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StandardTest Method for Mechanical Seal Strength Testing for Round Cups and Bowl Containers with Flexible Peelable Lids[1]

This standard is issued under the fixed designation F2824; 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.

ε[1] NOTE—Fig. X1.1 was added editorially in April 2011.

1. Scope

1.1 This test method describes a method for the measurement of mechanical seal strength while separating the entire lid (cover/membrane) from a rigid or semi-rigid round container.

1.2 This test method differs from Test Method F88. Test Method F88 tests a portion of the seal where as this test method tests the force required to separate the entire lid (cover/membrane) from the container.

1.3 This test method is used to determine the continuous and maximum forces required to separate the lid (cover/membrane) from the container.

1.4 This test method uses an angle of pull of 45°, however other angles of pull may be used provided results are documented noting the used angle of pull and said procedure is validated.

1.5 Typical examples of container shapes that could be tested using this or a similar method include oval, rectangular, and circular with single or multiple cavities having a sealed lid (cover/membrane). Examples of products packaged in these types of containers are: ready meals, creamers, coffee, yogurts, household fresheners, chemical and pharmaceutical products, and numerous others not mentioned. However, this test method, described within, is specifically for round containers.

1.6 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.

1.7 *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:*[2]

D4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

F17 Terminology Relating to Flexible Barrier Packaging

F88 Test Method for Seal Strength of Flexible Barrier Materials

2.2 *Other Standard:*

ANSI/AAMI/ISO 11607–1 Packaging for Terminally Sterilized Medical Devices—Part 1: Requirements for Materials, Sterile Barrier Systems, and Packaging Systems[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *average seal strength*—the sum of the individual forces recorded divided by the total number of those measurements. The calculation can be expressed as the average between the peaks or within the peaks (see Fig. 1).

3.1.2 *flexible*—See Terminology F17.

3.1.3 *grip separation rate*—a function of the test equipment design and angle of peel to achieve the correct peel rate. It is the actual peel rate of separating the lid (cover/membrane) from the container. For this test method, the actual separation rate is 12 in./min (300 mm/min).

3.1.4 *maximum seal strength*—the maximum force measured when separating progressively, under the conditions of the test.

3.1.5 *peel angle*—the angle of the lid (cover/membrane) relative to the container seal surface at all points of removal of

[1] This test method is under the jurisdiction of ASTM Committee F02 on Flexible Barrier Packaging and is the direct responsibility of Subcommittee F02.20 on Physical Properties.

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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 American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

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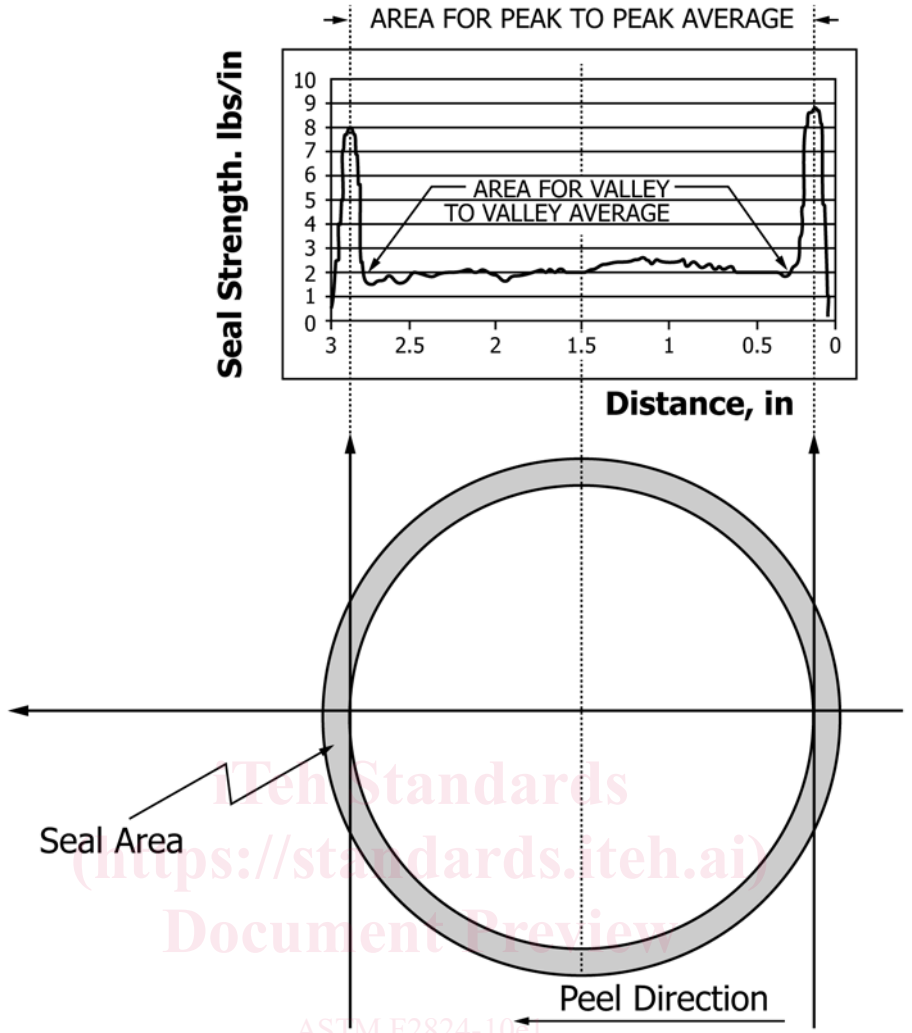

FIG. 1 Average Seal Strength

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the lid (cover/membrane) from the container seal surface. The preferred angle for this test method is 45° (Fig. 2) but other angles can be used.

3.1.6 *peel line*—the line of direction of peel, normally 90° to the line beginning at the starting peel point and bisects the container area evenly (see Fig. 2).

3.1.7 *seal area*—the total area of the container which is sealed to the lid (cover/membrane) and requires a force to separate them.

3.1.8 *starting peel point*—the extended tab provided by the design of the lid (cover/membrane).

3.1.9 *work*—the energy required to separate the lid (cover/membrane) from the test container. Typically, this calculation is made by the computer software or can be calculated as the area under the force-displacement curve.

4. Summary of Test Method

4.1 The test sample (container) is fastened securely to the test fixture with the starting peel point (extended tab if provided) of the lid (cover/membrane) attached to the grip of the force measuring device (load cell). The lid (cover/membrane) is peeled from the container at a constant rate of speed along the peel line of the container and at a 45° angle (other angles are permitted but must be noted and reported with test results) measured from the sealed surface of the container and lid (cover/membrane). Forces measured during the test are recorded and plotted for analysis and reporting.

5. Significance and Use

5.1 Test Method F88 has been the standard for the mechanical peel strength testing of peelable seals since the 1960s. Normally the testing is run on a portion of the seal. The result is an actual seal strength picture of that portion of the seal. This test method is different in that the entire package seal is peeled open and data collected for the entire sealed area.

5.2 This test method is a tool for quality assurance use as well as performance evaluation of a seal during separation.

5.3 With appropriate software, data is collected depicting the seal strength of the entire length of the seal. As a result, it is possible to see seal strength variations, as the seal is peeled apart, thereby evaluating the consistency and uniformity of the seal (see Fig. 1).

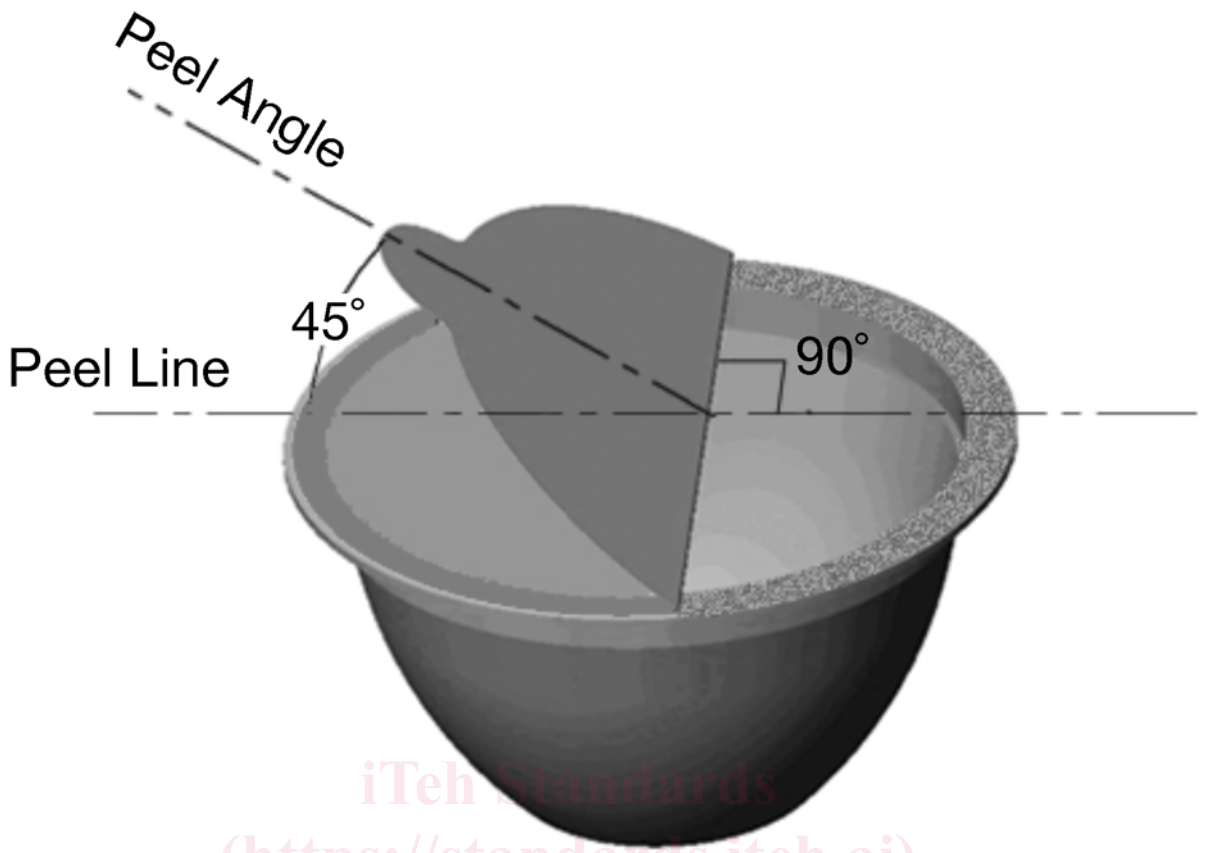

FIG. 2 Peel Line and Peel Angle

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6. Apparatus

6.1 Testing machine of the constant-rate-of-peel type shall be used.

6.2 The constant rate of peel between the clamp (grip) and the sample container shall be maintained at a constant rate of 12 ± 0.5 in./min (300 ± 12.7 mm/min).

6.3 There shall be an electronic measuring device (force gage) capable of taking a sufficient number of readings per second and compatible with the computer program such that a continuous graph of force versus displacement is achieved. It is also possible to use an analog instrument which inputs to an *X-Y* plotter to obtain the force versus displacement curve. A clamp or grip is fastened to the electronic measuring device and suitable for holding the lid (cover/membrane) shall be used (see Fig. 1).

6.4 There shall be a fixture suitable for securing the sample container in such a position as to cause the lid (cover/membrane) to be peeled at a constant 45° angle during the entire test. Since any movement of the container in the fixture can affect the value obtained by the electronic measuring device, the container must be held fast.

7. Sampling and Test Specs and Units

7.1 Sample size is determined by using an approved statistically validated sampling plan.

7.2 Sample identification should be made prior to specific test samples, if necessary. Record the information such that test results and anomalies are identifiable back to the individual specimens.

8. Preparation of Apparatus

8.1 Apparatus shall be positioned according to manufacturer's instructions and in a suitable environment for testing conditions.

9. Calibration and Standardization

9.1 Calibration of the force gage shall be verified prior to testing and accurate to ±1 % of the full scale of the electronic measuring device.

9.2 Follow the gage manufacturer's procedure for calibration.

10. Conditioning

10.1 Conditioning of the samples will depend on the material under evaluation. If conditioning before testing is appropriate, normal, and desirable, then condition the test specimens at 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 5 % RH until material has reached stabilization. See Practice D4332 for guidance on conditioning practices.