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.

Designation: D2244 – 21

Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates[1]

This standard is issued under the fixed designation D2244; 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 U.S. Department of Defense.

INTRODUCTION

This practice originally resulted from the consolidation of a number of separately published methods for the instrumental evaluation of color differences. As revised in 1979, it included four color spaces in which color-scale values could be measured by instruments, many of which were obsolete, and the color differences calculated by ten equations for different color scales. The sections on apparatus, calibration standards and methods, and measurement procedures served little purpose in the light of modern color-measurement technology. The revision published in 1993 omitted these sections, and limited the color spaces and color-difference equations considered, to the three most widely used in the paint and related coatings industry. A previous revision added two new color tolerance equations and put one of the color difference equations from the 1993 version in an informative appendix for historical purposes.

1. Scope

1.1 This practice covers the calculation, from instrumentally measured color coordinates based on daylight illumination, of color tolerances and small color differences between opaque specimens such as painted panels, plastic plaques, or textile swatches. Where it is suspected that the specimens may be metameric, that is, possess different spectral curves though visually alike in color, Practice D4086 should be used to verify instrumental results. The tolerances and differences determined by these procedures are expressed in terms of approximately uniform visual color perception in CIE 1976 CIELAB opponent-color space (**1**)[2], CMC tolerance units (**2**), CIE94 tolerance units (**3**), the DIN99 color difference formula given in DIN 6176 (**4**), or the CIEDE2000 color difference units (**5**).

1.2 For product specification, the purchaser and the seller shall agree upon the permissible color tolerance between test specimen and reference and the procedure for calculating the color tolerance. Each material and condition of use may require specific color tolerances because other appearance factors, (for example, specimen proximity, gloss, and texture), may affect the correlation between the magnitude of a measured color difference and its commercial acceptability.

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

1.4 *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:*[3]

D1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials

D4086 Practice for Visual Evaluation of Metamerism

E284 Terminology of Appearance

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

E805 Practice for Identification of Instrumental Methods of

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

Current edition approved June 1, 2021. Published June 2021. Originally approved in 1964. Last previous edition approved in 2016 as D2244 – 16. DOI: 10.1520/D2244-21.

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

[3] 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.

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