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.

Designation: F2055 – 17 (Reapproved 2021)

Standard Test Method for Size and Squareness of Resilient Floor Tile by Dial Gauge Method[1]

This standard is issued under the fixed designation F2055; 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 determination of both dimensions (length and width) and squareness of resilient floor tile. This test method is intended for use with square tiles ranging from a nominal 9 in. (226 mm) to 40 in. (1016 mm) in dimension.

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, 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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

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

3. Significance and Use

3.1 Both dimension and squareness of resilient floor tile are important considerations, because installed flooring may exhibit an objectionable appearance when either or both characteristics deviate from established tolerances. This test method provides a means of determining actual dimensions and squareness by using a single apparatus and procedure.

4. Apparatus

4.1 The apparatus shall consist of four dial gauges and two reference index strips mounted on a flat bedplate in a configuration that, by rotation of the sample, allows the measurement of all four sides of resilient tile samples (see Fig. 1). One edge of the bedplate is elevated to create a test surface which is offset or tilted 15 ± 1 degrees from horizontal. This offset applies minimal pressure to the test specimen against the longer index strip to ensure repeatable measurement. A reference plate representing target tile size and squareness is used to zero all dial gauges (see Fig. 2).

4.2 *Dial Gauges*—The four dial gauges are mounted in guide slots that are machined into the bedplate to allow for measurement of various tile sizes while remaining within 10% of the corner of the tile edge (for the two corner gauges and one squareness gauge) or within the central 10 % of the tile edge (for the center gauge only). Dial gauges may report measurements using either electrical or mechanical means, but they shall be graduated to read 0.001 in. (0.02 mm) and have a stem travel greater than 0.25 in. (6 mm). The contact foot of the dial-gauge stem shall be flat 0.50–0.75 ± 0.001 in. (12.7–19.1 mm ± 0.2 mm) in diameter and exert a total force of not more than 3.0 ± 0.1 ozf (0.83 ± 0.003 N). Dial gauges shall be securely positioned so that when the reference plate is in place, the contact foot is extended approximately 50% of its full travel.

4.3 *Index Strips*—The apparatus contains 2 fixed index strips. A horizontal index strip shall be mounted parallel to and just inside the lower edge of the bedplate. It shall be 1.5 ± 0.1 in. (38 ± 3 mm) greater in length and a minimum of twice the thickness of the largest tile to be tested. A second index strip shall be mounted 90° ± 10 s (1.57080 ± 0.00005 rad.) to the horizontal index strip. The lower end of this index strip shall be 0.125 ± 0.01 in. (3.1 ± 0.25 mm) above the right end of the horizontal index strip and is used to locate one corner of the sample tile.

4.4 *Reference Plate*—The reference plate shall be made to the target dimensions of the manufactured tile. The length and

[1] This test method is under the jurisdiction of ASTM Committee F06 on Resilient Floor Coverings and is the direct responsibility of F06.20Test Methods.

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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.

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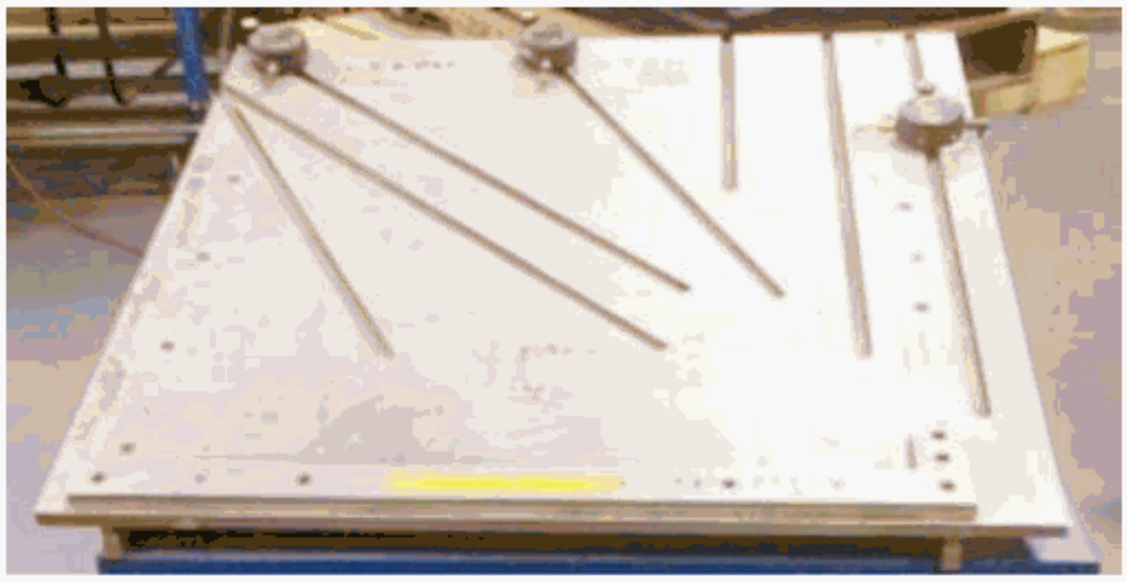
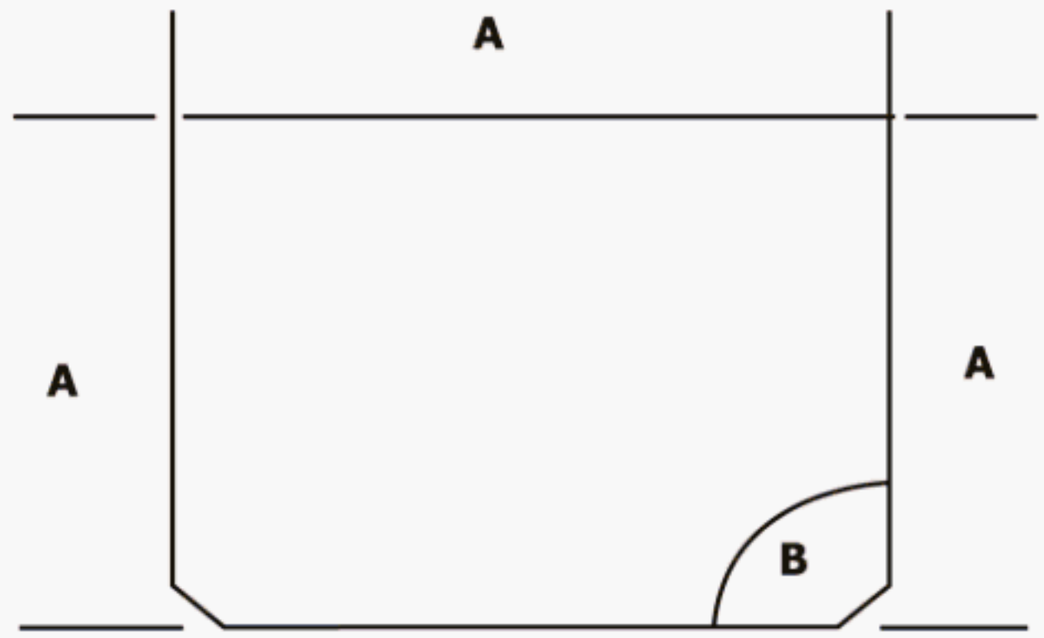


FIG. 1 Tile Measurement Apparatus



A: Tile Target Dimension ± 0.001 in. (0.02 mm)
B: 90° ± 10 s (1.57080 ± 0.00005 rad.)

FIG. 2 Reference Plate

width dimensions shall be within ± 0.001 in. (0.02 mm) of the specified dimensions of the resilient tile. The reference plate shall contain at least two sides which are perpendicular to 90° ± 10 s (1.57080 ± 0.00005 rad.) to one another and are used to set the squareness gauge to zero.

5. Specimens

5.1 The specimens shall consist of 5 full size tiles.

6. Conditioning

6.1 Condition the test specimens, reference plate, and apparatus a minimum of 24 h at 73.4 ± 1.8 °F (23 ± 1 °C) and 50 ± 10 % relative humidity. Tests shall be conducted in this same environment. Samples shall be conditioned on a flat surface such as a table or floor surface to ensure they will contact the bedplate uniformly during measurement.

7. Procedure

7.1 Place the appropriate reference plate onto the bedplate surface and slide it firmly against the two index strips. Set each of the four dial indicators to zero. Remove the reference plate. All dial indicators will now reflect their fully extended measurements. In the case of digital dial indicators, the display will indicate a negative number. In the case of mechanical dial indicators, the display will move counter-clockwise from zero.

NOTE 1—Dirt and foreign particles may collect along the upper face of the index strip and affect the zero setpoint. Use a small brush to maintain the cleanliness of the index strip surfaces before and after each use.

TABLE 1 Typical Measurement Data

Rotation No.	Gauge A	Gauge B	Gauge C	Gauge D
1	0.002	0.003	–0.002	0.002
2	0.003	0.000	0.001	–0.003
3	0.004	0.001	0.003	0.002
4	0.003	0.002	0.005	–0.004

7.2 *Measuring Size and Squareness*—Identify one edge of the sample tile as "Edge #1" by attaching a label to the face of the tile near that edge. Place the tile into the apparatus and carefully move it into position such that it will depress all four dial gauges and is in firm contact with both index strips. Record the measurements on all four gauges to the nearest 0.001 in. (0.02 mm).

7.3 Remove the tile from the bedplate and rotate it 90° in the clockwise direction. Repeat the process described in 7.2 and record the four gauge readings. Repeat for each of the two remaining sides.

7.4 After all samples have been measured, place the reference gauge back on the bedplate to verify that no movement of dial gauges has occurred. A movement of greater than 0.001 in. (0.02 mm) shall be cause to repeat the measurement process.

8. Calculations

8.1 *Tile Size*—Record all measurements in the format shown in Table 1. Measurements shall be recorded to the nearest 0.001 in. (0.02 mm) for all gauges. The four rotations provide two measurements of the length and width at the center and both edges of each of the tile specimens. Report the dimensions and squareness for each specimen using the formulas in 8.2.

8.2 Perform the following calculations using Table 1 data to determine length, width, and squareness deviations for the sample tile. The final report shall include tile size, test date, and length, width, and squareness deviations.

Length and Width Deviation	Squareness Deviation
Length Deviation, Left Side = (1A+3C)/2	Corner 1 = (D1)
Length Deviation, Center = (1B+3B)/2	Corner 2 = (D2)
Length Deviation, Right Side = (1C+3A)/2	Corner 3 = (D3)
Width Deviation, Left Side = (2A+4C)/2	Corner 4 = (D4)
Width Deviation, Center = (2B+4B)/2	
Width Deviation, Right Side = (2C+4A)/2	

9. Report

9.1 Report the dimensions and squareness for each specimen using the formulas in 8.2.

10. Precision and Bias

10.1 The precision of this test method is based on an intralaboratory study of F2055, Size and Squareness of Resilient Floor Tile by Dial Gauge Method, conducted in 2007. Each of seven laboratories tested six different types of flooring tile materials for deviations across their length, width, and diagonal. Every "test result" represents an individual determination. All participating laboratories reported ten replicate test

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TABLE 2 Length Deviation Left (inches)

Material	Average[A] $\bar{x}$	Standard Deviation of the Lab Averages $S\,\bar{x}$	Repeatability Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
A	–0.0003	0.0045	0.0022	0.0050	0.0061	0.0141
B	0.0037	0.0023	0.0013	0.0027	0.0038	0.0075
C	–0.2126	0.0033	0.0024	0.0041	0.0066	0.0115
D	0.0137	0.0023	0.0023	0.0034	0.0064	0.0094
E	–0.0158	0.0051	0.0035	0.0063	0.0098	0.0177
F	–0.0207	0.0044	0.0026	0.0052	0.0074	0.0147

[A] The average of the laboratories' calculated averages.

results (from one operator) for each type of flooring material. Practice E691 was followed for the design and analysis of the data.[3]

10.1.1 *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.

10.1.1.1 Repeatability limits are listed in Tables 2-11.

10.1.2 *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.

10.1.2.1 Reproducibility limits are listed in Tables 2-11.

10.1.3 The terms (repeatabilty limit and reproducibility limit) are used as specified in Practice E177.

10.1.4 Any judgment in accordance with 10.1.1 and 10.1.2 would have an approximate 95 % probability of being correct.

10.2 *Bias*—At the time of this study, there was no accepted reference material suitable for determining the bias of this test method, therefore no statement on bias is being made.

10.3 The precision statement was determined through statistical examination of 1120 results, from seven laboratories, on six materials. These six tile materials were described as the following:

Material A: 12 in. by 12 in. VCT
Material B: 12 in. by 12 in. VCT
Material C: 18 in. by 18 in. Rubber Tile
Material D: 18 in. by 18 in. Vinyl Tile
Material E: 24 in. by 24 in. Rubber Tile
Material F: 24 in. by 24 in. Vinyl Tile

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

11. Keywords

11.1 dial gauge; resilient flooring; resilient tile; tile

[3] Details are given in ASTM Research Report RR:F06-1008, available from ASTM International Headquarters.

TABLE 3 Length Deviation Center (inches)

Material	Average[A] $\bar{x}$	Standard Deviation of the Lab Averages $S\,\bar{x}$	Repeatability Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
A	0.0005	0.0035	0.0016	0.0038	0.0044	0.0107
B	0.0038	0.0018	0.0012	0.0022	0.0034	0.0062
C	–0.2126	0.0023	0.0013	0.0027	0.0037	0.0076
D	0.0141	0.0027	0.0011	0.0030	0.0031	0.0083
E	–0.0146	0.0040	0.0023	0.0047	0.0065	0.0131
F	–0.0207	0.0034	0.0024	0.0042	0.0066	0.0118

[A] The average of the laboratories' calculated averages.

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TABLE 4 Length Deviation Right (inches)

Material	Average[A] $\bar{x}$	Standard Deviation of the Lab Averages $S\bar{x}$	Repeatability Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
A	0.0006	0.0026	0.0020	0.0033	0.0055	0.0093
B	0.0041	0.0021	0.0017	0.0028	0.0048	0.0077
C	−0.2126	0.0029	0.0024	0.0039	0.0068	0.0108
D	0.0151	0.0020	0.0019	0.0028	0.0055	0.0079
E	−0.0174	0.0054	0.0043	0.0070	0.0119	0.0196
F	−0.0212	0.0051	0.0031	0.0061	0.0087	0.0171

[A] The average of the laboratories' calculated averages.

TABLE 5 Width Deviation Left (inches)

Material	Average[A] $\bar{x}$	Standard Deviation of the Lab Averages $S\bar{x}$	Repeatability Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
A	0.0016	0.0033	0.0015	0.0037	0.0043	0.0102
B	−0.0030	0.0024	0.0021	0.0033	0.0059	0.0092
C	−0.2124	0.0033	0.0023	0.0041	0.0065	0.0115
D	0.0148	0.0034	0.0020	0.0040	0.0055	0.011
E	−0.0135	0.0044	0.0033	0.0057	0.0093	0.0158
F	−0.0214	0.0046	0.0032	0.0057	0.0088	0.0159

[A] The average of the laboratories' calculated averages.

TABLE 6 Width Deviation Center (inches)

Material	Average[A] $\bar{x}$	Standard Deviation of the Lab Averages $S\bar{x}$	Repeatability Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
A	0.0021	0.0034	0.0014	0.0037	0.0039	0.0105
B	−0.0025	0.0023	0.0022	0.0033	0.0061	0.0092
C	−0.2127	0.0022	0.0023	0.0032	0.0063	0.0090
D	0.0154	0.0026	0.0013	0.0030	0.0038	0.0083
E	−0.0129	0.0043	0.0034	0.0056	0.0096	0.0158
F	−0.0205	0.0033	0.0028	0.0044	0.0078	0.0124

[A] The average of the laboratories' calculated averages.

TABLE 7 Width Deviation Right (inches)

Material	Average[A] $\bar{x}$	Standard Deviation of the Lab Averages $S\bar{x}$	Repeatability Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
A	0.0017	0.0029	0.0022	0.0037	0.0060	0.0104
B	−0.0033	0.0020	0.0023	0.0032	0.0066	0.0089
C	−0.2107	0.0024	0.0026	0.0037	0.0072	0.0102
D	0.0156	0.0032	0.0021	0.0039	0.0058	0.0109
E	−0.0136	0.0053	0.0032	0.0063	0.0089	0.0176
F	−0.0208	0.0046	0.0035	0.0059	0.0098	0.0164

[A] The average of the laboratories' calculated averages.

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TABLE 8 D1 Squareness Deviation (inches)

Material	Average[A] $\bar{x}$	Standard Deviation of the Lab Averages $S\,\bar{x}$	Repeatability Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
A	0.0007	0.0028	0.0033	0.0045	0.0093	0.0127
B	–0.0001	0.0037	0.0026	0.0046	0.0072	0.0128
C	0.0030	0.0036	0.0057	0.0070	0.0160	0.0197
D	0.0018	0.0013	0.0029	0.0034	0.0082	0.0094
E	0.0027	0.0055	0.0052	0.0078	0.0145	0.0218
F	0.0029	0.0059	0.0035	0.0070	0.0099	0.0196

[A] The average of the laboratories' calculated averages.

TABLE 9 D2 Squareness Deviation (inches)

Material	Average[A] $\bar{x}$	Standard Deviation of the Lab Averages $S\,\bar{x}$	Repeatability Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
A	0.0009	0.0050	0.0028	0.0058	0.0078	0.0162
B	0.0039	0.0041	0.0025	0.0049	0.0070	0.0138
C	0.0012	0.0028	0.0079	0.0088	0.0221	0.0246
D	0.0005	0.0033	0.0039	0.0053	0.0109	0.0147
E	0.0086	0.0060	0.0066	0.0092	0.0184	0.0258
F	0.0015	0.0067	0.0031	0.0075	0.0086	0.0209

[A] The average of the laboratories' calculated averages.

TABLE 10 D3 Squareness Deviation (inches)

Material	Average[A] $\bar{x}$	Standard Deviation of the Lab Averages $S\,\bar{x}$	Repeatability Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
A	–0.0003	0.0034	0.0023	0.0042	0.0065	0.0118
B	0.0011	0.0047	0.0030	0.0057	0.0084	0.0159
C	0.0019	0.0047	0.0070	0.0088	0.0197	0.0246
D	0.0016	0.0018	0.0028	0.0035	0.0079	0.0097
E	0.0010	0.0060	0.0068	0.0093	0.0189	0.0261
F	0.0022	0.0056	0.0043	0.0072	0.0120	0.0201

[A] The average of the laboratories' calculated averages.

TABLE 11 D4 Squareness Deviation (inches)

Material	Average[A] $\bar{x}$	Standard Deviation of the Lab Averages $S\bar{x}$	Repeatability Standard Deviation S_r	Reproducibility Standard Deviation S_R	Repeatability Limit r	Reproducibility Limit R
A	0.0006	0.0039	0.0031	0.0051	0.0087	0.0142
B	0.0032	0.0037	0.0031	0.0050	0.0088	0.0139
C	0.0034	0.0045	0.0056	0.0074	0.0157	0.0208
D	0.0031	0.0042	0.0037	0.0057	0.0104	0.0160
E	0.0077	0.0062	0.0045	0.0078	0.0125	0.0218
F	0.0017	0.0076	0.0046	0.0090	0.0128	0.0251

[A] The average of the laboratories' calculated averages.

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