INTERNATIONAL

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Standard Practice for Conditioning Flexible Barrier Materials for Flex Durability[1]

This standard is issued under the fixed designation F392/F392M; 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 practice covers conditioning of flexible barrier materials for the determination of flex resistance. Subsequent testing can be performed to determine the effects of flexing on material properties. These tests are beyond the scope of this practice.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 *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]

E171 Practice for Conditioning and Testing Flexible Barrier Packaging

F2097 Guide for Design and Evaluation of Primary Flexible Packaging for Medical Products

3. Terminology

3.1 *pinhole, n*—a small opening of non-specific shape or dimension that passes completely through all layers of a flexible material.

[1] This practice is under the jurisdiction of ASTM Committee F02 on Flexible Barrier Packaging and is the direct responsibility of Subcommittee F02.50 on Package Design and Development.

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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.

3.1.1 *Discussion—*

The use of the term "pin" provides the relative size reference as in a small hole made with or as if with a pin.

4. Summary of Practice

4.1 Specimens of flexible materials are flexed at standard atmospheric conditions defined in Specification E171, unless otherwise specified. Flexing conditions and number and severity of flexing strokes vary with the type of structure being tested. The flexing action consists of a twisting motion followed, in most cases, by a horizontal motion, thus, repeatedly twisting and crushing the film. The frequency is at a rate of 45 cycles per minute (cpm.)

4.2 Flex failure is determined by measuring the effect of the flex conditioning on the barrier and/or mechanical performance of the structure. The property to be evaluated determines the appropriate conditioning level.

4.3 The various flex conditioning levels are summarized as follows:

4.3.1 *Condition A*—Full flex for 1 h (that is, 2700 cycles).

4.3.2 *Condition B*—Full flex for 20 min (that is, 900 cycles).

4.3.3 *Condition C*—Full flex for 6 min (that is, 270 cycles).

4.3.4 *Condition D*—Full flex for 20 cycles.

4.3.5 *Condition E*—Partial flex only for 20 cycles.

5. Significance and Use

5.1 This practice is valuable in determining the resistance of flexible-packaging materials to flex-formed pinhole failures. Conditioning levels A, B, or C are typically used for this evaluation.

5.2 This practice is valuable for determining the effect of flexing on barrier properties such as gas and/or moisture transmission rates. Conditioning levels D or E are typically used for this evaluation.

5.3 This practice does not measure any abrasion component relating to flex failure.

5.4 Failures in the integrity of one or more of the plies of a multi-ply structure may require different testing than the detection of holes completely through the structure. Permeation tests using gas or water vapor can be used in conjunction with the flex test to measure the loss of ply integrity. However, any permeation test requiring a pressure differential will not measure the permeation coefficient in the presence of pinholes. For a list of test methods refer to Guide F2097.

5.4.1 The various conditions described in this procedure are to prevent testing a structure under conditions that either give too many holes to effectively count (normally greater than 50), or too few to be significant (normally less than five per sample). Material structure, purpose for testing and a mutual agreement between parties involved are important points to consider in the selection of conditioning level for testing.

6. Apparatus

6.1 *Flex Tester,* [3] designed so that it can be set up in accordance with the specifications listed in Section 9. This apparatus shall consist essentially of a 90 ± 1-mm [3.5-in.] diameter stationary mandrel and a 90 ± 1 mm diameter movable mandrel spaced at a distance of 180 ± 2 mm [7 in.] apart from face-to-face at the starting position (that is, maximum distance) of the stroke. Mandrels shall contain vents to prevent pressurization of samples. The specimen supporting shoulders on the mandrels shall be 13 ± 1 mm [0.5 in.] wide. The motion of the movable mandrel is controlled by a grooved shaft to which it is attached. For the full or maximum stroke the groove is designed to give a twisting motion of 440 ± 4° in the first 90 mm of the stroke of the movable mandrel,

[3] The Gelbo Tester, which is capable of producing the prescribed flexing action, available from the United States Testing Co., Inc., 1415 Park Ave., Hoboken, NJ 07030, or its equivalent, has been found satisfactory for this practice.

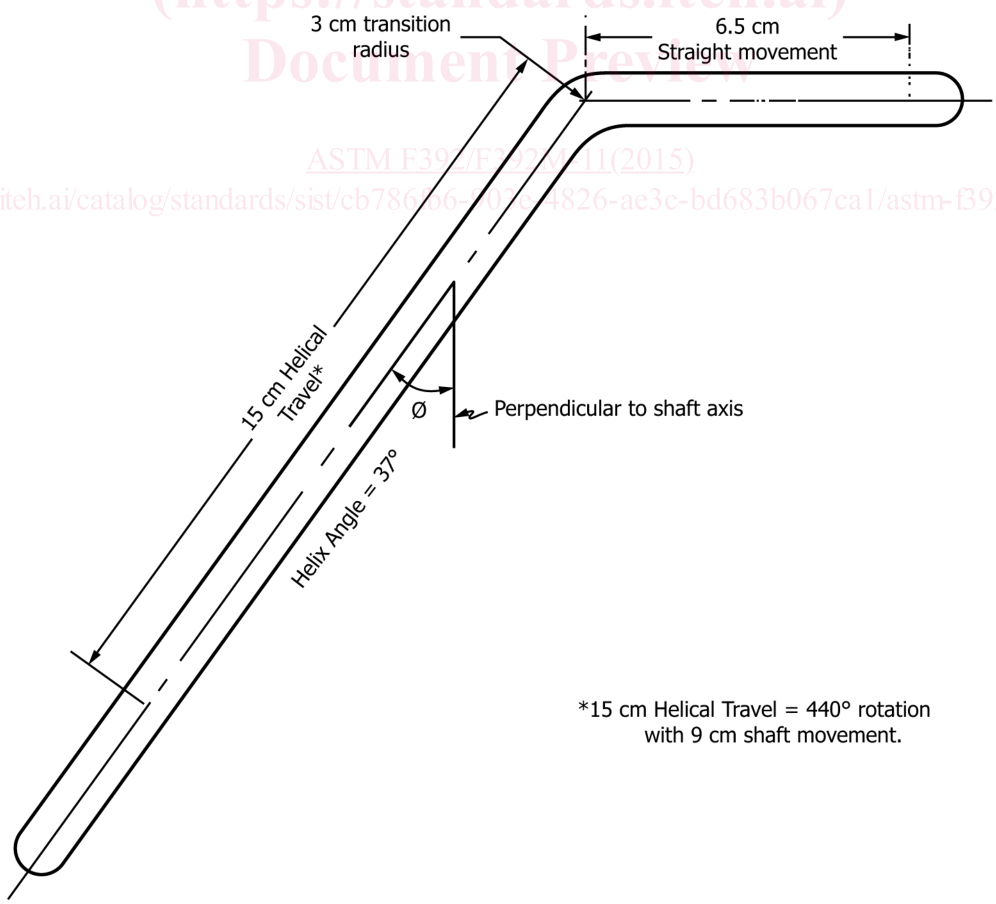

FIG. 1 Planar Evolution of Gelbo Shaft Helical Groove 30.70-mm [1.20-in.] Diameter Shaft)