Designation: C1650 – 14 (Reapproved 2021)

Standard Practice for Instrumental Reflectance Measurement of Color for Flat Glass, Coated, and Uncoated[1]

This standard is issued under the fixed designation C1650; 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 practice provides guidelines for the instrumental reflectance measurement of the color of flat, coated and uncoated glass. (See Terminology E284.)

1.2 The practice specifically excludes fluorescent and iridescent samples.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

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

E179 Guide for Selection of Geometric Conditions for Measurement of Reflection and Transmission Properties of Materials

E284 Terminology of Appearance

E308 Practice for Computing the Colors of Objects by Using the CIE System

E1164 Practice for Obtaining Spectrometric Data for Object-Color Evaluation

E1331 Test Method for Reflectance Factor and Color by Spectrophotometry Using Hemispherical Geometry

2.2 *CIE Standard:*[3]

CIE 15:2004 Colorimetry, Third Edition

3. Summary of Practice

3.1 The reflected color of glass products, (see Guide E179) is measured in reflectance specular included mode on a CIE-conforming diffuse geometry instrument. (See Test Method E1331 and CIE 15:2004.) The glass color is expressed in CIE tristimulus values based on spectral transmittance measurements over the full CIE spectral range of 350 to 780 nm with a maximum 10 nm band pass. (See CIE 15:2004 and Practice E308.) For color measurement, use of a truncated spectral range of 400 to 700 nm is acceptable. (See CIE 15:2004.) Further information on the UV absorbing characteristics of the glass or glass coating, or both, may be determined by examining the spectral data in the 350 to 400 nm range. If the instrument allows spectral measurement above 700 nm, useful information on the IR reflectance characteristics of the glass coating may also be determined. If coatings are present, they can be opaque or partially reflective.

4. Significance and Use

4.1 Color measurement quantifies the coating color for glass and is often related to coating thickness and composition as well as tinting used in the substrate glass. The user of this document defines an acceptable range of color appropriate for the end use. Typical quality concerns for the reflected color measurement of coated glass products are an indication of consistency in the coating process and verification of lot-to-lot color consistency for end-user acceptance.

4.2 If the reflected color of a glass product is consistent from lot-to-lot and within agreed supplier-buyer acceptance criteria, that product color is expected to be consistent and acceptable for end-use.

[1] This practice is under the jurisdiction of ASTM Committee C14 on Glass and Glass Products and is the direct responsibility of Subcommittee C14.11 on Optical Properties.

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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] Available from U.S. National Committee of the CIE (International Commission on Illumination), C/o Alan Laird Lewis, 282 E. Riding, Carlisle, MA 01741, http://www.cie-usnc.org.