Designation: D4991 – 07 (Reapproved 2023)

Standard Test Method for Leakage Testing of Empty Rigid Containers by Vacuum Method[1]

This standard is issued under the fixed designation D4991; 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 test method covers the testing of empty containers for resistance to leakage under differential pressure conditions such as those which can occur during air transport. It is suitable for testing rigid containers intended for the transportation of some hazardous liquids in accordance with the United Nations Recommendations On The Transport Of Dangerous Goods (UN TDG) and the International Civil Aviation Organization Technical Instructions For The Safe Transport Of Dangerous Goods By Air (ICAO TIs).

1.2 *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.*

1.3 *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]

D996 Terminology of Packaging and Distribution Environments

D3078 Test Method for Determination of Leaks in Flexible Packaging by Bubble Emission

2.2 *United Nations Document:*

ST/SG/AC.10/1 Recommendations On The Transport Of Dangerous Goods[3]

2.3 *International Civil Aviation Organization:*

DOC 9284-AN/905 Technical Instructions For The Safe Transport Of Dangerous Goods By Air[4]

3. Terminology

3.1 *Definitions:* Terms and definitions used in this test method may be found in Terminology D996.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *rigid container*—a container sufficiently rigid that under a positive pressure of 100 kPa gauge the volumetric expansion does not exceed 0.5 %, such as a glass bottle.

4. Summary of Test Method

4.1 An empty rigid container to be tested is pressurized by immersion in an ethylene glycol-water solution in a transparent test chamber and subjected to a gradually increasing partial vacuum. The container is observed for signs of leakage, as evidenced by escaping air bubbles during depressurization or fluid in the container after re-pressurization.

5. Significance and Use

5.1 Containers may be pressurized in accordance with this test method without modification to the closure or to the body of the container. This test method may be used for testing rigid containers intended for the transportation of some liquids by air in accordance with the ICAO TIs or in accordance with the UN TDG.

5.2 This test method establishes the point at which leakage commences, with a limit of approximately 95 kPa (13.8 psi) differential. See Test Method D3078 for flexible packages.

5.3 This test method may not be suitable for some packages, such as packages with paper cap seals, where the test fluid may rapidly deteriorate the packaging.

6. Apparatus

6.1 *Transparent Vessel,* large enough to permit the test specimen(s) to be immersed in the test fluid with a minimum

[1] This test method is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.21 on Shipping Containers and Systems - Application of Performance Test Methods.

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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 United Nations Sales Section, United Nations, New York, NY 10017.

[4] Available from Intereg Group, Inc., 5724 N. Pulaski Rd., Chicago, IL 60646.