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Svetloba in razsvetljava - Osnovni izrazi in merila za specifikacijo zahtev za razsvetljavo

Light and lighting - Basic terms and criteria for specifying lighting requirements

Licht und Beleuchtung - Grundlegende Begriffe und Kriterien für die Festlegung von Anforderungen an die Beleuchtung

Lumière et éclairage - Termes de base et critères pour la spécification des exigences en éclairage

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Light and lighting - Basic terms and criteria for specifying lighting requirements

Lumière et éclairage - Termes de base et critères pour la spécification des exigences en éclairage

Licht und Beleuchtung - Grundlegende Begriffe und Kriterien für die Festlegung von Anforderungen an die Beleuchtung

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Foreword

This document (EN 12665:2011) has been prepared by Technical Committee CEN/TC 169 “Light and lighting”, 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of an identical text or by endorsement, at the latest by December 2011, and conflicting national standards shall be withdrawn at the latest by December 2011.

This document has been prepared under a mandate given to CEN/CENELEC/ETSI by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

This document supersedes EN 12665:2002.

The main technical changes in this revision are:

— inclusion of terms previously absent collated from EN 1837, EN 1838, EN 12193, EN 12464-1, EN 12464-2, EN 13032-1, EN 13032-2 and EN 15193.

The significant change between EN 12665:2002 and EN 12665:2011 is within the scope of the document. EN 12665:2002 defined basic terms for use in lighting applications, and specialist terms with limited applications were defined in individual standards. In practice this resulted in cases of similar terminology being used to define different concepts, and conversely different terms being used to describe similar concepts. Therefore EN 12665:2011 defines basic terms and definitions for use in all lighting applications. Furthermore some references have been updated.

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Introduction

This European Standard specifies a basic framework to be used for the specification of lighting requirements.

Where a term is contained in CIE Publication 17.4:1987 International Lighting Vocabulary (IEC 60050, International Electrotechnical Vocabulary, Chapter 845 Lighting), the term given in this standard is identical. For some terms additional explanation is given in informative Annex A. An index of terms is given in informative Annex B.

The lighting requirements for a space are determined by the need to provide:

— adequate illumination for safety and movement;

— conditions which will facilitate visual performance and colour perception;

— acceptable visual comfort for the occupants in the space.

The relative importance of these factors will vary for different applications. The lighting requirements for visual comfort and satisfaction of the occupants, will often exceed the requirements for visual performance alone. For example, the visual task may simply require the discrimination of black symbols on a white background; the colour rendering of the lighting is irrelevant to this task but it is important in making the appearance of the room and occupants acceptable. Variations of the lighting in space and time may also be important for visual satisfaction and can help to meet the interpersonal differences found within groups of people.

Considerations should also be given to the energy used by lighting and to maintenance.

The parameters which need to be specified to ensure good visual conditions and an efficient lighting installation are common to many applications. These are dealt with in Clause 4.

1 Scope

This European Standard defines basic terms and definitions for use in all lighting applications. This European Standard also sets out a framework for the specification of lighting requirements, giving details of aspects which have to be considered when setting those requirements.

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 17.4:1987, *International lighting vocabulary — Chapter 845: Lighting*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Eye and vision

3.1.1
adaptation
process by which the state of the visual system is modified by previous and present exposure to stimuli that can have various luminances, spectral distributions and angular subtenses

NOTE 1 The terms light adaptation and dark adaptation are also used, the former when the luminances of the stimuli are of at least several candelas per square metre, and the latter when the luminances are of less than some hundredths of a candela per square metre.

NOTE 2 Adaptation to specific spatial frequencies, orientations, sizes, etc. are recognized as being included in this definition.

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-07]

3.1.2
accommodation
adjustment of the dioptric power of the crystalline lens by which the image of an object, at a given distance, is focused on the retina

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-44]

3.1.3
visual acuity
1. qualitatively: capacity for seeing distinctly fine details that have very small angular separation

2. quantitatively: any of a number of measures of spatial discrimination such as the reciprocal of the value of the angular separation in minutes of arc of two neighbouring objects (points or lines or other specified stimuli) which the observer can just perceive to be separate

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-43]

3.1.4
brightness
luminosity (obsolete)
attribute of a visual sensation according to which an area appears to emit more or less light

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-28]

3.1.5
contrast
1. in the perceptual sense: assessment of the difference in appearance of two or more parts of a field seen simultaneously or successively (hence: brightness contrast, lightness contrast, colour contrast, simultaneous contrast, successive contrast, etc.)

2. in the physical sense: quantity intended to correlate with the perceived brightness contrast, usually defined by one of a number of formulae which involve the luminances of the stimuli considered, for example: $\Delta L/L$ near the luminance threshold, or $L1/L2$ for much higher luminances

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-47]

3.1.6
brightness contrast
subjective assessment of the difference in brightness between two or more surfaces seen simultaneously or successively

3.1.7
colour contrast
subjective assessment of the difference in colour between two or more surfaces seen simultaneously or successively

3.1.8
glare
condition of vision in which there is discomfort or a reduction in the ability to see details or objects, caused by an unsuitable distribution or range of luminance, or to extreme contrasts

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-52]

3.1.9
flicker
impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-49]

3.1.10
visual field
area or extent of physical space visible to an eye at a given position and direction of view

NOTE It should be stated whether the visual field is monocular or binocular.

3.1.11
visual performance
performance of the visual system as measured for instance by the speed and accuracy with which a visual task is performed

[IEC 60050-845:1987/CIE 17.4:1987; 845-09-04]

3.1.12
visual comfort
subjective condition of visual well-being induced by the visual environment

3.1.13
reaction time
minimum time interval between the occurrence of an event demanding immediate action and the response to the event (unit: s)

NOTE The reaction time includes the time needed for perception, taking a decision and acting.

3.1.14
visual task
visual elements of the activity being undertaken

NOTE The main visual elements are the size of the structure, its luminance, its contrast against the background and its duration.

3.2 Light and colour

3.2.1
luminous flux
Φ
quantity derived from radiant flux Φ_e by evaluting the radiation according to its action upon the CIE standard photometric observer (unit: lm)

NOTE 1 For photopic vision

$$\phi = K_m \int_0^\infty \left(\frac{d\phi_e(\lambda)}{d\lambda} \right) \times V(\lambda) d\lambda$$

where

Φ is the luminous flux;

$\frac{d\phi_e(\lambda)}{d\lambda}$ is the spectral distribution of the radiant flux;

$V(\lambda)$ is the spectral luminous efficiency function.

NOTE 2 For the values of K_m (photopic vision) and K'_m (scotopic vision), see IEC 60050-845:1987/CIE 17.4:1987; 845-01-56.

[IEC 60050-845:1987/CIE 17.4:1987; 845-01-25]

3.2.2
luminous intensity (of a source, in a given direction)
I
quotient of the luminous flux $d\Phi$ leaving the source and propagated in the element of solid angle $d\Omega$ containing the given direction, by the element of solid angle (unit: cd = lm · sr $^{-1}$)

$$I = \frac{d\phi}{d\Omega}$$

where

I is the luminous intensity of a source in a given direction;

$d\Phi$ is the luminous flux leaving the source;

$d\Omega$ is the solid angle.

[IEC 60050-845:1987/CIE 17.4:1987; 845-01-31]

3.2.3
luminance (in a given direction, at a given point of a real or imaginary surface)
L
quantity defined by the equation (unit: cd · m^{-2} = lm · m^{-2} · sr^{-1})

$$L = \frac{\mathrm{d}\Phi}{\mathrm{d}A \cos\vartheta \mathrm{d}\Omega}$$

where

L is the luminance in a given direction or at a given point of a surface;

$\mathrm{d}\phi$ is the luminous flux transmitted by an elementary beam passing through the given point and propagating in the solid angle $\mathrm{d}\Omega$ containing the given direction;

$\mathrm{d}A$ is the area of a section of that beam containing the given point;

$\mathrm{d}\Omega$ is the solid angle;

ϑ is the angle between the normal to that section and the direction of the beam.

NOTE See notes 1 to 5 to IEC 60050-845:1987/CIE 17.4:1987; 845-01-34.

[IEC 60050-845:1987/CIE 17.4:1987; 845-01-35]

3.2.4
average luminance
$\overline{L}$

luminance averaged over the specified surface or solid angle (unit: cd · m^{-2})

3.2.5
minimum luminance
L_{min}
lowest luminance of any relevant point on the specified surface (unit: cd · m^{-2})

NOTE The relevant points at which the luminances are determined should be specified in the appropriate application standard.

3.2.6
maximum luminance
L_{max}
highest luminance of any relevant point on the specified surface (unit: cd · m^{-2})

NOTE The relevant points at which the luminances are determined should be specified in the appropriate application standard.

3.2.7
maintained luminance
$\overline{L}_{m}$
minimum average luminance (unit: cd · m^{-2})

NOTE 1 Value below which average luminance should not fall.

NOTE 2 It is the average luminance at the time maintenance should be carried out.

3.2.8
initial average luminance
$\overline{L}_i$
average luminance when the installation is new (unit: cd · m^{-2})

3.2.9
luminance contrast
photometric quantity intended to correlate with brightness contrast, usually defined by one of a number of equations which involve the luminances of the stimuli considered

(see also 3.1.5 [IEC 60050-845:1987/CIE 17.4:1987; 845-02-47])

NOTE Luminance contrast can be defined as luminance ratio

$C_1 = L_2/L_1$ (usually for successive stimuli),

or by the following equation

$C_2 = (L_2 - L_1) / L_1$ (usually for surfaces viewed simultaneously),

when the areas of different luminance are comparable in size and it is desired to take an average, the following equation can be used instead

$C_3 = (L_2 - L_1) / 0{,}5(L_2 + L_1)$

where

L_1 is the luminance of the background, or largest part of the visual field; and L_2 is the luminance of the object;

L_2 is the luminance of the object.

3.2.10
illuminance (at a point of a surface)
E
quotient of the luminous flux $\mathrm{d}\Phi$ incident on an element of the surface containing the point, by the area $\mathrm{d}A$ of that element (unit: lx = lm · m^{-2})

NOTE Equivalent definition: Integral, taken over the hemisphere visible from the given point, of the expression $L \cdot \cos\ \theta \cdot \mathrm{d}\Omega$, where L is the luminance at the given point in the various directions of the incident elementary beams of solid angle $\mathrm{d}\Omega$, and θ is the angle between any of these beams and the normal to the surface at the given point.

$$E = \frac{\mathrm{d}\Phi}{\mathrm{d}A} = \int_{2\pi sr} L \cos\theta \mathrm{d}\Omega$$

where

E is the illuminance at a point of a surface;

L is the luminance at the given point in the various directions of the incident elementary beams of solid angle $\mathrm{d}\Omega$;

Θ is the angle between an incident beam and the normal to the surface at the given point;

$\mathrm{d}\Omega$ is the solid angle.

[IEC 60050-845:1987/CIE 17.4:1987; 845-01-38]

3.2.11
average illuminance
$\overline{E}$
illuminance averaged over the specified surface (unit: lx)

NOTE In practice this can be derived either from the total luminous flux falling on the surface divided by the total area of the surface, or alternatively from an average of the illuminances at a representative number of points on the surface.

3.2.12
minimum illuminance
E_{min}
lowest illuminance at any relevant point on the specified surface (unit: lx)

3.2.13
maximum illuminance
E_{max}
highest illuminance at any relevant point on the specified surface (unit: lx)

3.2.14
maintained illuminance
$\overline{E}_m$
minimum average illuminance (unit: lx)

NOTE 1 Value below which the average illuminance on the specified area should not fall.

NOTE 2 It is the average illuminance at the time maintenance should be carried out.

3.2.15
initial illuminance
$\overline{E}_i$
average illuminance on the specified surface when the installation is new (unit: lx)

3.2.16
spherical illuminance (at a point)
E_o
total luminous flux falling on the whole surface of a very small sphere located at the specified point divided by the surface area of the sphere (unit: lx)

(see also IEC 60050-845:1987/CIE 17.4:1987; 845-01-40 spherical irradiance)

3.2.17
hemispherical illuminance (at a point)
E_{hs}
total luminous flux falling on the curved surface of a very small hemisphere located at the specified point divided by the curved surface area of the hemisphere (unit: lx)

NOTE The base of the hemisphere is taken to be horizontal unless stated otherwise.

3.2.18
cylindrical illuminance (at a point, for a direction)
E_z
total luminous flux falling on the curved surface of a very small cylinder located at the specified point divided by the curved surface area of the cylinder (unit: lx)

NOTE The axis of the cylinder is taken to be vertical unless stated otherwise.

(see also IEC 60050-845:1987/CIE 17.4:1987; 845-01-41 cylindrical irradiance)

3.2.19
semi-cylindrical illuminance (at a point)
E_{sz}
total luminous flux falling on the curved surface of a very small semi-cylinder located at the specified point, divided by the curved surface area of the semi-cylinder (unit: lx)

NOTE The axis of the semi-cylinder is taken to be vertical unless stated otherwise. The direction of the curved surface should be specified.

3.2.20
uniformity (luminance, illuminance)
U_o
ratio of minimum illuminance (luminance) to average illuminance (luminance) on (of) a surface

(see also IEC 60050-845:1987/CIE 17.4; 845-09-58 uniformity ratio of illuminance)

NOTE Use is also made of the ratio of minimum illuminance to maximum illuminance in which case this should be specified explicitly.

3.2.21
reference surface
surface on which illuminance is measured or specified

[IEC 60050-845:1987/CIE 17.4:1987; 845-09-49]

3.2.22
disability glare
glare that impairs the vision of objects without necessarily causing discomfort

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-57]

3.2.23
discomfort glare
glare that causes discomfort without necessarily impairing the vision of objects

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-56]

3.2.24
veiling reflections
specular reflections that appear on the object viewed and that partially or wholly obscure the details by reducing contrast

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-55]

3.2.25
luminous environment
lighting considered in relation to its physiological and psychological effects

[IEC 60050-845:1987/CIE 17.4:1987; 845-09-03]

3.2.26
colour rendering
effect of an illuminant on the colour appearance of objects by conscious or subconscious comparison with their colour appearance under a reference illuminant

NOTE In German, the term “Farbwiedergabe” is also applied to colour reproduction.

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-59]

3.2.27
CIE 1974 general colour rendering index
R_a
mean of the CIE 1974 special colour rendering indices for a specified set of eight test colour samples

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-63]

3.2.28
colour stimulus
visible radiation entering the eye and producing a sensation of colour, either chromatic or achromatic

[IEC 60050-845:1987/CIE 17.4:1987; 845-03-02]

3.2.29
tristimulus values (of a colour stimulus)
amounts of the three reference colour stimuli, in a given trichromatic system, required to match the colour of the stimulus considered

NOTE In the CIE standard colorimetric systems, the tristimulus values are represented by the symbols X, Y, Z and X_{10}, Y_{10}, Z_{10}.

[IEC 60050-845:1987/CIE 17.4:1987; 845-03-22]

3.2.30
chromaticity coordinates
ratio of each of a set of three tristimulus values to their sum

NOTE 1 As the sum of the three chromaticity coordinates equals 1, two of them are sufficient to define a chromaticity.

NOTE 2 In the CIE standard colorimetric systems, the chromaticity coordinates are presented by the symbols x, y, z and x_{10}, y_{10}, z_{10}.

[IEC 60050-845:1987/CIE 17.4:1987; 845-03-33]

3.2.31
chromaticity
property of a colour stimulus defined by its chromaticity coordinates, or by its dominant or complementary wavelength and purity taken together

[IEC 60050-845:1987/CIE 17.4:1987; 845-03-34]

3.2.32
colour temperature
T_c
temperature of a Planckian radiator whose radiation has the same chromaticity as that of a given stimulus (unit: K)

NOTE The reciprocal colour temperature is also used, unit: K^{-1}.

[IEC 60050-845:1987/CIE 17.4:1987; 845-03-49]

3.2.33
correlated colour temperature
T_{cp}
temperature of the Planckian radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions (unit: K)

NOTE 1 The recommended method of calculating the correlated colour temperature of a stimulus is to determine on a chromaticity diagram the temperature corresponding to the point on the Planckian locus that is intersected by the agreed isotemperature line containing the point representing the stimulus (see CIE Publication No 15).

NOTE 2 Reciprocal correlated colour temperature is used rather than reciprocal colour temperature whenever correlated colour temperature is appropriate.

[IEC 60050-845:1987/CIE 17.4:1987; 845-03-50]

3.2.34
fusion frequency
critical flicker frequency (for a given set of conditions)
frequency of alternation of stimuli above which flicker is not perceptible (unit: Hz)

[IEC 60050-845:1987/CIE 17.4:1987; 845-02-50]

3.2.35
reflectance (for incident radiation of given spectral composition, polarization and geometrical distribution)
ρ
ratio of the reflected radiant or luminous flux to the incident flux in the given conditions (unit: 1)

[IEC 60050-845:1987/CIE 17.4:1987; 845-04-58]

3.2.36
transmittance (for incident radiation of given spectral composition, polarization and geometrical distribution)
τ
ratio of the transmitted radiant or luminous flux to the incident flux in the given conditions (unit: 1)

[IEC 60050-845:1987/CIE 17.4:1987; 845-04-59]

3.2.37
absorptance
α
ratio of the absorbed radiant or luminous flux to the incident flux under specified conditions (unit: 1)

[IEC 60050-845:1987/CIE 17.4:1987; 845-04-75]

3.2.38
photometry
measurement of quantities referring to radiation as evaluated according to a given spectral luminous efficiency function, e.g. $V(\lambda)$ or $V'(\lambda)$

[IEC 60050-845:1987/CIE 17.4:1987; 845-05-09]

3.2.39
access zone luminance
eye adaptation luminance in the access zone (unit: cd · m^{-2})

3.2.40
contrast revealing coefficient
q_c
quotient between the luminance (L) of the road surface, and the vertical illuminance (E_v) at that point (unit: cd · m^{-2} · lx^{-1})

$$q_c = \frac{L}{E_v}$$

where

q_c is the contrast revealing coefficient;

L is the luminance of the road surface at the point;

E_v is the vertical illuminance at the point