



Designation: E 1331 – 96 (Reapproved 2003)

## Standard Test Method for Reflectance Factor and Color by Spectrophotometry Using Hemispherical Geometry<sup>1</sup>

This standard is issued under the fixed designation E 1331; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method describes the instrumental measurement of the reflection properties and color of object-color specimens by the use of a spectrophotometer or spectrophotometer with a hemispherical optical measuring system, such as an integrating sphere.

1.2 The test method is suitable for use with most object-color specimens. However, it should not be used for retroreflective specimens or for fluorescent specimens when highest accuracy is desired. Specimens having intermediate-gloss surfaces should preferably not be measured by use of this geometry.

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:

D 2244 Practice for Calculation of Color Differences from Instrumentally Measured Color Coordinates<sup>2</sup>

E 179 Guide for Selection of Geometric Conditions for Measurement of Reflection and Transmission Properties of Materials<sup>2</sup>

E 284 Terminology of Appearance<sup>2</sup>

E 308 Practice for Computing the Colors of Objects by Using the CIE System<sup>2</sup>

E 805 Practice for Identification of Instrumental Methods of Color or Color-Difference Measurement of Materials<sup>2</sup>

E 991 Practice for Color Measurement of Fluorescent Specimens<sup>2</sup>

E 1164 Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation<sup>2</sup>

### 3. Terminology

#### 3.1 Definitions:

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee E12 on Appearance and is the direct responsibility of Subcommittee E12.02 on Spectrophotometry and Colorimetry.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 06.01.

3.1.1 The definitions in Guide E 179, Terminology E 284, and Practice E 1164 are applicable to this test method.

### 4. Summary of Test Method

4.1 This test method provides a procedure for measuring the reflectance factors of reflecting object-color specimens by using a spectrophotometer or spectrophotometer equipped with a hemispherical optical measuring system such as an integrating sphere.

4.2 This test method includes procedures for calibrating the instrument and for selecting specimens suitable for precision measurement.

4.3 Most modern spectrophotometers have the capacity to compute the color coordinates of the specimen immediately following the measurement. When this is the case, the user must select the color system, observer, and illuminant (Practice E 308, Section 6).

### 5. Significance and Use

5.1 The most direct and accessible methods for obtaining the color coordinates of object colors are by instrumental measurement using spectrophotometers or colorimeters with either hemispherical or bidirectional optical measuring systems. This test method provides procedures for such measurement by reflectance spectrophotometry using a hemispherical optical measuring system.

5.2 This test method is especially suitable for measurement of the following types of specimens for the indicated uses (Guide E 179 and Practice E 805):

5.2.1 All types of object-color specimens to obtain data for use in computer colorant formulation.

5.2.2 Object-color specimens for color assessment.

5.2.2.1 For the measurement of plane-surface high-gloss specimens, the specular component should generally be excluded during the measurement.

5.2.2.2 For the measurement of plane-surface intermediate-gloss specimens and of textured-surface specimens, including textiles, where the first-surface reflection component may be distributed over a wide range of angles, measurement may be made with the specular component included, but the resulting color coordinates may not correlate best with visual judgments of the color. The use of bidirectional geometry, such as 45/0 or 0/45, may lead to better correlations.