



## Standard Test Method for Total Luminous Reflectance Factor by Use of 30/t Integrating-Sphere Geometry<sup>1</sup>

This standard is issued under the fixed designation E 1651; 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.

### INTRODUCTION

This test method has a long but undocumented history. The electric lighting industry for many years used a visual reflectometer with 30° unidirectional illumination and a sphere to collect all the reflected light so as to obtain a measure of total luminous reflectance factor, specular plus diffuse, for 30/t geometry. The original visual design was later equipped with a photovoltaic cell and microammeter. The lighting industry has preferred to maintain this geometry rather than to use a standard CIE geometry, such as 6/t. In 1975, the original 30/t geometry was incorporated in an instrument of modern design. This test method documents the calibration and measurement procedures for such an instrument.

### 1. Scope

1.1 This test method covers measurement of total luminous reflectance factor of opaque, nonfluorescent specimens by use of an integrating-sphere reflectometer with illumination at an angle of 30° from the surface normal and diffuse viewing with specular component included.

1.2 This test method is intended to be used for evaluation of total luminous reflectance factor of reflector lighting sheet material. It may be used for evaluation of other material when its specific geometry has been found to be applicable.

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:

E 177 Practice for Use of the Terms Precision and Bias in ASTM Standards<sup>2</sup>

E 179 Guide for Selection of Geometric Conditions for Measurement of Reflection and Transmission Properties of Materials<sup>3</sup>

E 259 Practice for Preparation of Pressed Powder White Reflectance Factor Transfer Standards for Hemispherical and Bi-Directional Geometries<sup>3</sup>

E 284 Terminology of Appearance<sup>3</sup>

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method<sup>2</sup>

E 1345 Practice for Reducing the Effect of Variability of Color Measurement by Use of Multiple Measurements<sup>3</sup>

E 1347 Test Method for Color and Color-Difference Measurements by Tristimulus (Filter) Colorimetry<sup>3</sup>

### 3. Terminology

3.1 Definitions in Guide E 179 and Terminology E 284 are applicable to this test method.

### 4. Summary of Test Method

4.1 This test method requires the use of a reflectometer equipped with an integrating sphere with an angle of illumination of 30° to the surface normal and diffuse viewing with the specular component included. In other respects, the details of the instrument geometry are as specified in Guide E 179. The use of the 30° angle of illumination allows complete collection of flux reflected at angles near the specular angle.

4.2 This test method utilizes only the Y tristimulus function, leading to the measurement of luminous reflectance. In other respects, the spectral characteristics and methodology used are similar to those described in Test Method E 1347. It should be noted that, when and if suitable equipment is available,

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<sup>2</sup> Annual Book of ASTM Standards, Vol 14.02.

<sup>3</sup> Annual Book of ASTM Standards, Vol 06.01.