



Standard Test Methods for Short-Term Indentation and Residual Indentation of Resilient Floor Covering¹

This standard is issued under the fixed designation F1914; 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 procedures to determine short-term indentation and residual indentation of resilient flooring, when subjected to concentrated loads.

1.2 The test methods appear in the following order:

Indentation by McBurney ² Test	Section 4 to 10
Indentation and Residual Indentation	11 to 15

1.3 There are two procedures with their respective apparatus. The first (McBurney Test) is described in Sections 4 to 10 and is restricted to a spherical foot. It is only used for initial indentation measurements of VCT. The second is described in Sections 11 to 15 and has interchangeable feet with variable geometry. It is used to measure initial and residual indentation.

1.4 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.

1.5 *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:*³

[E691 Practice for Conducting an Interlaboratory Study to](#)

[Determine the Precision of a Test Method](#)

[E2251 Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids](#)

[F141 Terminology Relating to Resilient Floor Coverings](#)

[F1066 Specification for Vinyl Composition Floor Tile](#)

[F1303 Specification for Sheet Vinyl Floor Covering with Backing](#)

[F1700 Specification for Solid Vinyl Floor Tile](#)

[F1913 Specification for Vinyl Sheet Floor Covering Without Backing](#)

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology [F141](#).

INITIAL INDENTATION MEASUREMENTS OF VCT (MCBURNEY TEST)²

4. Significance and Use

4.1 This test method measures short-term indentation of resilient flooring and is useful as a predictor of performance in actual installations over time.

4.2 The slope, m , of a log-log plot indentation (I) versus time (T), is related to the indentation of tile in service. The 115°F (46°C) indentation is a measure of the tendency of the tile to indent at temperatures above 77°F (25°C).

5. Apparatus

5.1 *Apparatus*²—The indentation tester is a spherical foot device consisting essentially of a rigidly mounted indenter acting under an initial load of 2.00 ± 0.02 lbf (8.90 ± 0.09 N) and a total deadweight load of 30.00 lbf \pm 0.25 lbf (133.45 ± 1.11 N) with a suitable dial indicator, calibrated in 0.0005 in. (0.01 mm) increments. The spherical foot shall be 0.250 ± 0.0005 in. (6.35 ± 0.01 mm) in diameter. A suitable apparatus is shown in [Fig. 1](#).

5.2 *Flat Glass Plate*, of 0.25 in. (6.35 mm) minimum thickness for supporting the specimen and tester during test.

5.3 *Timing Device* that will indicate the time in seconds.

5.4 *Thermometer*, calibrated as in Specification [E2251](#).

¹ This test method is under the jurisdiction of ASTM Committee F06 on Resilient Floor Coverings and is the direct responsibility of Subcommittee F06.30 on Test Methods - Performance.

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² The sole source of supply of the McBurney Indentation Tester known to the committee at this time is Frazier Precision Co, Gaithersburg, MD. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee¹, which you may attend.

³ 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.

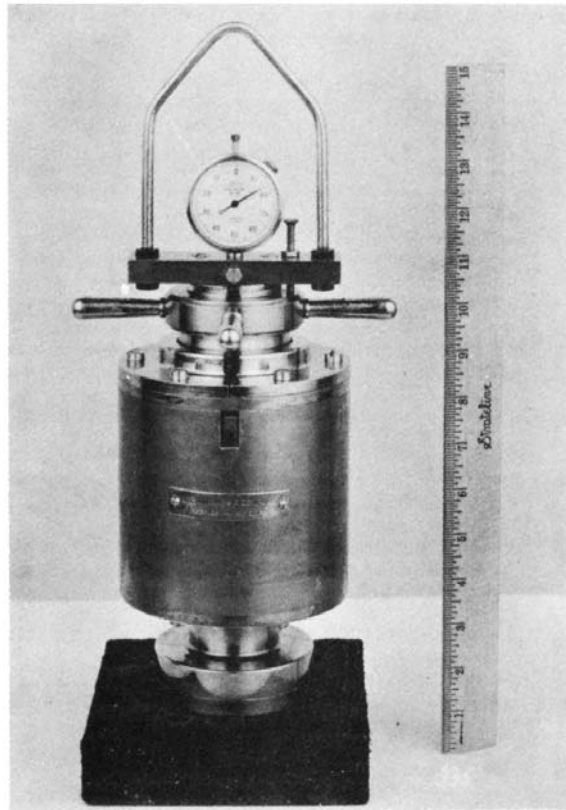


FIG. 1 Apparatus for Measuring Indentation: McBurney

5.5 *Circular Plexiglas Template*, 3.50 in. (88.9 mm) in diameter, 0.25 in. (6.35 mm) thick and having a 0.3125 in. (7.94 mm) diameter hole drilled in the center and a 0.75 in. (19.05 mm) diameter concentric circle etched on the face.

5.6 *Water Baths*, or air atmosphere maintained at $77 \pm 0.9^\circ\text{F}$ ($25 \pm 0.5^\circ\text{C}$) or $115 \pm 1^\circ\text{F}$ ($46 \pm 0.5^\circ\text{C}$).

6. Test Specimens

6.1 The test specimen shall be a full tile, usually 12 by 12 in. (approximately 305 by 305 mm) or 9 by 9 in. (approximately 230 by 230 mm). Larger tiles shall be cut to one of the above sizes.

7. Conditioning

7.1 For testing in air, condition the specimen(s) for 1 h at the test temperature.

7.2 For testing in water, condition the specimen(s) at the test temperature for 15 min minimum and 30 min maximum (see Table 1).

7.3 Condition the indentation tester and glass plate in the same medium and for at least the same time period as the specimen(s).

8. Procedures

8.1 *Nonembossed Surfaces:*

8.1.1 Place the specimen on the glass plate with the wearing surface up.

8.1.2 Place the indenter on the specimen. Be sure the indenter tip is retracted into the base when the instrument is placed on the specimen and when being moved to another test location.

8.1.3 Apply the initial 2-lbf (8.9-N) load (shaft assembly) to the specimen surface.

8.1.3.1 Position the 28-lbf (124.5-N) load on the specimen by holding down with the thumb the 2-lbf (8.9-N) shaft cross bar to proper load.

8.1.3.2 Gently lower the load to force the shaft cross bar upward until there is no clearance between the shaft and the upper wear plate. This will ensure proper 2-lbf (8.9-N) loading and positioning of the 28-lbf (124.5-N) load.

8.1.4 Set the dial gage at zero.

8.1.5 Release the 28-lbf (124.5-N) load and start the timing device. (Steps 8.1.3-8.1.5 should not exceed a total of 5 s.) Load release should be smooth and as mechanical as possible. Turn the collar at least one-half turn beyond release to allow sufficient travel for indentation. Do not hold the collar handle after the load is released as this may tilt the instrument from vertical.

8.1.6 Record the depth of indentation at $1 \text{ min} \pm 1 \text{ s}$ and $10 \text{ min} \pm 1 \text{ s}$ to the nearest 0.0001 in. (0.0025 mm) for 77°F (25°C) testing and at $30 \pm 1 \text{ s}$ for 114.8°F (46°C) testing.

8.1.7 Perform three of the required tests at randomly selected locations on the specimens. Record the three individual readings and the average for each time period.

8.2 *Embossed Surfaces:*

TABLE 1 Sample Conditioning and Testing Procedure

Specification	Conditioning			Foot Geometry and Diameter	Total Load	Indentation Time	Recovery Time for Residual Indentation
	Temperature	Time	Medium				
F1066	77 ± 1°F 25 ± 0.5°C	15–30 min or 1 h	water	spherical	30 ± 0.25 lb (13.6 ± 0.115 kg)	1 min	N/A
	77 ± 1°F 25 ± 0.5°C	15–30 min or 1 h	air water	0.25 ± 0.0005 in. (6.35 ± 0.0127 mm) spherical	30 ± 0.25 lb (13.6 ± 0.115 kg)	10 min	N/A
	115 ± 1°F 46 ± 1°C	15–30 min or 1 h	air water	0.25 ± 0.0005 in. (6.35 ± 0.0127 mm) spherical	30 ± 0.25 lb (13.6 ± 0.115 kg)	30 s	N/A
F1303, Type I	75 ± 4°F 23 ± 2°C	6 h	air air	0.25 ± 0.0005 in. (6.35 ± 0.0127 mm) spherical	50 ± 0.5 lb (22.7 ± 0.225 kg)	5 min	60 min
F1303, Type II F1913	75 ± 4°F 23 ± 2°C	6 h	air	0.75 ± 0.0005 in. (19.05 ± 0.0127 mm) flat	75 ± 0.75 lb (34.2 ± 0.340 kg)	15 min	60 min
F1700	75 ± 4°F 23 ± 2°C	6 h	air	0.25 ± 0.0005 in. (6.35 ± 0.0127 mm) flat	140 ± 1 lb (63.5 ± 0.454 kg)	10 min	60 min
				0.178 ± 0.0005 in. (4.521 ± 0.0127 mm)			

8.2.1 Prior to conditioning use the template described in 5.5 to locate areas on the specimen where a flat surface lies within the 0.75 in. (19.05 mm) diameter circle etched in the template. Mark the area for placement of the indenter by tracing around the template with a pencil. Follow the procedure detailed in 8.1-8.1.7 after placing the indenter with its base inside the circle.

NOTE 1—If the embossed surface of the tile is such that a 0.75 in. diameter smooth area cannot be located in the same or parallel plane that the indenter base will rest on, or the surface is completely nonuniform such as a textured surface, or both, the test shall not be made.

9. Report

9.1 Report the tile indentation as the average value(s) of the three tests made at each temperature and time interval. These shall be designated as the 1-min, 10-min and 30-s indentation values. Include in the report the nominal gage of the tile; that is, 1/16, 3/32, or 1/8 in. (approximately 1.6, 2.4, or 3.2 mm, respectively).

10. Precision and Bias

10.1 *Precision*—The precision statement is based on round robin testing performed at committee members' laboratories using this procedure to perform the tests.

10.1.1 *Repeatability*—The estimated repeatability at the 95 % confidence limit is as follows:

For 1 and 10-min indentations	±0.0005 in.
For 30 s indentation	±0.001 in.
For slope <i>m</i> of the log <i>I</i> /log <i>T</i>	±0.008 mils/decade min

10.1.2 *Reproducibility*—Based on a limited study, the estimated reproducibility is as follows:

For 1 and 10-min indentations	±0.001 in.
For 30 s indentation	±0.002 in.
For slope <i>m</i> of the log <i>I</i> /log <i>T</i>	±0.02 mils/decade min

10.2 *Accuracy*—No justifiable statement on accuracy can be made, since the true value of the property cannot be established by an accepted reference method.

INDENTATION AND RESIDUAL INDENTATION

11. Significance and Use

11.1 The indentation and the residual indentation of resilient floor covering is important since the resistance and recovery from indentation reflects on the ability of the resilient floor covering to perform properly after installation.

11.2 The indentation of a resilient floor covering shall be measured using a specified type of indenter, flat or spherical, under a specified load and time.

11.3 The residual indentation of a resilient floor covering shall be measured after a specified recovery time.

11.4 See Table 1 for detailed testing and conditioning requirements by products (specification) type.

12. Apparatus

12.1 The apparatus⁴ shall consist of a dead weight loaded indenter with interchangeable feet of variante geometry. The device shall be equipped with a dial gage indicator to measure the depth of indentation and shall have a rigid metal plate for supporting the specimen. The frame shall be capable of guiding the weight assembly (Fig. 2).

⁴ The sole source of supply of the apparatus known to the committee at this time is DEK-TRON Scientific Instruments, 244 East Third Street, Plainfield, NJ 07060. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee¹, which you may attend.

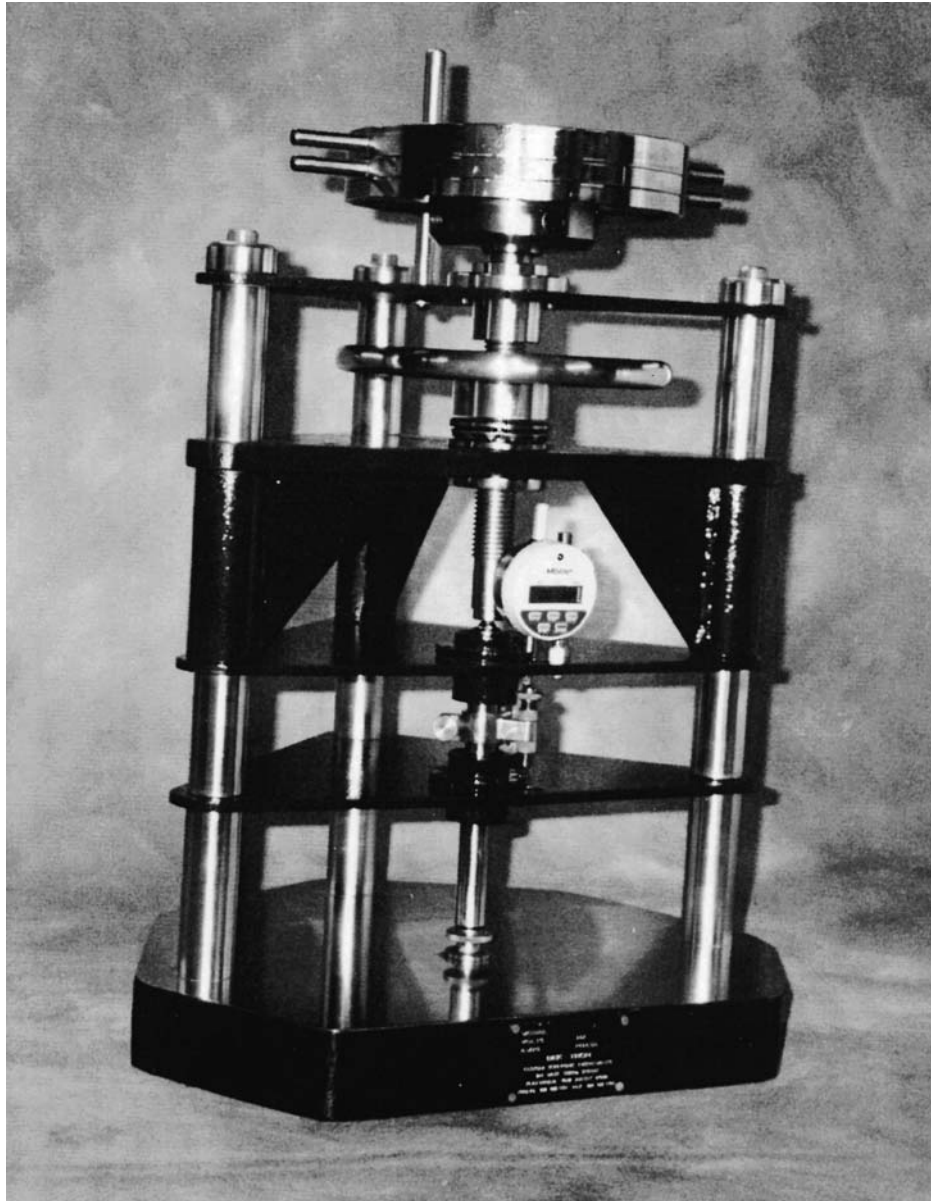


FIG. 2 Apparatus for Measuring Indentation and Residual Indentation

12.2 The indenter consists of a plunger part and a foot part. The plunger part is made of a steel bar rigidly supported vertically in such a manner that its lower end face is flat and parallel to the specimen support. The foot part of the indenter is either spherical or cylindrical with its axis perpendicular to the specimen support. The face of the indenter foot that contacts the specimen is buffed smooth to a roughness of 16 to 8 $\mu\text{in.}$ (0.4 to 0.2 μm). For standard sizes, refer to **Table 1**. The indenter may be either monolithic or have a detachable foot part to permit the use of varying foot sizes. The detachable foot must be attached tightly to the plunger before proceeding to the tests. The upper end of the indenter is provided with a weight-releasing device for applying the load without impact to the indenter and for activating a dial indicator from which the depth of penetration of the indenter can be read. The weight of the indenter shall be 1 ± 0.01 lb (0.45 ± 0.05 kg).

12.3 The dial indicator attached to the plunger part of the indenter is equipped with a scale graduated to read the depth of indentation to 0.001 in. (0.025 mm). This dial indicator is not needed for residual indentation.

12.4 The metal plate for supporting the specimen shall be fixed rigidly in a horizontal position in the framework of the apparatus and shall have a smooth, flat surface.

12.5 An appropriate clock that will indicate the time in seconds.

13. Procedure

13.1 Test Specimen:

13.1.1 Cut a specimen of floor covering at least 2 by 2 in. (50 by 50 mm) in size if rectangular, or 2 in. (50 mm) in diameter, if circular.

13.1.2 Use a specimen the same thickness as the sample unless otherwise specified in the detail product's specification.

13.2 *Conditioning*—(see **Table 1** for specific conditioning requirements).

13.2.1 There is a selection of sample conditioning. The use of air conditioning or of water immersion conditioning is defined in the detail product's specification. Immersion shall not be used if water causes the product to swell.

13.2.2 Condition and test the specimen in air maintained at $73.4 \pm 3.6^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) and $50 \pm 5\%$ relative humidity unless otherwise specified.

13.2.3 If conditioning in water, maintain the water temperature at $77 \pm 0.9^\circ\text{F}$ ($25 \pm 0.5^\circ\text{C}$) or $115 \pm 1^\circ\text{F}$ ($46 \pm 0.5^\circ\text{C}$). Immerse the specimen for not less than 15 min or more than 30 min before testing in either air or water.

13.2.4 Do not condition or test linoleum, felt-backed, foam or rubber products in water. Do not condition or test any product in water that will swell as a result of water immersion.

13.3 *Testing*:

13.3.1 Use a flat indenter foot 0.178 in. (4.52 mm) in diameter unless otherwise specified. Apply the total load to the specimen detailed in **Table 1**.

13.3.2 Apply the load for 30 ± 2 s unless otherwise specified in the detail product's specification. For residual indentation measurements, allow the specimen to rest 60 ± 1 min between the removal of the load and the measurement of thickness. Refer to **Table 1** for detailed information regarding conditioning, indenter foot geometry, total load and application time.

13.3.3 Determine the initial thickness of the specimen at the center using the dial micrometer. Record the value to the nearest 0.001 in. (0.025 mm) as T_1 .

13.3.4 Place the specimen, with the wearing surface up, flat on the supporting plate of the apparatus. Gently lower the specified indenter foot without impact until it contacts the surface of the specimen where the initial thickness measurement was made. Set the dial indicator scale to zero. Apply the specified total load to the specimen using the weight release. Maintain the load for the required time. Read the indentation from the dial indicator after the required time has elapsed. Record the value to the nearest 0.001 in. (0.025 mm) as T_2 , then remove the weight.

13.3.5 Set the specimen aside for the required recovery time when measuring residual indentation. Measure the final thick-

ness at the same point where the initial measurement is made. Record the value to the nearest 0.001 in. (0.025 mm) as T_3 .

13.3.6 Do not exceed 60 min total for immersion testing when water conditioning and determining indentation in accordance with **Table 1**.

14. Calculation and Report

14.1 *Indentation*:

14.1.1 Calculate the foot indentation of the specimen as follows:

$$\text{Indentation} = T_1 - T_2 \quad (1)$$

$$\text{Indentation, \%} = (T_2/T_1) \times 100$$

where:

T_1 = thickness of the uncompressed specimen, and
 T_2 = indentation of the specimen.

14.1.2 Test a minimum of three specimens per sample.

14.2 *Residual Indentation*:

14.2.1 Calculate the residual indentation of the specimen as follows:

$$\text{Residual Indentation} = T_1 - T_3 \quad (2)$$

$$\text{Residual Indentation, \%} = [(T_1 - T_3)/T_1] \times 100$$

where:

T_1 = thickness of the uncompressed specimen, and
 T_3 = thickness of the specimen after resting for the required time.

14.2.2 Test a minimum of three specimens per sample.

14.3 *Report*:

14.3.1 Report the average of the specimens tested as the foot indentation or the residual indentation. Record the results to the nearest 0.1 % or 0.001 in. (0.025 mm). Record the size and type of the indenter foot used, the total weight applied, the application time, and the rest period after removing the weight.

15. Precision and Bias

15.1 The precision and bias of this test method are being determined by interlaboratory round robin in compliance with Practice **E691**.

16. Keywords

16.1 indentation; McBurney; resilient flooring; residual indentation

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