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Standard Test Method for Determination of Leaks in Flexible Packaging by Bubble Emission¹

This standard is issued under the fixed designation D 3078; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the determination of gross leaks in flexible packaging containing a headspace gas. Test sensitivity is limited to 1×10^{-5} atm cm³/s (1×10^{-6} Pa m³/s) or even less sensitive as indicated in a recent interlaboratory test (reported in Section 12).

1.2 Small leaks may not be detected by this procedure. Viscoelastic effects on the products, or entrapped air, become significant and prevent passage through small openings. Positive pressure inside the pouch after the vacuum is drawn may force the product to plug small leaks. The size of the leak that can be detected is dependent upon the products contained, the nature of the packaging material, and the test parameters selected.

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1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 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 and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 *ASTM Standards:*

E425 Terminology Relating to Leak Testing²

E 425 Definitions of Terms Related to Leak Testing³

E 515 Test Method for Leaks Using Bubble Emission Techniques

F 98 Practices for Determining Hermeticity of Electron Devices by a Bubble Test⁰

3. Terminology

3.1 *Definition:*

3.1.1 *leak*—any opening in a flexible package that, contrary to intention, either allows the contents to escape or substances to enter.

4.

5. Apparatus

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4.1 *Vacuum Chamber*—Any transparent container capable of withstanding approximately one atmosphere pressure differential, fitted with a vacuum-tight cover. A vacuum gage, an inlet tube from a source of vacuum, and an outlet tube to the atmosphere shall be connected to the chamber cover. The inlet and outlet tubes shall be equipped with hand valves. Attached to the underside of the cover shall be a transparent plate that will closely approximate the inside dimensions of the container and be such a distance

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¹ This test method is under the jurisdiction of ASTM Committee F02 on Flexible Barrier Packaging and is the direct responsibility of Subcommittee F02.40 on Package Integrity.

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² Discontinued; see 1990 Annual Book of ASTM Standards, Vol 03.03.

³ 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.

⁰ Withdrawn.

from the top of the container that when it is two-thirds filled with fluid, the attached plate will be positioned 1 in. (25 mm) under the fluid.

6.5. Materials

6.1

5.1 *Immersion Fluids*— Use an immersion fluid which does not degrade the package being tested. Fluids with a low surface tension are generally more sensitive. Examples include water, water treated with a wetting agent, denatured alcohol, and mineral oil. Other possible fluids are listed in Test Method E 515 and Practices F 98.

7.

6. Sampling

7.1 *The* 6.1 *The* number of specimens used in the test sample may be varied according to the nature of the product, its cost, its size, and whether the specimens are taken from a production line in a normal packaging operation, or are few in number, or are to be used only for purposes of comparative evaluation of procedures or materials.

8.7. Test Specimen

8.1

7.1 *Flexible Package*, with or without its intended contents.

9.

8. Conditioning

9.1 *The* 8.1 *The* test sample and test fluid shall be at equilibrium with normal room temperature.

10.9. Procedure

10.1 *Submerge* 9.1 *Submerge* the specimen in fluid contained in the vessel within the vacuum chamber. The uppermost surface of the specimen shall be covered by not less than 1 in. (25 mm) of fluid.

NOTE 1—Two or more small packages may be tested at the same time, provided that they are placed in such a manner that all parts of every package under test can be observed for leakage during the test.

10.2 *Set* 9.2 *Set* the cover on the vacuum chamber, close the outlet valve, and turn on the vacuum so that the gage rises slowly (approximately 1 in. Hg/s) to a selected vacuum level. The vacuum level chosen should be as large as possible in order to ensure optimal sensitivity of the test. Limiting factors will include package fragility, the degree of package expansion, and the test-fluid vapor pressure.

10.3 *During* 9.3 *During* the rise in vacuum, observe the submerged specimen for leakage in the form of a steady progression of bubbles from the flexible container. Isolated bubbles caused by entrapped air are not considered as leaks. Also note the approximate increase in package volume. The pressure differential of the test is inversely related to the volume increase of the sample; therefore, large volume increases significantly detract from the severity of the test. Flexible packaging with little or no headspace cannot be reliably evaluated with this test method.

10.4 *Hold* 9.4 *Hold* the vacuum for a specified time period; 30 s is recommended, but this may be set at the tester's discretion.

10.5 *Release* 9.5 *Release* the vacuum, remove the lid, and examine the specimen for the presence of test fluid inside the specimen.

11.10. Interpretation of Results

11.1 *If* 10.1 *If* there are bubbles definitely attributable to leaks in a specimen during the rise of vacuum, or when held at full vacuum, the specimen fails the test.

11.2 *If* 10.2 *If* test fluid attributable to a leak is inside a specimen, the specimen fails the test.

11.3 *If* 10.3 *If* there are no bubbles observed attributable to leaks, and if no test fluid attributable to a leak is inside a specimen, the specimen passes the test.

12.11. Report

12.1 *Report* the following information:

12.1.1 *A* statement that the test was conducted in compliance with this test method or a description of the deviations from this test method.

12.1.2 *Identification* of the specimen and the specific material tested:

12.1.2.1 *Identification* of the test fluid and the maximum vacuum level employed;

12.1.2.2 *A* statement regarding the approximate average and range of sample expansions when at maximum vacuum; and

12.1.2.3 *The* time period held at maximum vacuum;

12.1.3 *A* statement whether or not leakage occurred, and if possible, a report of the location of each leak.

12.1.4 *A* statement of the number of specimens included in the test and the number of failures, if any.