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# Colorimetry —

## Part 6: CIEDE2000 Colour-difference formula

*Colorimétrie —*

*Partie 6: Formule d'écart de couleur CIEDE2000*



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ISO/CIE 11664-6 was prepared by CIE Technical Committee TC 1-57 of Division 1 *Vision and colour*. as CIE S 014-6.

ISO/CIE 11664 consists of the following parts, under the general title *Colorimetry*:

— *Part 1: CIE standard colorimetric observers*

— *Part 2: CIE standard illuminants*

— *Part 3: CIE tristimulus values*

— *Part 4: CIE 1976 L*a*b* Colour space*

— *Part 5: CIE 1976 L*u*v* Colour space and u', v' uniform chromaticity scale diagram*

— *Part 6: CIEDE2000 Colour-difference formula*

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**International Standard**

# Colorimetry – Part 6: CIEDE2000 Colour-Difference Formula

Colorimétrie – Partie 6: Formule d'écart de couleur CIEDE2000

Farbmessung – Teil 6: CIEDE2000-Farbabstandsformel





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## Foreword

International Standards produced by the Commission Internationale de l'Eclairage are concise documents on aspects of light and lighting that require a unique definition. They are a primary source of internationally accepted and agreed data which can be taken, essentially unaltered, into universal standard systems.

This CIE International Standard has been prepared by CIE Technical Committee TC 1-57*. It has been approved by the Board of Administration and Division 1 "Vision and Colour" of the Commission Internationale de l'Eclairage and the CIE National Committees.

The following ISO and IEC committees and working groups co-operated in the preparation of this International Standard:

IEC TC100/TA2 (Audio, video and multimedia systems)

ISO TC6 (Paper, board and pulps)

ISO TC35/SC9/WG22 (Paints and varnishes)

ISO TC38/SC1/WG7 (Textiles)

ISO TC42 (Photography)

ISO TC130 (Graphic technology)

ISO/IEC/JTC1/SC28 (Office systems)



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# Colorimetry – Part 6: CIEDE2000 Colour-Difference Formula

## Introduction

The three-dimensional colour space produced by plotting CIE tristimulus values ($X$, $Y$, $Z$) in rectangular coordinates is not visually uniform, nor is the ($x$, $y$, $Y$) space nor the two-dimensional CIE ($x$, $y$) chromaticity diagram. Equal distances in these spaces and diagrams do not represent equally perceptible differences between colour stimuli. For this reason the CIE has standardized two more-nearly uniform colour spaces (known as CIELAB and CIELUV) whose coordinates are non-linear functions of $X$, $Y$ and $Z$. Numerical values representing approximately the relative magnitude of colour differences can be described by simple Euclidean distances in these spaces or by more sophisticated colour-difference formulae that improve the correlation with the relative perceived size of differences. The purpose of this CIE International Standard is to define one such formula, the CIEDE2000 formula. The Standard is based on CIE Technical Report 142-2001.

The formula is an extension of the CIE 1976 $L^*a^*b^*$ colour-difference formula (ISO 11664-4:2008(E)/CIE S 014-4/E:2007) with corrections for variation in colour-difference perception dependent on lightness, chroma, hue and chroma-hue interaction. Reference conditions define material and viewing environment characteristics to which the formula applies.

## 1 Scope



This CIE International Standard specifies the method of calculating colour differences according to the CIEDE2000 formula.

The Standard is applicable to input values of CIELAB $L^*$, $a^*$, $b^*$ coordinates calculated according to ISO 11664-4:2008(E)/CIE S 014-4/E:2007. The Standard may be used for the specification of the colour difference between two colour stimuli perceived as belonging to reflecting or transmitting objects. This includes displays, if they are being used to simulate reflecting or transmitting objects and if the tristimulus values representing the stimuli are appropriately normalized. The Standard does not apply to colour stimuli perceived as belonging to areas that appear to be emitting light as primary light sources, or that appear to be specularly reflecting such light.

## 2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CIE 142-2001. *Improvement to industrial colour-difference evaluation*, 2001.

CIE S 017/E:2011. *ILV: International Lighting Vocabulary*, 2011.

ISO 11664-4:2008(E)/CIE S 014-4/ E:2007. Joint ISO/CIE Standard: *Colorimetry – Part 4: 1976 L*a*b* Colour Space*, 2008.

## 3 Definitions, Symbols and Abbreviations

For the purposes of this International Standard, the terms and definitions given in CIE S 017/E:2011 (International Lighting Vocabulary), and the following symbols and abbreviations apply.