



Designation: C366/C366M – 16 (Reapproved 2022)^{ε1}

Standard Test Methods for Measurement of Thickness of Sandwich Cores¹

This standard is issued under the fixed designation C366/C366M; 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 U.S. Department of Defense.

^{ε1} NOTE—Editorial corrections were made in Section 1 in May 2022.

1. Scope

1.1 These test methods cover plant manufacturing procedures for measuring the thickness of flat sandwich cores. Permissible core material forms include those with continuous bonding surfaces (such as balsa wood and foams) as well as those with discontinuous bonding surfaces (such as honeycomb). The two test methods covered include the following:

1.1.1 *Test Method A*—Roller-Type Thickness Tester.

1.1.2 *Test Method B*—Disk-Type Thickness Tester.

NOTE 1—These test methods are designed for measuring thickness of core as it is produced and are not intended for use in determining dimensions of core specimens for other tests.

1.2 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.2.1 Within the text, the inch-pound units are shown in brackets.

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

1.4 *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.*

¹ These test methods are under the jurisdiction of ASTM Committee D30 on Composite Materials and are the direct responsibility of Subcommittee D30.09 on Sandwich Construction.

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2. Referenced Documents

2.1 *ASTM Standards*:²

D883 Terminology Relating to Plastics

D3878 Terminology for Composite Materials

D5229/D5229M Test Method for Moisture Absorption Properties and Equilibrium Conditioning of Polymer Matrix Composite Materials

E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

E171 Practice for Conditioning and Testing Flexible Barrier Packaging

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

E456 Terminology Relating to Quality and Statistics

3. Terminology

3.1 *Definitions*—Terminology D3878 defines terms relating to high-modulus fibers and their composites, as well as terms relating to sandwich constructions. Terminology D883 defines terms relating to plastics. Terminology E456 and Practice E177 define terms relating to statistics. In the event of a conflict between terms, Terminology D3878 shall have precedence over the other terminologies.

3.2 *Symbols*:

3.2.1 CV —coefficient of variation statistic of a sample population for a given property (in percent)

3.2.2 S_{n-1} —standard deviation statistic of a sample population for a given property

3.2.3 X_i —test result for an individual specimen from the sample population for a given property

3.2.4 \bar{x} —mean or average (estimate of mean) of a sample population for a given property

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.

4. Summary of Test Methods

4.1 These test methods consist of environmentally conditioning a sandwich core specimen, zeroing a thickness tester, placing the core underneath the tester, and measuring the core thickness by sliding the core underneath the tester. Procedures are provided for thickness measurement using both roller-type and disk-type thickness testers.

5. Significance and Use

5.1 Normally, a close tolerance is desirable for core thickness so that sandwich panels may be manufactured with all the sandwich components fitting properly and without crushing the core.

5.2 These test methods are designed for measuring thickness of core as it is produced and are not intended for use in determining dimensions of core specimens for other tests.

5.3 These test methods provide standard methods of obtaining the core thickness of flat sandwich core materials, and provide a basis for determining average thickness dimensions. The thickness properties derived may be used in design properties, material specifications, research and development applications, and quality assurance.

5.4 Factors that influence core thickness measurement and shall therefore be reported include the following: core material through-thickness rigidity, surface roughness, specimen geometry (including warpage), specimen preparation, methods of dimensional measurement, specimen conditioning, and moisture content during dimensional measurements.

6. Interferences

6.1 *Material and Specimen Preparation*—Poor material fabrication practices and damage induced by improper specimen machining are known causes of high data scatter in composites and sandwich structures in general. Important aspects of sandwich core specimen preparation that contribute to data scatter include the existence of joints, voids or other core discontinuities, out-of-plane curvature/warpage, and surface roughness.

6.2 *Measurement Equipment and Procedures*—Results are affected by the method of thickness measurement, use of pressure to flatten warped core, and the distance along which thickness is measured.

6.3 *Environment*—Results are affected by the environmental conditions under which specimens are conditioned, as well as the conditions under which the tests are conducted. Specimens tested in various environments, with different ambient moisture contents, can exhibit significant differences in measured thickness.

7. Apparatus

7.1 Test Method A—Roller-Type Thickness Tester:

7.1.1 *Roller-Type Thickness Tester*—The tester shall consist of a flat table with a rigid yoke framework attached, as shown in Fig. 1. Two rollers shall be mounted on this yoke, one fixed in position and one movable in the vertical direction. The vertical movement of the upper roller shall be translated to a



FIG. 1 Roller-Type Thickness Tester

dial gage, calibrated in 0.01 mm [0.001 in.] increments, that registers the amount of variation above or below a preset nominal dimension. The lower roller shall be fixed in position so that it projects 6 mm [0.25 in.] above the measurement surface. The upper roller shall exert a force of 18 N [4 lbf] on the core material.

7.2 Method B—Disk-Type Thickness Tester:

7.2.1 *Disk-Type Thickness Tester*—The tester shall consist of a flat table with a rigid yoke framework attached, as shown in Fig. 2. A 25 mm [1 in.] diameter presser disk movable in a vertical direction shall be mounted on the yoke. The vertical movement of the disk shall be translated to a dial gage, calibrated in 0.01 mm [0.001 in.] increments, that registers the amount of variation above or below a preset nominal dimension. The disk shall exert a force of 24 N [5.5 lbf] on the core material.

7.3 *Measurement Surface*—A flat, rigid surface shall be positioned such that the specimen can be supported underneath the thickness tester without bending or warping.

8. Sampling and Test Specimens

8.1 *Sampling*—Test at least five specimens per test condition, or take five readings from alternative locations on a

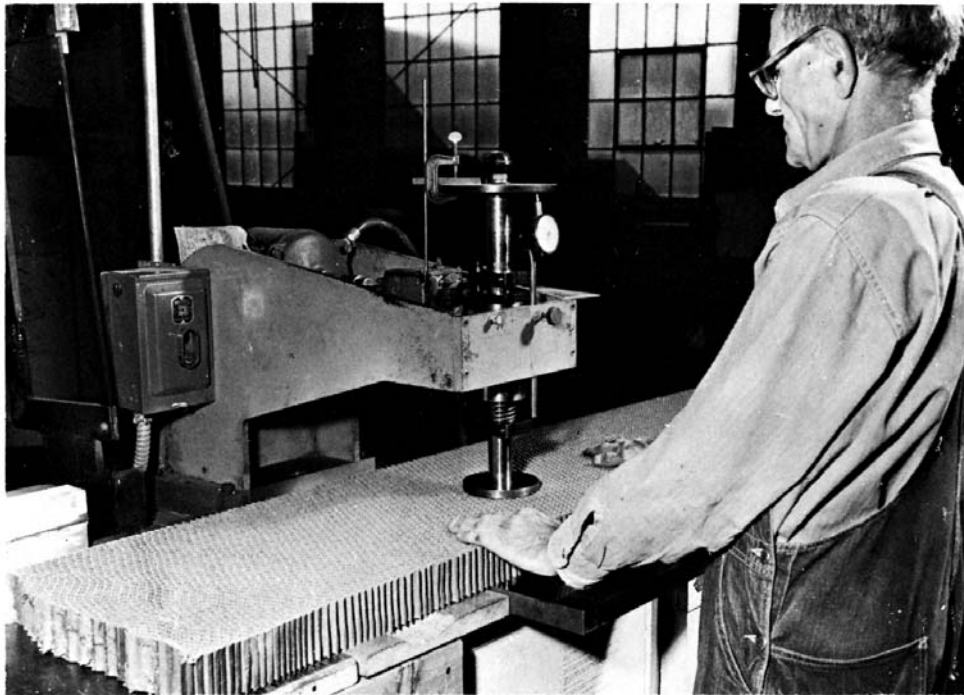


FIG. 2 Disk-Type Thickness Tester

single large specimen, unless valid results can be gained through the use of fewer specimens, as in the case of a designed experiment. For statistically significant data, consult the procedures outlined in Practice E122. Report the method of sampling.

8.2 *Geometry*—Test specimens shall be flat but otherwise may be any length, width, and thickness consistent with the limits of the measuring apparatus.

8.3 *Specimen Preparation and Machining*—Ensure the test specimens are flat, and that the facing plane surfaces are parallel to each other. Take precautions when cutting specimens to avoid notches, undercuts, and rough or uneven surfaces which can affect the measured thickness due to inappropriate machining methods. Record and report the specimen cutting preparation method.

8.4 *Labeling*—Label the test specimens so that they will be distinct from each other and traceable back to the sheet of origin, and will neither influence the test nor be affected by it.

9. Calibration

9.1 The accuracy of all measuring equipment shall have certified calibrations that are current at the time of use of the equipment.

10. Conditioning

10.1 As the physical dimensions of the core materials are affected by moisture, it is recommended to subject the test specimens to standard ASTM atmospheric conditions (Specification E171) of 23 ± 3 °C [73 ± 5 °F] and 50 ± 5 % relative humidity, in accordance with Procedure C of Test Method D5229/D5229M. However, if the test requestor does not

explicitly specify a pre-test conditioning environment, no conditioning is required and the test specimens may be tested as prepared.

10.2 The pre-test specimen conditioning process, to include specified environmental exposure parameters, shall be reported with the test data.

10.3 If no explicit conditioning process is performed, the specimen conditioning process shall be reported as “unconditioned”.

10.4 Record the actual temperature and humidity at the time of measurement.

11. Procedure

11.1 *Parameters to be Specified Before Test:*

11.1.1 The specimen sampling method, specimen geometry, and conditioning travelers (if required).

11.1.2 The properties and data reporting format desired.

NOTE 2—Determine specific material property, accuracy, and data reporting requirements prior to test for proper selection of apparatus.

11.1.3 The environmental conditioning test parameters.

11.1.4 The method of thickness measurement (Method A or B) and accuracy of thickness tester.

11.2 *General Instructions:*

11.2.1 Report any deviations from this test method, whether intentional or inadvertent.

11.2.2 Condition the specimens as required. Store the specimens in the conditioned environment until test time, if the test environment is different than the conditioning environment.

11.3 *Method A—Roller-Type Thickness Tester:*