



Standard Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates¹

This standard is issued under the fixed designation E 313; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This practice provides numbers that correlate with visual ratings of yellowness or whiteness of white and near-white or colorless object-color specimens, viewed in daylight by an observer with normal color vision. White textiles, paints, and plastics are a few of the materials that can be described by the indices of yellowness or whiteness calculated by this practice.

1.2 For a complete analysis of object colors, by a specified observer and under a specified illuminant, use of three parameters is required. For near-white specimens, however, it is often useful to calculate single-number scales of yellowness or whiteness. This practice provides recommended equations for such scales and discusses their derivations and uses, and limits to their applicability (see also Ref (1)²).

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 1535 Practice for Specifying Color by the Munsell System³
- D 1729 Practice for Visual Examination of Color Differences of Opaque Materials³
- D 1925 Test Method for Yellowness Index of Plastics⁴
- E 284 Terminology of Appearance³
- E 308 Practice for Computing the Colors of Objects by Using the CIE System³
- E 805 Practice for Identification of Instrumental Methods of Color or Color-Difference Measurement of Materials³

¹ This practice is under the jurisdiction of ASTM Committee E-12 on Appearance and is the direct responsibility of Subcommittee E12.04 on Color and Appearance Analysis.

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² The boldface numbers in parentheses refer to the list of references at the end of this practice.

³ Annual Book of ASTM Standards, Vol 06.01.

⁴ Discontinued; see 1994 Annual Book of ASTM Standards, Vol 08.01.

- E 991 Practice for Color Measurement of Fluorescent Specimens³
- E 1164 Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation³
- E 1247 Test Method for Identifying Fluorescence in Object-Color Specimens by Spectrophotometry³
- E 1331 Test Method for Reflectance Factor and Color by Spectrophotometry Using Hemispherical Geometry³
- E 1345 Practice for Reducing the Effect of Variability of Color Measurement by Use of Multiple Measurements³
- E 1347 Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry³
- E 1348 Test Method for Transmittance and Color by Spectrophotometry Using Hemispherical Geometry³
- E 1349 Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional Geometry³
- E 1360 Practice for Specifying Color by Using the Optical Society of America Uniform Color Scales System³
- E 1499 Guide to the Selection, Evaluation, and Training of Observers³
- E 1541 Practice for Specifying and Matching Color Using the Colorcurve System³

3. Terminology

3.1 Terms and definitions in Terminology E 284 are applicable to this practice.

3.2 Definitions:

3.2.1 *perfect reflecting diffuser, n*—ideal reflecting surface that neither absorbs nor transmits light, but reflects diffusely, with the radiance of the reflecting surface being the same for all reflecting angles, regardless of the angular distribution of the incident light.

3.2.2 *whiteness, n*—the attribute of color perception by which an object color is judged to approach the preferred white.

3.2.3 *whiteness index, WI, n*—a number, computed by a given procedure from colorimetric data, that indicates the degree of departure of an object color from that of a preferred white.

3.2.4 *yellowness, n*—the attribute of color perception by which an object color is judged to depart from colorless or a preferred white toward yellow.