum time required by the applicable regulations.

9.3.1 Reference 49 CFR 178.814, UN 6.5.6.8, and IMDG 6.5.6.8.

9.3.2 The test time for all IBC samples is a minimum of 10 min.

10. Packaging Evaluation

10.1 Each container shall be visually monitored throughout the test and any leakage of water recorded.

10.2 A continuous discharge from any closure, plug, seam, or any part of the container is considered a failure.

10.3 Record the time, pressure, and location of the initial failure for each test container.

10.4 Container closures or plugs are not to be tightened or re-torqued after the test has started.