NOTICE: This standard has either been superseded and replaced by a new version or withdrawn.
Contact ASTM International (www.astm.org) for the latest information

Designation: F2251 – 13 (Reapproved 2018)

Standard Test Method for Thickness Measurement of Flexible Packaging Material[1]

This standard is issued under the fixed designation F2251; 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 measurement of thickness of flexible packaging materials using contact micrometers.

1.2 The Precision and Bias statement for this test method was developed using both handheld and bench top micrometers with foot sizes ranging from 4.8 to 15.9 mm (3⁄16 to 5⁄8 in.).

1.3 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.

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

1.5 *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]

D374/D374M Test Methods for Thickness of Solid Electrical Insulation

D5947 Test Methods for Physical Dimensions of Solid Plastics Specimens

D6988 Guide for Determination of Thickness of Plastic Film Test Specimens

E171/E171M Practice for Conditioning and Testing Flexible Barrier Packaging

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

2.2 *ANSI/ASQ Standards:*[3]

ANSI/ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes

ANSI/ASQC Z1.9 Sampling Procedures and Tables for Inspection by Variables

3. Terminology

3.1 *Definitions:*

3.1.1 *bench micrometer*—tabletop measurement system using a dead weight or spring.

3.1.2 *foot*—the moving component of the micrometer that comes in contact with the sample.

4. Significance and Use

4.1 This test method provides a means for measuring a thickness dimension. Accurate measurement of thickness can be critical to meeting specifications and characterizing process, product, and material performance.

4.2 This test method does not address acceptability criteria. These need to be jointly determined by the user and producer of the product. Repeatability and reproducibility of measurement is shown in the Precision and Bias section. Attention should be given to the inherent variability of materials being measured as this can affect measurement outcome.

5. Apparatus

5.1 Mechanical gage, suitable for measuring thickness:

5.1.1 The thickness gage may be either a bench or hand-held mechanical model.

5.1.2 The gage should be capable of accurately measuring in increments of 2.5 µm (0.0001 in.).

5.1.3 The foot size and foot pressure should be known and identified. Because of the compressibility of different materials it is important when comparing results between different laboratories that the size of the foot and pressure be the same. Refer to Guide D6988 for further guidance on foot pressures.

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

Current edition approved Sept. 1, 2018. Published November 2018. Originally approved in 2003. Last previous edition approved in 2013 as F2251 – 13. DOI: 10.1520/F2251-13R18.

[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 Instititute (ANSI) 25 W. 43rd St., 4th Floor, New York, NY 10036.

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States

5.1.4 It is recommended that a calibration be performed on the apparatus used and certified to a recognized industry standard such as National Institute of Standards and Technology (NIST).

NOTE 1—Test Methods D5947 and D374/D374M give guidance on methods for checking calibration and parallelism.

6. Sampling

6.1 The number of samples tested should be adequate to be predictive of performance. Caution should be taken when eliminating samples with defects as this can bias results.

6.2 See ANSI/ASQC Z1.4 or Z1.9 for guidance on sampling plans and practices.

7. Conditioning

7.1 Conditioning of the samples will depend on the material under evaluation. If conditioning before testing is appropriate, normal, and desirable, refer to Specification E171/E171M for guidance.

8. Procedure

8.1 Review applicable specifications, drawings, or procedures. Specify unit of measure to be used and directions related to precision requirements (for example, measure to nearest 0.0001 in., round up or down to nearest 1 µm, and so forth).

8.2 Clean the micrometer contact area (foot and anvil).

8.3 Verify that the micrometer reads 0.0 µm (0.00000 in.) when no specimen is present.

8.4 Place sample to be measured between the gage foot and anvil. The foot and anvil must be maintained in a parallel state. The sample must be placed such that the measurement location is parallel to the gage foot and anvil. The sample should lay flat and smooth without wrinkles, creases or folds. Material should not be under tension when measured.

8.5 Release foot and allow reading to stabilize.

8.6 Read thickness on gauge readout or face.

9. Report

9.1 Report the following information:

9.1.1 Lot number and source of material, date, time, location and operator of test and complete identification of materials being tested.

9.1.2 Any conditioning of the materials.

9.1.3 The apparatus used to measure the thickness, including the foot size and foot pressure.

9.1.4 Any and all deviations from standard.

9.1.5 The sampling plan and number of specimens tested along with test results should at a minimum include mean, range and standard deviation.

10. Precision and Bias

10.1 *Precision*—A research report[4] describes a round robin conducted in 2002 in accordance with Practice E691, involving seven laboratories measuring eight specimens. Ten different pieces of equipment were used to collect information. Equipment used and foot sizes are listed in Table 1. Measurements taken included use of micrometers in 0.0001 in. divisions. Statistical summaries of repeatability (within a laboratory) and reproducibility (between laboratories) are listed in Tables 2 and 3. All test results are expressed in SI units of measure.

10.2 Concept of "*r*" and "*R*" in Tables 2 and 3—If S_r and S_R have been calculated from a large enough body of data, and for test results that are averages from three tests on one specimen for each test result, then the following applies:

10.3 Repeatability "*r*" is the interval representing the critical difference between two test results for the same material, obtained by the same operator using the same equipment on the same day in the same laboratory. Two test results shall be judged to be not equivalent if they differ by more than the "r" value for that material.

10.4 Reproducibility "*R*" is the interval representing the critical difference between two test results for the same material, obtained by different operators using different equipment in different laboratories, not necessarily on the same day. Two test results shall be judged to be not equivalent if they differ by more than the "*R*" value for that material.

10.5 Any judgment in accordance with 10.3 or 10.4 will have approximately 95 % (0.95) probability of being correct.

10.6 *Bias*—Bias gage measures to 0.0736 mm (2.94 mils) per NIST calibration testing. Micrometer measurements collected to 0.1 mils precision. Analysis is based upon a 2.9 mil target. The chart in Fig. does not indicate a consistent bias.

11. Keywords

11.1 dimension; micrometer; thickness measurement

iTeh Standards (https://standards.iteh.ai) Document Preview ASTM F2251-13(2018)

[4] A research report is available from ASTM International Headquarters. Request RR:F02-1018.

TABLE 1 Description of Equipment used in Round Robin Studies

NOTE 1—Force ranges from instruments are specified from 10 to 150 g. Exceptions include bench top model at 15.875 mm (0.625 in.) rated at 7.3 psi with a dead weight load of 1033 g and 6.35 mm (0.25 in.) handheld is rated at a force between 600 to 1000 g.

Diameter Foot Size, mm	Foot Size, in.	Type	Make
4.7752	0.188	Bench	Mitutuoyo
4.7752	0.188	Bench	Mitutuoyo
4.7752	0.188	Bench	Mitutuoyo
6.35	0.250	Handheld	Mitutuoyo
6.35	0.250	Bench	Mitutuoyo
9.525	0.375	Bench	Ono Sokki
9.525	0.375	Handheld	Precision Material
9.525	0.375	Handheld	Mitutuoyo
15.875	0.625	Bench	TMI