Designation: F1514 – 03 (Reapproved 2013)

Standard Test Method for Measuring Heat Stability of Resilient Flooring by Color Change[1]

This standard is issued under the fixed designation F1514; 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 a procedure for determining the resistance of resilient floor covering to color change from exposure to elevated temperature over a specified period of time.

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]

D794 Practice for Determining Permanent Effect of Heat on Plastics (Withdrawn 1998)[3]

D2244 Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

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 Resilient floor covering is made by fusing polymer materials under heat or pressure, or both, in various manufacturing and decorating processes. The polymer material may be compounded with plasticizers, stabilizers, fillers, and other ingredients for processibility and product performance characteristics. The formulation of the compound can be varied considerably depending on the desired performance characteristics and methods of processing. See Practice D794 for additional significance and use information.

3.1.1 Heat stability, which is resistance to discoloration from heat, is a basic requirement for processing and functional use.

3.1.2 This test method provides a means of measuring the amount of color change in flooring products when subjected to elevated temperatures over a period of time (functional use of the flooring product).

3.2 This test method is not intended to be a means of predicting the amount of color change that occurs during processing (manufacture).

3.3 This test method specifies that a sample is subjected to 158°F ± 2°F (70°C ± 1°C) for 7 days, and the color difference is measured by a spectrophotometer and expressed as ΔE^* units.

NOTE 1—It is the intent that this test method be used for testing heat stability performance properties to be referenced in resilient flooring specifications.

4. Apparatus

4.1 *Circulating Air Oven,* which can be maintained at 158°F ± 2°F (70°C ± 1°C).

4.2 *Suitable Spectrophotometer or Colorimeter* with a minimum ¼ in. (6.35 mm) diameter opening having both a cool white fluorescent (CWF) and daylight light (D-65) sources that measure color in CIE L*, a*, b* using CIE 10° Standard Observer and Specular Included. See Test Method D2244. When an individual color cannot be totally covered within the ¼ in. spectrophotometer opening, then the largest spectrophotometer opening shall be used.

4.3 A suitable holder rack that separates samples a minimum ½ in. (12.70 mm) in a standing or vertical position.

5. Hazards

5.1 *Cautions:*

[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] 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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

5.1.1 Do not stack specimens while being exposed to elevated temperatures.

5.1.2 Be sure each specimen is marked in the corner and on the back for easy identification.

5.1.3 Monitor temperature during duration of test in oven to ensure maintenance of proper temperature.

5.1.4 Be sure color measuring equipment is properly warmed-up and calibrated prior to use.

5.1.5 Be sure specimens are held flat when measuring color.

6. Procedure

6.1 Cut three specimens from each sample, approximately 2 in. by 2 in. (50 mm by 50 mm). All specimens shall be of the same color, pattern, and texture.

NOTE 2—White, monochromatic, flat material is preferred for testing.

6.2 Obtain and record initial L*, a*, and b* readings on each of the three specimens with the color measuring equipment before placing in the circulating air oven set at 158°F ± 2°F (70°C ± 1°C). Mark the exact initial area of the measurement for future location in the color measurement equipment.

6.3 Place test specimens, positioned on edge, in the racks (4.3) into the circulating air oven at 158°F ± 2°F (70°C ± 1°C) for 7 days ± 1 h. The samples are placed in the oven parallel to the direction of air flow.

6.4 Remove specimens from circulating air oven and recondition at 73.4°F ± 2°F (23°C ± 1°C) for 1 h.

6.5 Within 24 h after reconditioning, obtain final L*, a*, b* and calculate ΔE^* readings on each specimen at the marked position using the color measuring equipment. Use either the cool white fluorescent (CWF) or daylight (D-65) light source.

7. Report

7.1 Record the light source used for measurement.

7.2 Record initial and final L*, a*, b*, and ΔE^* values for each specimen and report the individual and average ΔE^* values.

8. Precision and Bias

8.1 *Interlaboratory Test Program*[4]—An interlaboratory study evaluating the color stability of resilient vinyl flooring to the effects of exposure to heat was run in 1991 through 1993. Six laboratories tested three categories of an experimental unprinted resilient sheet flooring structure having a 0.010 in. (0.254 mm) transparent top layer containing varying levels of stabilizers. Exposure to 158°F ± 2°F (70°C ± 1°C) heat for 7 days was used to provide an accelerated heat aging environment. Color measurements were made under daylight (D-65) and cool white fluorescent (CWF) illumination. Each category level contained four test specimens randomly drawn from the master batch of material prepared by a single manufacturing site. Practice E691 was followed for the design and analysis of the data; the details of the test program are being compiled into a research report.

8.2 *Test Results*—The terms repeatability limit and reproducibility limit are used as specified in Practice E177. The precision information has been summarized in Table 1. There is a mixture of constancy and proportionality when the 2.8s indices are compared throughout the test range. It should be noted that in this study measurement of color change correlated with the varying levels of stabilization. As a result, this test method shows that color stability performance varies as the level of stabilization is varied.

8.3 *Precision*—See Table 1.

8.4 *Bias*—Since there is no accepted reference material, method, or laboratory suitable for determining the bias for the procedure in this test method for measuring the heat induced discoloration in vinyl resilient flooring, no statement on bias is being made.

9. Keywords

9.1 accelerated test; heat resistance; heat stability; resilient flooring; spectrophotometer

[4] Supporting data have been filed at ASTM Headquarters and may be obtained by requesting Research Report RR:F06-1003.

TABLE 1 Statistical Analysis of Interlaboratory Test Program

Material	Stabilization Level	ΔE^* Average	Repeatability Standard Deviation[A]	Repeatability Limit	Reproducibility Standard Deviation[A]	Reproducibility Limit
Daylight (D-65)						
B	High	1.093	0.150	0.420	0.282	0.790
A	Medium	1.804	0.153	0.428	0.385	1.078
C	Low	5.885	0.313	0.876	1.467	4.108
Cool White Fluorescent (CWF)						
B	High	1.220	0.208	0.582	0.324	0.970
A	Medium	2.039	0.168	0.470	0.431	1.207
C	Low	6.636	0.353	0.988	1.671	4.679

[A] A comparison of standard deviations shows the reproducibility value to be approximately 2 to 5 times greater than the corresponding repeatability value. Repeatability within a laboratory is better than reproducibility between laboratories.