Designation: ~~F2199 – 18~~ F2199 – 20

Standard Test Method for Determining Dimensional Stability and Curling Properties of Resilient Flooring after Exposure to Heat[1]

This standard is issued under the fixed designation F2199; 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 the change in linear dimensions of resilient floor tile/plank products after exposure to heat and reconditioning to ambient temperature.

1.2 This test method allows one to also measure curling that can occur after a specimen has been exposed to heat and reconditioned back to ambient temperature.

1.3 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.

1.4 *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]

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

F141 Terminology Relating to Resilient Floor Coverings

F2055 Test Method for Size and Squareness of Resilient Floor Tile by Dial Gage Method

F2421 Test Method for Measurement of Resilient Floor Plank by Dial Gauge

3. Terminology

3.1 Definitions are in accordance with Terminology F141 unless otherwise indicated.

4. Significance and Use

4.1 The final appearance of an installed floor depends upon several factors. These include but are not limited to size and squareness in the case of tiles/planks, the quality of joint cut, the quality and preparation of the subfloor and the skill of the installer. Long term appearance of the installed floor is also dependent on but not limited to the ability of the tile/plank to resist shrinkage due to internal stress relief. This test method is used to measure the ability of the floor to retain its original dimensions following exposure to heat, simulating a long service life at reasonable and expected temperatures.

5. Apparatus

5.1 *Mechanical Convection-Type Oven, or equivalent,* capable of maintaining a default temperature of 180 ± 3.6 °F (82 ± 2 °C), with inside dimensions large enough to hold several tile/planks horizontally on aluminum exposure plates. Other temperature settings may be utilized, if specifically referenced in a resilient flooring specification. Temperature must be maintained to the same ±3.6 °F(2 °C) accuracy of desired set point.

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

5.2 *Specimen Exposure Plates,* consisting of flat 14-gauge, 0.0625-in. (1.6-mm), thick aluminum. The aluminum exposure plates may be contained in a rack, either fixed in or removable from the rack, and should be at least 1 in. (25.4 mm) larger in each linear dimension than the linear dimension of the specimen tested. If contained in a rack, the spacing between each plate should be at least 0.625-in. (16-mm). The rack shall be constructed with all four sides open.

5.3 *Block and Dial Gauge Assembly,* as described in Test Method F2055. See Fig. 1. If testing planks longer than 24 in. (610 mm), Test Method F2421 shall be utilized for size measurements.

5.4 *Forced Air Cooling (Fan, Blower, etc.),* may be used for accelerating specimen conditioning before heating and after cooling exposure to ensure proper equilibrium of test specimen (see 6.1 and 7.1).

5.5 *Micrometer,* The micrometer shall be pillar-mounted, or other suitable device accurate to at least 0.001 in. (0.025 mm).

5.6 *Feeler Gauge,* Feeler gauges shall be down to 0.001 in. (0.025 mm).

5.7 *Calibrated Shim or Spacer Block,* of appropriate dimensions.

5.7.1 The calibrated shim or spacer block allows one to measure plank width differences utilizing the block and dial gauge apparatus (see Fig. 2 as an example).

5.8 *Reference Plates,* Different tile/plank sizes, with respective reference plates, can be specified, provided the size and squareness apparatus is designed to handle the testing and measurement of the different sizes.

6. Test Specimen

6.1 The test specimen consists generally of a resilient floor tile or plank. Run test in duplicate. Typical floor tile/plank dimensions are 12 by 12 in. (305 by 305 mm), 24 by 24 in. (610 by 610 mm), 5 by 48 in. (127 by 610 mm), 5 by 12 in. (127 by 305 mm) or 5 by 24 in. (127 by 610 mm); for a cut down plank. Other sizes in square or rectangular dimensions may also be tested

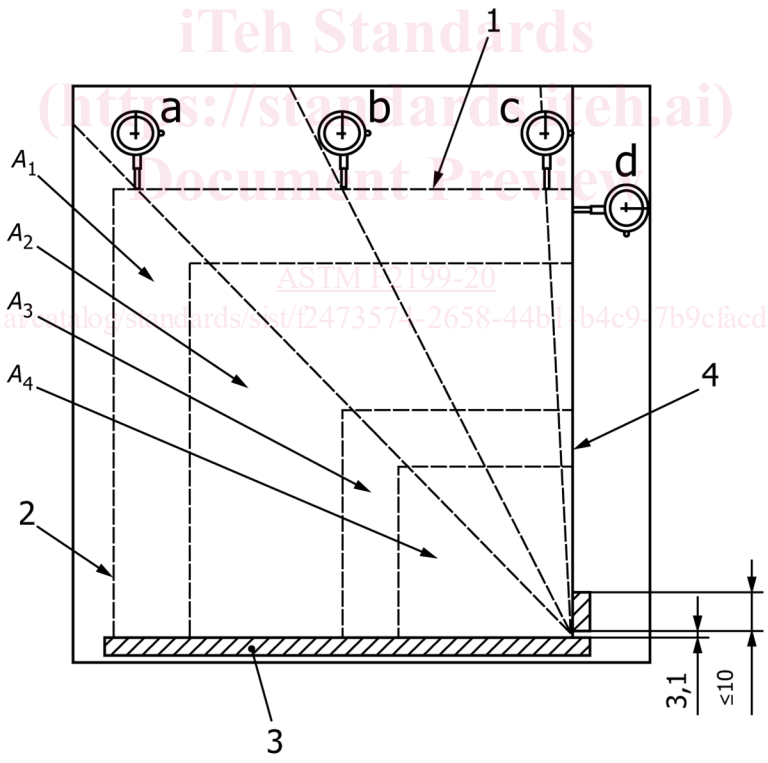

FIG. 1 Apparatus for Measuring Side Length, Straightness

Key

1 edge 1
2 edge 2
3 edge 3
4 edge 4
a Within 10 % of the corner of the tile edge.
b Within the central 10 % of the tile edge.
c Within 10 % of the corner of the tile edge.
d Within 10 % of the corner of the tile edge

A_1 template 610 by 610 mm
A_2 template 508 by 508 mm
A_3 template 305 by 305 mm
A_4 template 229 by 229 mm

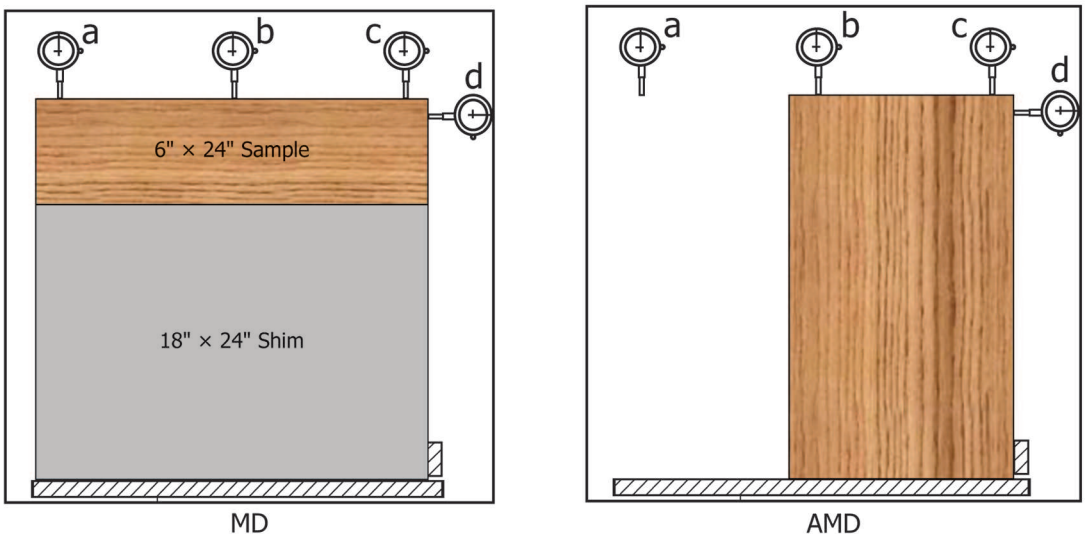

FIG. 2 Example Shim Block/Plank Measurement Set-up

provided the block and dial gauge can accommodate size capability and calibration requirements. If testing planks longer than 24 in. (610 mm), Test Method F2421 shall be utilized for size measurements greater than 24 in. (610 mm).

7. Conditioning

7.1 A conditioned room maintained at a temperature of 73.4 ± 1.8 °F (23 ± 1 °C) and 50 ± 5 % relative humidity.

7.2 *Conditioning Before Exposure:* Condition the specimens at 73.4 ± 1.8 °F (23 ± 1 °C) and 50 ± 5 % relative humidity for not less than 24 h prior to starting the test unless otherwise specified.

8. Procedure

8.1 Different tile/plank sizes, with respective reference plates, can be specified provided the size and squareness apparatus is designed to handle the testing and measurement of the different sizes.

8.2 *Conditions for Measurement*—Measure the tile specimen (8.4, 8.5, 8.8, 8.9) in the conditioning room (7.1).

8.3 *Calibration of Block and Dial Gauge Indicators*—Calibrate the block and dial gauge indicators as indicated in Test Methods F2055 or F2421, respectively.

8.4 *Initial Measurements – Dimensional Stability:*

8.4.1 *Initial Measurement*—Place the specimen, after conditioning (7.2), on the block and dial gauge assembly (5.3) face up and measure in the machine direction (MD), if identifiable, and the across machine direction (AMD), if identifiable, according to the procedure in Test Methods F2055 or F2421. These points shall be marked as reference locations on the specimen so that the final measurements will be made at the same exact locations. Three measurements in the across manufacturing direction (AMD) of the flooring material, and minimum two measurements in the manufacturing (MD) direction are required. For narrow planks (where two measurement gauges cannot be utilized for measurements – See Fig. 2) take first MD reading then turn sample 180 degrees for second MD reading. The squareness measurement step is not required.

8.5 *Initial Measurement – Curling:*

8.5.1 Use a feeler gauge and measure the space between the support plate and the bottom of the product at the corners. If using feeler gauges, read to the nearest 0.001 in. (0.025 mm). An alternative to using feeler gauges is the use of a micrometer (5.5). If using a micrometer, read the height difference from the surface plate to the top of the specimen at the reference locations, at the corners, unless otherwise instructed. Read to the nearest 0.001 in. (0.025 mm). (**Warning**–When handling test specimens and making measurements, to avoid distortion, do not apply undue force to the test specimen.

8.6 *Heat Exposure*—Start the heat exposure portion of the test within 1 h or making the initial dimensional measurements.

8.6.1 Place the tile/plank specimen face up in the exposure rack (5.2) on the aluminum exposure plates. Position the plates on racks in the heated cabinet (5.1) at 180 ± 3.6 °F (82 ± 2 °C) for 6 ± 0.25 h (standard default temperature unless otherwise cited in a flooring specification document). Expose the four open sides of the rack to the direction of the airflow within the cabinet so that the circulating air passes freely over the tile specimens.

8.6.2 If a different temperature or time, or both, is utilized, the test sheet must accurately reflect conditions used to test the curl and dimensional stability. The same tolerances for temperature and time, as required for default conditions, would apply to any different set of temperature/time conditions utilized.

8.7 *Conditioning after Exposure*—Remove the specimen plate assembly from the oven cabinet (5.1). Allow the assembly to condition at room temperature (7.1) for at least 24 h. Wear gloves when handling the hot aluminum plate.

8.8 *Final Measurements – Curling:*

8.8.1 After the reconditioning period, measure curling as described in 8.6. Determine the curling by measuring the change in specimen height after the heat exposure and reconditioning period, for all four corner locations used for the initial measurements, in the same manner curling was initially measured, for each specimen.

8.8.2 Record individual curl values, as well as maximum value for each specimen.

8.9 *Final Measurements – Dimensional Stability:*

8.9.1 Remove the specimen from the aluminum plate after measuring for curling, and place the specimen on the block and dial gauge assembly (5.1) face up and measure in the across machine direction (AMD) and the machine direction (MD), according to the procedure in Test Method F2055 or F2421. Make sure the final readings were taken at the exact reference locations as for the initial readings.

8.9.2 On each test specimen, determine the length at each of the reference locations. Three measurements in the across manufacturing direction (AMD) of the flooring material, and minimum two measurements in the manufacturing (MD) direction. For very narrow planks take first MD reading then turn sample 180 degrees for second MD reading.

NOTE 1—Squareness measurements are not to be taken as part of the dimensional stability determination.

9. Calculations

9.1 *Curling:*

9.1.1 Calculate the curling value for each sample, in accordance with the following equation:

$$Curling_{value} = (C_{final} - C_{initial}) \tag{1}$$

where:

C_{final} = Average of the four corner curling height measurements after heat exposure and reconditioning for each specimen.
$C_{initial}$ = Average of the four corner curling height measurements prior to heat exposure for each specimen.

$$\text{Final Curling}_{\text{value}} = \text{Avg of the two specimens Curling}_{\text{values}} \tag{2}$$

$$\text{Final Curling}_{\text{Max}} = \text{Avg of the two Specimens Max Curling}_{\text{values}} \tag{3}$$

where:

Max Curling$_{value}$ = the maximum value of the four Curling$_{value}$ measurements, for each specimen.

9.1.2 Upward curl is expressed as a positive curling and downward curl is expressed as a negative curling.

9.1.3 The curling values are recorded and reported in inches to the nearest 0.001 in. (0.025 mm).

9.2 *Dimensional Stability:*

9.2.1 Calculate the dimensional stability for each test specimen (MD and AMD). The initial and final values are expressed separately.

9.2.2 Calculate the mean value for the test specimens.

9.2.3 The ~~final~~initial AMD average measurements are subtracted from ~~initial~~final AMD average measurements. A negative value indicates shrinkage and a positive value indicates growth.

9.2.4 The MD and AMD dimensional stability results are calculated, recorded, and reported as individual measurements on an applicable characteristic chart or report form. The results can be expressed in ~~percent(%)~~ percent (%) or reported directly in mils (mm), depending on how the specification requirements may request data reported.

9.3 See calculation for linear dimensional represented as a percentage change:

$$\text{Linear Change}\,\% = \left[\frac{(D_f - D_i)}{D_i}\right] \times 100 \tag{4}$$

where:

D_f = the average final length, and
D_i = the average initial length.

10. Precautions

10.1 While no supporting data exists, it is important that the aluminum exposure plates for supporting the specimen be kept smooth and polished so that surface friction does not interfere with free shrinkage or growth of the specimens. The plates must be flat and free of convex or concave warp.

10.2 For any type of block and dial gauge, care must be taken so that the specimen is properly seated against the base horizontal index guide when a specific measurement is being taken. Specimens with concave or convex edges can easily be read incorrectly.