



Standard Test Method for Measuring Trueness and Squareness of Rigid Block and Board Thermal Insulation¹

This standard is issued under the fixed designation C550; 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.

1. Scope

1.1 This test method covers locations for measuring the trueness and squareness of rigid block/board thermal insulation. This test method does not purport to address the variability in board thickness. Thickness is addressed in other ASTM standards.

1.2 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.

1.3 *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

C168 Terminology Relating to Thermal Insulation

C390 Practice for Sampling and Acceptance of Thermal Insulation Lots

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

3. Terminology

3.1 **Definitions**—For definitions of terms used in this test method, refer to Terminology **C168**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 **squareness**—the lack of deviation from a right angle.

3.2.2 **trueness**—the lack of deviation from straightness or flatness.

¹ This test method is under the jurisdiction of ASTM Committee **C16** on Thermal Insulation and is the direct responsibility of Subcommittee **C16.32** on Mechanical 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.

4. Significance and Use

4.1 It is possible that insulating blocks or boards that are not true or square will not fit properly. It is possible that extra labor will be required to obtain proper fit and that this could affect the product performance as well as the appearance of the finished installation.

4.2 This test method provides terminology and describes locations for obtaining consistent measurements of trueness and squareness of blocks and boards.

5. Apparatus

5.1 **Straightedge**, minimum length equal to the maximum dimension of the block or board with a maximum out of trueness of ± 0.003 in./ft (± 0.25 mm/m).

5.2 **Rigid Ruler**, graduated to 0.03 in. (1.0 mm) or finer.

5.3 **Square**, shall have sides at least as long as the longest side of the block. If the longest side of the block is greater than 20 in. (500 mm), then the length of the square must be at least 20 in. (500 mm). The maximum deviation from 90° shall be no more than ± 3 min (± 0.9 mrad).

5.4 **Flat Surface**, large enough to accommodate the block or board in its full length and width dimensions, with a trueness of ± 0.008 in./ft (± 0.65 mm/m).

5.5 **Feeler Gage Set**, from 0.001 to 0.020 in. (0.03 to 0.50 mm).

5.6 **Tape Measure**, steel, long enough to measure the longest side of the block, graduated in 0.031 in. (1 mm) intervals.

6. Test Specimens

6.1 The test specimens shall be of commercial size.

6.2 The number of test specimens shall be defined by the appropriate product specification.

6.3 When the appropriate product specification does not cover sampling, samples shall be selected in accordance with Practice **C390** inspection requirements.

7. Procedure

7.1 Edge Trueness in the x/y Direction:

7.1.1 With the straightedge next to the block/board on the flat surface, concave deviation from true shall be determined at the point of maximum deviation (see Fig. 1 A and B).

7.1.2 For convex deviation from true, the deviation shall be measured by equalizing the distance between the straightedge and the block/board at both corners of the block/board (see Fig. 1 A and B).

7.1.3 Deviation from true shall be determined to the nearest 0.03 in. (1.0 mm).

7.2 Edge Trueness in the z (Thickness) Direction:

7.2.1 With the square next to the block/board as shown in Fig. 1C, the concave deviation from true shall be determined at the point of maximum deviation.

7.2.2 For convex deviation from true, the deviation shall be measured by equalizing the distance between the square and the block/board at both surfaces of the block/board as shown in Fig. 1D.

7.2.3 Deviation from true shall be determined to the nearest 0.03 in. (0.8 mm).

7.3 Edge Squareness:

7.3.1 For edge squareness, the block/board shall be placed on the flat surface such that the deviation from square is apparent as in Fig. 2A.

7.3.2 With the square resting on the flat surface, determine the deviation from square to the nearest 0.03 in. (1.0 mm) for all four edges at the point of maximum deviation.

7.4 Corner Squareness:

7.4.1 For corner squareness, the square shall be placed against the long edge as in Fig. 2B.

7.4.2 Determine the deviation from square for all four corners at 20 in. (500 mm) from the edge to the nearest 0.03 in. (1.0 mm). If the block/board is less than 20 in. (500 mm) in width, determine the deviation at full width and report the deviation at full width.

7.5 Board Squareness:

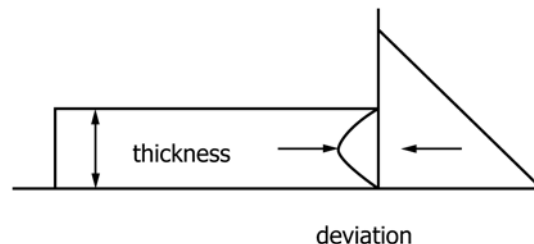
7.5.1 For board squareness, the block/board shall be placed on a flat surface and the diagonal lengths shall be measured to the nearest 0.03 in. (1.0 mm) as in Fig. 2C.

7.5.2 the block/board squareness is the difference between the lengths of the diagonals.

7.6 Face Trueness:

7.6.1 For edge face trueness, place the block/board on the flat surface with the concave face down as in Fig. 3A.

C. Concave Deviation



D. Convex Deviation

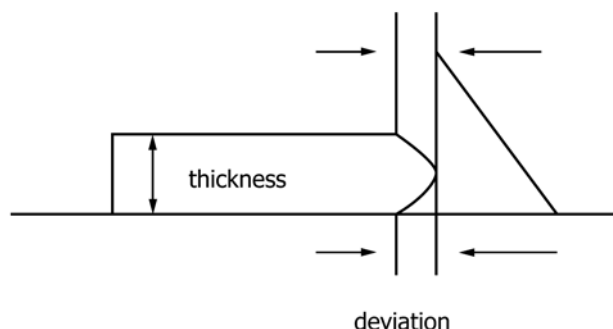


FIG. 1 Edge Trueness (continued)

7.6.2 Without additional force or load to the block/board, determine the edge face trueness at the point of maximum deviation to the nearest 0.03 in. (1.0 mm).

7.6.3 For end face trueness, place the block/board on the flat surface with the concave face down as in Fig. 3B.

7.6.4 Determine end face trueness as in 7.6.2.

8. Report

8.1 Report the following information:

- 8.1.1 Product type and nominal dimensions.
- 8.1.2 Manufacturer and date of manufacture or lot number.
- 8.1.3 Date of testing.
- 8.1.4 Temperature during testing.

8.2 Trueness:

- 8.2.1 Maximum deviation from edge and end trueness in inches (or millimetres).
- 8.2.2 Maximum deviation from edge trueness across the width in inches (or millimetres).
- 8.2.3 Maximum deviation from end trueness across the width in inches (or millimetres).

8.3 Squareness:

- 8.3.1 Maximum deviation from edge squareness in inches (or millimetres).
- 8.3.2 Maximum deviation from corner squareness in inches (or millimetres).

8.4 Face Trueness:

- 8.4.1 Maximum deviation from flatness along the length of the block/board in inches (or millimetres).

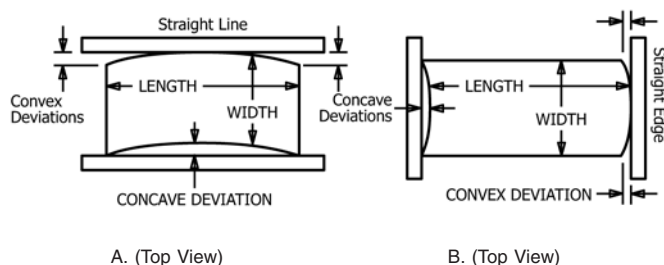


FIG. 1 Edge Trueness

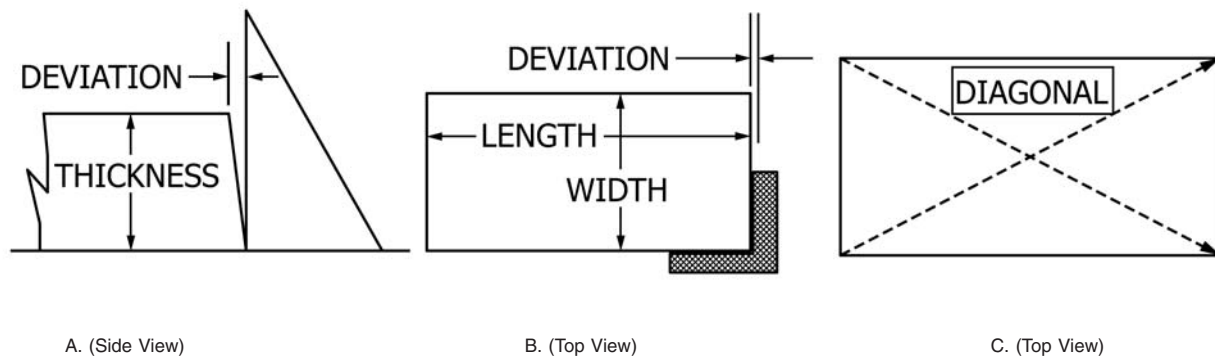


FIG. 2 Squareness

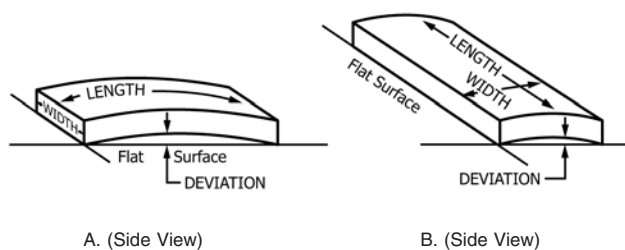


FIG. 3 Face Trueness

8.4.2 Maximum deviation from flatness across the width of the block/board in inches (or millimetres).

9. Precision and Bias

9.1 The precision of this test method is based on an interlaboratory study of Test Method C550, Standard Test Method for Measuring Trueness and Squareness of Rigid Block and Board Thermal Insulation, conducted in 2011. A total of seven laboratories participated in this study, taking 30 distinct measurements on five different sections of prepared thermal insulation. Each “test result” reported represents an individual determination, and all participants were asked to report triplicate test results for each measurement. The details are given in ASTM Research Report No. C16–1044.³

9.1.1 *Repeatability Limit (r)*—Two test results obtained within one laboratory shall be judged not equivalent if they differ by more than the “*r*” value for that material; “*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.

9.1.1.1 Repeatability limits are listed in Table 1 below.

9.1.2 *Reproducibility Limit (R)*—Two test results shall be judged not equivalent if they differ by more than the “*R*” value for that material; “*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.

9.1.2.1 Reproducibility limits are listed in Table 1 below.

9.1.3 The above terms (repeatability limit and reproducibility limit) are used as specified in Practice E177.

9.1.4 Any judgment made in accordance with statements 9.1.1 and 9.1.2 would have an approximate 95 % probability of being correct.

9.2 *Bias*—As there were no available standard reference materials at the time of this study, bias cannot be determined.

9.3 The precision statement was determined through statistical examination of 2518 test measurements, submitted by a total of seven laboratories, recording deviation measurements on five insulation boards.

9.4 To judge the equivalency of two test results, it is recommended to choose the board that is closest in characteristics to the test material.

10. Keywords

10.1 flatness; rigid thermal insulation; squareness; trueness

³ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:C16-1044. Contact ASTM Customer Service at service@astm.org.

TABLE 1 Precision Data

Figure Designation	Deviation	Material	Board	Deviation Type	Average Deviation, inch X	Repeatability Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
Fig. 1 A	Edge Trueness Length Direction	EPS	B	Convex	0.2293	0.0095	0.0260	0.0267	0.0727
Fig. 1 A	Edge Trueness Length Direction	EPS	B	Concave	0.2051	0.0059	0.0274	0.0166	0.0768
Fig. 1 B	Edge Trueness Width Direction	EPS	C	Concave	0.1104	0.0063	0.0297	0.0176	0.0831
Fig. 1 B	Edge Trueness Width Direction	EPS	C	Convex	0.1208	0.0180	0.0468	0.0504	0.1310
Fig. 1 C	Edge Squareness	EPS	B	Concave	0.1116	0.0048	0.0617	0.0133	0.1727
Fig. 1 D	Edge Squareness	EPS	B	Convex	0.0933	0.0002	0.0304	0.0007	0.0851
Fig. 2 B	Corner Squareness	EPS	D	Corner 1 ^A	0.2981	0.0147	0.0543	0.0412	0.1520
Fig. 2 B	Corner Squareness	EPS	D	Corner 2 ^A	0.2483	0.0073	0.0314	0.0205	0.0878
Fig. 2 C	Board Squareness	EPS	D	Diagonal	0.4474	0.0104	0.0230	0.0291	0.0644
Fig. 3 B	End Face Trueness	EPS	E	End 1 ^B	0.1533	0.0073	0.0249	0.0205	0.0696
Fig. 3 B	End Face Trueness	EPS	E	End 2 ^B	0.1565	0.0119	0.0229	0.0333	0.0640

^ADiagonal corners.

^BOpposite ends.

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