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SS-EN ISO/CIE 11664-1:2019

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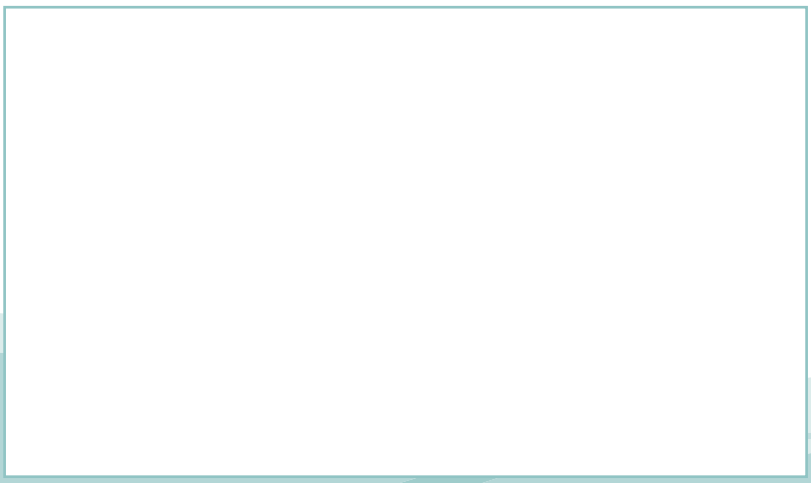
Kolorimetri –
Del 1: CIE standard kolometriska observatörer
(ISO/CIE 11664-1:2019)

Colorimetry –
Part 1: CIE standard colorimetric observers
(ISO/CIE 11664-1:2019)



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Europastandarden EN ISO/CIE 11664-1:2019 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN ISO/CIE 11664-1:2019.

Denna standard ersätter SS-EN ISO 11664-1:2011, utgåva 1.

The European Standard EN ISO/CIE 11664-1:2019 has the status of a Swedish Standard. This document contains the official version of EN ISO/CIE 11664-1:2019.

This standard supersedes the SS-EN ISO 11664-1:2011, edition 1.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS, who can also provide general information about Swedish and foreign standards.

Denna standard är framtagen av kommittén för Ljus och belysning, SIS/TK 380/AG 03.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på www.sis.se - där hittar du mer information.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO/CIE 11664-1

July 2019

ICS 17.180.20

Supersedes EN ISO 11664-1:2011

English Version

Colorimetry - Part 1: CIE standard colorimetric observers (ISO/CIE 11664-1:2019)

Colorimétrie - Partie 1: Observateurs CIE de référence pour la colorimétrie (ISO/CIE 11664-1:2019)

Farbmetrik - Teil 1: CIE farbmetrische Normalbeobachter (ISO/CIE 11664-1:2019)

This European Standard was approved by CEN on 24 May 2019.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN ISO/CIE 11664-1:2019) has been prepared by Technical Committee CEI "International Commission on Illumination" in collaboration with Technical Committee CEN/TC 139 “Paints and varnishes” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2020, and conflicting national standards shall be withdrawn at the latest by January 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 11664-1:2011.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO/CIE 11664-1:2019 has been approved by CEN as EN ISO/CIE 11664-1:2019 without any modification.

Introduction

Colours with different spectral compositions can look alike. An important function of colorimetry is to determine whether a pair of such metameric colour stimuli will look alike. The use of visual colorimeters for this purpose is handicapped by variations in the colour matches made among observers classified as having normal colour vision. Visual colorimetry also tends to be time-consuming. For these reasons, it has long been the practice in colorimetry to make use of sets of colour-matching functions to calculate tristimulus values for colours: equality of tristimulus values for a pair of colours indicates that the colour appearances of the two colours match, when they are viewed in the same conditions by an observer for whom the colour-matching functions apply. The use of standard sets of colour-matching functions makes the comparison of tristimulus values obtained at different times and locations possible.

Colorimetry —

Part 1:
CIE standard colorimetric observers

1 Scope

This document specifies colour-matching functions for use in colorimetry. Two sets of colour-matching functions are specified.

a) Colour-matching functions for the CIE 1931 standard colorimetric observer.

   This set of colour-matching functions is representative of the colour-matching properties of observers with normal colour vision for visual field sizes of angular subtense from about 1° to about 4°, for vision at photopic levels of adaptation.

b) Colour-matching functions for the CIE 1964 standard colorimetric observer.

   This set of colour-matching functions is representative of the colour-matching properties of observers with normal colour vision for visual field sizes of angular subtense greater than about 4°, for vision at sufficiently high photopic levels and with spectral power distributions such that no participation of the rod receptors of the retina is to be expected.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 S 017:—,[1)] *ILV: International Lighting Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in CIE S 017 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
colour stimulus function
$\varphi_\lambda(\lambda)$
function describing the spectral distribution of the colour stimulus

Note 1 to entry: The colour stimulus function is generated by the spectral distribution of a radiometric quantity, such as radiance or radiant flux.

Note 2 to entry: For object colours the colour stimulus function, $\varphi_\lambda(\lambda)$, is equal to the product of the relative spectral distribution, $S(\lambda)$, and either the spectral reflectance, $\rho(\lambda)$, or the spectral radiance factor, $\beta(\lambda)$, or the spectral transmittance, $\tau(\lambda)$, depending on the application.

1) Under preparation. Stage at the time of publication: CIE DIS 017:2016.

[SOURCE: CIE S 017:—, entry 17-23-003, modified — The definition has been completely revised and the notes to entry have been added.]

3.2
metameric colour stimuli, pl
metamers, pl
spectrally different colour stimuli that have the same tristimulus values in a specified colorimetric system

Note 1 to entry: The corresponding property is called “metamerism”.

[SOURCE: CIE S 017:—, entry 17-23-008]

3.3
monochromatic stimulus
spectral stimulus
stimulus consisting of monochromatic radiation

[SOURCE: CIE S 017:—, entry 17-23-011]

3.4
equi-energy spectrum
equal energy spectrum
spectrum of radiation whose spectral distribution of a radiometric quantity as a function of wavelength is constant throughout the visible region

Note 1 to entry: The radiation of the equi-energy spectrum is sometimes regarded as an illuminant, in which case it is denoted by the symbol E.

[SOURCE: CIE S 017:—, entry 17-23-023, modified — “($\varphi_\lambda(\lambda)$ = constant)” at the end of the definition omitted.]

3.5
additive mixture
<colour stimuli> stimulation that combines on the retina the actions of various colour stimuli in such a manner that they cannot be perceived individually

[SOURCE: CIE S 017:—, entry 17-23-030]

3.6
colour matching
action of making a colour stimulus appear the same in colour as a given colour stimulus

[SOURCE: CIE S 017:—, entry 17-23-031]

3.7
trichromatic system
system for specifying colour stimuli in terms of tristimulus values, based on matching colours by additive mixture of three suitably chosen reference colour stimuli

[SOURCE: CIE S 017:—, entry 17-23-036]

3.8
reference colour stimuli, pl
three colour stimuli on which a trichromatic system is based

Note 1 to entry: These stimuli are either real colour stimuli or theoretical stimuli which are defined by linear combinations of real colour stimuli.

Note 2 to entry: In the CIE standard colorimetric systems, the reference colour stimuli are represented by the symbols [R], [G], [B]; [X], [Y], [Z]; [R_{10}], [G_{10}], [B_{10}] or [X_{10}], [Y_{10}], [Z_{10}].

[SOURCE: CIE S 017:—, entry 17-23-037, modified — “set of three" has been changed to “three" and the "and" has been changed to "or" in Note 2 to entry.]

3.9
tristimulus values, pl
<of a colour stimulus> amounts of the reference colour stimuli, in a given trichromatic system, required to match the colour of the stimulus considered

Note 1 to entry: In the CIE standard colorimetric systems, the tristimulus values are represented, for example, by the symbols R, G, B; X, Y, Z; R_{10}, G_{10}, B_{10} or X_{10}, Y_{10}, Z_{10}.

[SOURCE: CIE S 017:—, entry 17-23-038, modified — “amount of the three reference" has been changed to "amounts of the reference".]

3.10
colour-matching functions, pl
<of a trichromatic system> tristimulus values of monochromatic stimuli of equal radiant flux

[SOURCE: CIE S 017:—, entry 17-23-039, modified — Notes to entry omitted.]

3.11
CIE 1931 standard colorimetric system
X, *Y*, *Z*
system for determining the tristimulus values of any spectral power distribution using the set of reference colour stimuli [X], [Y], [Z], and the three CIE colour-matching functions $\bar{x}(\lambda), \bar{y}(\lambda), \bar{z}(\lambda)$ adopted by the CIE in 1931

Note 1 to entry: $\bar{y}(\lambda)$ is identical to $V(\lambda)$ and hence the tristimulus values Y are proportional to values of luminance.

Note 2 to entry: The CIE 1931 standard colorimetric system is applicable to centrally viewed fields of angular subtense between about 1° and about 4° (0,017 rad and 0,07 rad).

Note 3 to entry: The CIE 1931 standard colorimetric system can be derived from the CIE 1931 RGB colorimetric system using a transformation based on a set of three linear equations. The CIE 1931 RGB system is based on three real monochromatic reference stimuli.

Note 4 to entry: See also CIE 15, *Colorimetry*.

[SOURCE: CIE S 017:—, entry 17-23-045]

3.12
CIE 1964 standard colorimetric system
X_{10}, Y_{10}, Z_{10}
system for determining the tristimulus values of any spectral power distribution using the set of reference colour stimuli [X_{10}], [Y_{10}], [Z_{10}], and the three CIE colour-matching functions $\bar{x}_{10}(\lambda), \bar{y}_{10}(\lambda), \bar{z}_{10}(\lambda)$ adopted by the CIE in 1964

Note 1 to entry: The CIE 1964 standard colorimetric system is applicable to centrally viewed fields of angular subtense greater than about 4° (0,07 rad).

Note 2 to entry: When the CIE 1964 standard colorimetric system is used, all symbols that represent colorimetric measures are distinguished by use of the subscript 10.

Note 3 to entry: See also CIE 15, *Colorimetry*.

[SOURCE: CIE S 017:—, entry 17-23-046]