SLOVENSKI STANDARD

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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

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 169.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 12665:2022) has been prepared by Technical Committee CEN/TC 169 “Light and lighting”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12665:2018.

The main technical changes in this revision of EN 12665:2018 are through harmonisation with the revised CIE International Lighting Vocabulary, CIE S 017:2020.

Introduction

This document specifies a basic framework intended to be used for the specification of lighting requirements.

Where a term is contained in CIE Publication CIE S 017:2020 ILV, *International Lighting Vocabulary* or IEC 60050-845, *International Electrotechnical Vocabulary*, *Chapter 845*: *Lighting*, a reference is given to the equivalent term where the terms in both documents are, for all practical purposes, identical.

NOTE Definitions from CIE S 017:2020 and IEC 60050-845:2020 contain notes providing information on the numbering in previous versions of both documents. These notes were generally omitted as they are not necessary for application in European standards.

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 that 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. This basic framework covers aspects in the field of vision, photometry and colorimetry, involving natural and man-made optical radiation over the UV, the visible and the IR regions of the spectrum, and application subjects covering all usages of light, indoors and outdoors, including environmental, energy and sustainability requirements and aesthetics and non- image forming biological aspects.

Peculiar and specific terms can be defined in application standards.

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

The parameters that 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 of this document.

LED terms and definitions already existing within EN 62504 have not been included in this document.

For terms and definitions concerning daylight openings within a building envelope the following standards may also be consulted:

EN 12216, *Shutters, external blinds, internal blinds — Terminology, glossary and definitions*

EN 12519, *Windows and pedestrian doors — Terminology*

1 Scope

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

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

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

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

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 luminance values, spectral distributions and angular subtenses

Note 1 to entry: Adaptation to specific spatial frequencies, orientations, sizes, etc. are recognized as being included in this definition.

Note 2 to entry: 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.

[SOURCE: IEC 60050-845:2020 845-22-012 / CIE S 017:2020; 17-22-012, modified - Note 2 to entry added]

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

[SOURCE: IEC 60050-845:2020 845-22-086 / CIE S 017:2020; 17-22-086]

3.1.3
visual acuity
visual resolution
<qualitatively> capacity for seeing distinctly fine details that have very small angular separation

[SOURCE: IEC 60050-845:2020 845-22-077 / CIE S 017:2020; 17-22-077]

3.1.4
brightness
attribute of a visual perception according to which an area appears to emit, transmit or reflect, more or less light

Note 1 to entry: The use of this term is not restricted to primary light sources.

[SOURCE: IEC 60050-845:2020 845-22-059 / CIE S 017:2020; 17-22-059]

3.1.5
contrast
perceived contrast
<perceptual> assessment of the difference in appearance of two or more parts of a field seen simultaneously or successively

EXAMPLE 1 Brightness contrast, lightness contrast, colour contrast, simultaneous contrast, successive contrast.

EXAMPLE 2 By the proportional variation in contrast near the luminance threshold ($\Delta L/L$) or by the ratio of luminances for much higher luminances (L_1/L_2).

[SOURCE: IEC 60050-845:2020 845-22-089 / CIE S 017:2020; 17-22-089, modified - example 2 added]

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 by extreme luminance contrasts

Note 1 to entry: See also “disability glare”, “discomfort glare”.

[SOURCE: IEC 60050-845:2020 845-22-098 / CIE S 01/E 7:2020; 17-22-098]

3.1.9
flicker
perception of visual unsteadiness induced by a light stimulus the luminance or spectral distribution of which fluctuates with time, for a static observer in a static environment

Note 1 to entry: The fluctuations of the light stimulus with time include periodic and non-periodic fluctuations and can be induced by the light source itself, the power source or other influencing factors.

[SOURCE: IEC 60050-845:2020 845-22-092 / CIE S 017:2020; 17-22-092]

3.1.10
visual field
part of an external scene that is perceived when an observer gazes at some point in the scene

[SOURCE: IEC 60050-845:2020 845-22-080 / CIE S 017:2020; 17-22-080]

3.1.11
visual performance
quality of performance of the visual system of an observer related to central and peripheral vision

Note 1 to entry: Performance of the visual system may be measured for instance by the speed and accuracy with which a visual task is performed.

[SOURCE: IEC 60050-845:2020 845-29-005 / CIE S 017:2020; 17-29-005, modified – note 1 to entry added]

3.1.12
visual comfort
subjective condition of visual well-being induced by the luminous 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 1 to entry: 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 1 to entry: The main visual elements are the size of the structure, its luminance, its contrast against the background, its colour, and its duration.

3.1.15
visual acuity
visual resolution
<quantitatively> measure 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

[SOURCE: IEC 60050-845:2020 845-02-078 / CIE S 017:2020; 17-22-078]

3.1.16
contrast
<physical> quantity intended to correlate with the perceived brightness contrast, usually defined by one of a number of formulae that involve the luminances of the stimuli considered

EXAMPLE By the proportional variation in contrast near the luminance threshold ($\Delta L/L$) or by the ratio of luminances for much higher luminances (L_1/L_2).

3.1.17
field of vision
extent of space in which objects are visible to an eye in a given position

Note 1 to entry: In the horizontal plane meridian the field of vision extends to nearly 190° with both eyes open, the area seen binocularly is about 120°, and the area seen by one eye only is about 154°.

Note 2 to entry: The extent of the field of vision tends to diminish with age.

[SOURCE: IEC 65050-845:2020 845-22-081 / CIE S 017:2020; 17-22-081]

3.2 Light and colour

3.2.1
luminous flux
Φ_v, Φ
change in luminous energy with time

$$\Phi_v = \frac{dQ_v}{dt}$$

where Q_v is the luminous energy emitted, transferred or received, and t is time (unit: lm)

Note 1 to entry: Luminous flux is a quantity derived from the radiant flux, Φ_e, by evaluating the radiation according to its action upon the CIE standard photometric observer. Luminous flux can be derived from the spectral radiant flux distribution by

$$\Phi_v = K_m \int_0^\infty \Phi_{e,\lambda}(\lambda) V(\lambda) d\lambda$$

where K_m is maximum luminous efficacy, $\Phi_{e,\lambda}(\lambda)$ is spectral radiant flux, $V(\lambda)$ is spectral luminous efficiency and λ is wavelength.

Note 2 to entry: The distribution of the luminous intensities as a function of the direction of emission, e.g. given by the polar angles (ϑ, φ), is used to determine the luminous flux, Φ_v, within a certain solid angle, Ω, of a source:

$$\Phi_v = \iint_{\Omega} I_v(\vartheta, \varphi) \sin\vartheta d\varphi d\vartheta$$

Note 3 to entry: The corresponding radiometric quantity is "radiant flux". The corresponding quantity for photons is "photon flux".

[SOURCE: IEC 60050-845:2020 845-21-039, CIE S 017:2020; 17-21-039]

3.2.2
luminous intensity
I_v, I
<of a source, in a given direction> density of luminous flux with respect to solid angle in a specified direction

$$I_v = \frac{d\Phi_v}{d\Omega}$$

where Φ_v is the luminous flux emitted in a specified direction, and Ω is the solid angle containing that direction (unit: cd = lm · sr $^{-1}$)

Note 1 to entry: For practical realization of the quantity, the source is approximated by a point source.

Note 2 to entry: The distribution of the luminous intensities as a function of the direction of emission, e.g. given by the polar angles (ϑ, φ), is used to determine the luminous flux, Φ_v, within a certain solid angle, Ω, of a source:

$$\Phi_v = \iint_{\Omega} I_v\left(\vartheta,\varphi\right) sin\vartheta d\varphi d\vartheta$$

Note 3 to entry: Luminous intensity can be derived from the spectral radiant intensity distribution by

$$I_v = K_m \int_0^{\infty} I_{e,\lambda}\left(\lambda\right) V\left(\lambda\right) \mathrm{d}\lambda$$

where K_m is maximum luminous efficacy, $I_{e,\lambda}(\lambda)$ is the spectral radiant intensity at wavelength λ, and $V(\lambda)$ is spectral luminous efficiency.

Note 4 to entry: The corresponding radiometric quantity is "radiant intensity". The corresponding quantity for photons is "photon intensity".

[SOURCE: IEC 60050-845:2020 845-21-045 / CIE S 017:2020; 17-21-045]

3.2.3
luminance
L_v, L
density of luminous intensity with respect to projected area in a specified direction at a specified point on a real or imaginary surface (unit: cd · m^{-2} = lm · m^{-2} · sr^{-1})

$$L_v = \frac{\mathrm{d}I_v}{\mathrm{d}A} \frac{1}{\cos\alpha}$$

where I_v is luminous intensity, A is area and α is the angle between the normal to the surface at the specified point and the specified direction

Note 1 to entry: In a practical sense, the definition of luminance can be thought of as dividing a real or imaginary surface into an infinite number of infinitesimally small surfaces which can be considered as point sources, each of which has a specific luminous intensity, I_v, in the specified direction. The luminance of the surface is then the integral of these luminance elements over the whole surface.

The formula in the definition can mathematically be interpreted as a derivative (i.e. a rate of change of luminous intensity with projected area) and could alternatively be rewritten in terms of the average luminous intensity, $\bar{I}_v$, as:

$$L_v = \lim_{A\to 0} \frac{\overline{I_v}}{A} \frac{1}{\cos\alpha}$$

Hence, luminance is often considered as a quotient of averaged quantities; the area, A, should be small enough so that uncertainties due to variations in luminous intensity within that area are negligible; otherwise, the quotient $\overline{L}_v = \frac{\overline{I_v}}{A} \frac{1}{\cos\alpha}$ gives the average luminance and the specific measurement conditions have to be reported with the result.

Note 2 to entry: For a surface being irradiated, an equivalent formula in terms of illuminance, E_v, and solid angle, Ω, is $L_v = \frac{dE_v}{d\Omega} \frac{1}{cos\theta}$ where θ is the angle between the normal to the surface being irradiated and the direction of irradiation. This form is useful when the source has no surface (e.g. the sky, the plasma of a discharge).

Note 3 to entry: An equivalent formula is $L_v = \frac{\mathrm{d}\Phi_\mathbf{v}}{\mathrm{d}G}$ where $\boldsymbol{\Phi}_\mathbf{V}$ is luminous flux and G is geometric extent.

Note 4 to entry: Luminous flux can be obtained by integrating luminance over projected area, $A\cos\alpha$, and solid angle, Ω

$$\Phi_\mathrm{V} = \iint L_v \cos\alpha \, dA \, d\Omega$$

Note 5 to entry: Since the optical extent, expressed by Gn^2, where G is geometric extent and n is refractive index, is invariant, the quantity expressed by $L_\mathrm{V} n^{-2}$ is also invariant along the path of the beam if the losses by absorption, reflection and diffusion are taken as 0. That quantity is called "basic luminance".

Note 6 to entry: The formula in the definition can also be described as a function of luminous flux, Φ_V. In this case, it is mathematically interpreted as a second partial derivative of the luminous flux at a specified point (x, y) in space in a specified direction (ϑ,φ) with respect to projected area, A$\cos\alpha$, and solid angle, Ω,

$$L_v\left(x, y, \vartheta, \varphi\right) = \frac{d^2\Phi_v\left(x, y, \vartheta, \varphi\right)}{dA\left(x, y\right)\cos\alpha \, d\Omega\left(\vartheta, \varphi\right)}$$

where α is the angle between the normal to that area at the specified point and the specified direction.

Note 7 to entry: The corresponding radiometric quantity is "radiance". The corresponding quantity for photons is "photon radiance".

[SOURCE: IEC 60050-845:2020 845-21-050/ CIE S 017:2020; 17-71-050]

3.2.4
average luminance
L_av, $\bar{L}$, $L_\mathrm{v,av}$, $\bar{L}_\mathrm{v}$
luminance averaged over a specified surface (unit: cd · m^{-2})

Note 1 to entry: In practice, this may be approximated by an average of the luminances at a representative number of points on the surface. The number and position of these points should be specified in the relevant application guide.

[SOURCE: IEC 60050-845:2020 845-29-151 / CIE S 017:2020; 17-29-151, modified - Note 1 to entry added]

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

Note 1 to entry: 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 1 to entry: The relevant points at which the luminances are determined should be specified in the appropriate application standard.

3.2.7
maintained average luminance
maintained luminance
$\bar{L}_{\mathrm{m}}$
value below which the average luminance of a specified surface is not permitted to fall (unit: $\mathrm{cd} \cdot \mathrm{m}^{-2}$)

Note 1 to entry: The maintained average luminance is the average luminance of the specified surface at the time maintenance should be carried out.

[SOURCE: IEC 60050-845:2020 845-29-153 / CIE S 017:2020; 17-29-153, modified - selection of symbols]

3.2.8
initial average luminance
$\bar{L}_{\mathrm{i}}$
average luminance of the specified surface when the lighting installation is new (unit: $\mathrm{cd} \cdot \mathrm{m}^{-2}$)

[SOURCE: IEC 60050-845:2020 845-29-152 / CIE S 017:2020; 17-29-152, modified - selection of symbols]

3.2.9
luminance contrast
quantity relating to the difference in luminance between two surfaces

Note 1 to entry: Widely accepted definitions include:

$C = (L_1 - L_2) / L_1$ with $L_1 > L_2$ (positive contrast),

$C = (L_1 - L_2) / L_1$ with $L_1 < L_2$ (negative contrast),

$C = (L_1 - L_2) / (L_1 + L2)$ with $L_1 > L_2$,

where C is the luminance contrast and L_1 and L_2 are the luminances of the two surfaces.

Note 2 to entry: Although luminance contrast is intended to correlate with brightness contrast, it is possible that it does not do so directly because brightness contrast depends on other factors such as the angular separation, the luminance gradient, and any size difference between the two surfaces.

3.2.10
illuminance
E_{v}, E
density of incident luminous flux with respect to area at a point on a real or imaginary surface

$$E_v = \frac{\mathrm{d}\Phi_v}{\mathrm{d}A}$$

where Φ_{v} is luminous flux and A is the area on which the luminous flux is incident (unit: $\mathrm{lx} = \mathrm{lm} \cdot \mathrm{m}^{-2}$)

Note 1 to entry: Illuminance can be derived from the spectral irradiance distribution by

$$E_v = K_m \int_0^\infty E_{e,\lambda}(\lambda) V(\lambda) d\lambda$$

where K_m is maximum luminous efficacy, $E_{e,\lambda}$ (λ) is the spectral irradiance at wavelength λ and $V(\lambda)$ is spectral luminous efficiency.

Note 2 to entry: The corresponding radiometric quantity is "irradiance". The corresponding quantity for photons is "photon irradiance".

[SOURCE: IEC 60050-845:2020 845-21-060 / CIE S 017:2020; 17-21-060]

3.2.11
average illuminance
$\overline{E}$, $E_{v,av}$, $\overline{E}_v$
illuminance averaged over a specified surface (unit: lx)

Note 2 to entry: When stating the average illuminance it is necessary to provide a clear indication of the type of illuminance at the points of the surface, i.e. horizontal, vertical, spherical, cylindrical or semi-cylindrical.

Note 2 to entry: 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.

[SOURCE: IEC 60050-845:2020 845-29-155 / CIE S 017:2020; 7-29-155, modified - note 2 to entry added]

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 average illuminance
maintained illuminance
$\overline{E}_m$, $E_{v,av,m}$, $\overline{E_{v,m}}$, $E_{av,m}$
value below which the average illuminance over a specified surface is not permitted to fall (unit: lx)

Note 1 to entry: The maintained average illuminance is the average illuminance over the specified surface at the time maintenance should be carried out.

[SOURCE: IEC 60050-845:2020 845-29-157 / CIE S 017:2020; 17-29-157]

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

[SOURCE: IEC 60050-845:2020 845-29-156 / CIE S 017:2020; 17-29-156]

3.2.16
spherical illuminance
$E_{\mathrm{v,o}}$, E_{o}
mean value of illuminance on the outer curved surface of a very small (real or imaginary) sphere at a point in space (unit: lx)

Note 1 to entry: The spherical illuminance can be expressed by

$$E_{\mathrm{v,o}} = \int_{4\pi} L_{\mathrm{v}} \mathrm{d}\Omega$$

where Ω is solid angle and L_{v} is luminance.

Note 2 to entry: The spherical illuminance is the quotient of the luminous flux of all the light incident on the outer surface of an infinitely small sphere centred at the given point and the area of the diametrical cross-section of that sphere.

Note 3 to entry: The analogous quantities "spherical irradiance", $E_{\mathrm{e,o}}$, and "photon spherical irradiance" (also termed "photon fluence rate"), $E_{\mathrm{p,o}}$, are defined in a similar way, replacing luminance, L_{v}, by radiance, L_{e}, and photon radiance, L_{p}, respectively.

[SOURCE: IEC 60050-845:2020 845-221-066 / CIE S 017:2020; 17-21-066]

3.2.17
hemispherical illuminance
E_{hs}
<at a point> 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 1 to entry: The base of the hemisphere is taken to be horizontal unless stated otherwise.

3.2.18
cylindrical illuminance
E_{z}, $E_{v,c}$, E_{c}
mean value of illuminance on the outer curved surface of a very small (real or imaginary) sphere that is oriented vertically at a point in space (unit: lx)

Note 1 to entry: Cylindrical illuminance is sometimes also defined as the arithmetic mean of the vertical illuminance, $E_{\mathrm{v,v}}$, at a point

$$E_{\mathrm{z}} = \frac{1}{2\pi} \int_{0}^{2\pi} E_{\mathrm{v,v}} \mathrm{d}\varphi$$

where $E_{\mathrm{v,v}}$ is the vertical illuminance for an area element with its normal in the direction φ, and φ is the angle in the plane perpendicular to the axis of the cylinder.

Note 2 to entry: The corresponding radiometric quantity is "cylindrical irradiance". The corresponding quantity for photons is "photon cylindrical irradiance".

[SOURCE: IEC 60050-845:2020 845-21-063 / CIE S 017:2020; 17-21-063, modified - alternative symbol E_{z} added]