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

This standard is issued under the fixed designation F 1515; 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 light over a specified period of time.

1.2 *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]

D 2244~~Test Method~~ Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

D 2565~~Practice for Operating Xenon Arc-Type Light-Exposure Apparatus With and Without Water for Exposure of Plastics~~ Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications

D 4459~~Practice for Operating an Accelerated Lightfastness Xenon-Arc Type (Water-Cooled) Light-Exposure Apparatus for the Exposure of Plastics for Indoor Applications~~ Practice for Xenon-Arc Exposure of Plastics Intended for Indoor Applications

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

G~~26Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials~~[5] 155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

2.2 *DIN Standard:*

DIN 53384 Artificial Weathering and Aging of Plastics by Exposure to Laboratory UV Radiation Sources, April 1989

3. Summary of Practice

3.1 Specimens are exposed continuously at a controlled temperature and humidity to a properly filtered xenon-arc radiant-energy source. The filters selected are to simulate indoor exposure conditions behind window glass. See Practice D 4459.

3.2 To ensure uniform exposure, the specimens are mounted on a cylindrical framework that rotates around the xenon lamp suspended in the center.

3.3 The effect of radiation (actinic and thermal) on the specimen shall be the color difference between the specimen before and after exposure.

4. Significance and Use

4.1 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 processability and product performance characteristics. The formulation of the compound can be varied considerably depending on the desired performance characteristics and methods of processing.

4.2 Light stability, which is resistance to discoloration from light, is a basic requirement for functional use.

4.3 This test method provides a means of measuring the amount of color change in flooring products when subjected to

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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 F06.30 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* ~~, Vol 06.01.~~volume information, refer to the standard's Document Summary page on the ASTM website.

accelerated light exposure over a period of time (functional use of the flooring product).

4.4 This test method specifies that a sample is measured by a spectrophotometer and expressed in ΔE* units before and after accelerated light exposure.

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

5. Apparatus

5.1 The apparatus employed shall utilize either a water-cooled or air-cooled xenon-arc lamp as the source of radiation and should be of Type AH, BH, or E as described in Practices D 2565 or ~~G26~~G 155.

5.1.1 *Type AH*—An exposure apparatus in which the source of radiant energy shall be a water-cooled xenon-arc vertically located at the central axis of either a 20-in. (508-mm) diameter vertical specimen rack, or of a 25.5-in. (648-mm) diameter inclined rack. Means shall be provided to control temperature, relative humidity, and spectral irradiance. The specimen rack shall rotate at approximately 1 rpm.

5.1.2 *Type BH*—An exposure apparatus in which the source of radiant energy shall be a water-cooled xenon-arc vertically located at the central axis of a 37.75-in. (960-mm) diameter inclined or vertical specimen rack. Means shall be provided to control temperature, relative humidity and spectral irradiance. The specimen rack shall rotate at approximately 1 rpm.

5.1.3 *Type E*—An exposure apparatus in which the source of radiant energy shall be three air-cooled xenon-arc lamps operating simultaneously at a nominal 4500 watts each. The lamps shall be located within a central core, which shall be positioned at the center of a 610-mm (24.1-in.) diameter specimen rack. Means shall be provided to control temperature, relative humidity, and irradiance intensity. The specimen rack shall rotate around the light source.

NOTE 2—Type AH, Type BH, and Type E may not yield equivalent results.

5.2 *Xenon Light Source*—The xenon light source consists of a quartz-jacketed burner tube charged with xenon gas.

5.3 *Glass Filters*—Table 1 shows the relative spectral power distribution limits of xenon-arcs filtered for simulating a behind window-glass exposure. For water-cooled xenon, an inner borosilicate-glass cylinder is used in combination with a soda-lime-glass outer cylinder to selectively screen radiation output. For air-cooled xenon, the filters shall be an infrared (IR) reflecting inner glass filter, quartz middle filter, and a soda-lime-glass outer filter.

5.4 *Light Monitor*—The light monitor shall be capable of measuring spectral irradiance at either 340 nm (water-cooled) or at 300–400 nm (air-cooled) incident to the specimen.

5.5 *Black Panel Temperature (BPT) Sensor*—A black-coated stainless steel panel, as specified in Practice ~~G26~~G 155, should be used as the standard reference to control test temperature. (Alternative devices such as the Black Standard Thermometer (BST) described in DIN 53384 may be used. The BST equivalent to the BPT = 145°F (63°C) has been found to be approximately 153°F (67°C)).

5.6 A suitable spectrophotometer or colorimeter with a minimum 0.25-in. (6.35-mm) diameter opening having both cool white fluorescent (CWF) and daylight (D-65) light sources that measure color in CIE L*, a*, b* using CIE 10° Standard Observer and specular included. When an individual color cannot be totally covered within the 0.25 in. spectrophotometer opening, then the largest spectrophotometer opening shall be used. See Test Method D 2244.

6. Hazards

6.1 Check to be sure the apparatus is operating properly at the start of each test. Check the lamp condition at weekly intervals to be sure that the burner tube and optical filters are clean and that they have not exceeded the maximum recommended period of use.

6.2 Be sure specimens are held flat when measuring color.

7. Procedure

7.1 The test specimens shall be flat and of uniform thickness. Dimensions are not critical. However, the specimens should be capable of fitting the exposure rack and covering the aperture (usually 2.0 in. by 2.0 in. (50.8 mm by 50.8 ~~mm))~~mm) of the color-measuring apparatus used.

TABLE 1 Sunlight Behind Window Glass Simulation Relative Spectral Irradiance for Xenon-Arc Output as Percentage of Irradiance at 300 nm

Bandpass (nm)	All Xenon-Arcs[A]
290–300	<0.1
300–320	<2.7
320–340	10.0 ± 4.5
340–360	23.0 ± 1.5
360–380	33.0 ± 2.5
380–400	40.3 ± 4.8

[A] Xenon-Arc data presented is based on filter systems currently available. If filter systems are developed that produce a closer simulation of daylight behind window glass, this table will be revised to consider these developments.