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BSI Standards Publication

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

bsi.

National foreword

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The UK participation in its preparation was entrusted to Technical Committee EL/1, Light and lighting applications.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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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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Contents

European foreword

This document (EN 12665:2024) 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of an identical text or by endorsement, at the latest by November 2024, and conflicting national standards shall be withdrawn at the latest by November 2024.

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 12665:2018.

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

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Türkiye and the United Kingdom.

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*, *Part 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.

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 colourimetry, 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 terminology databases for use in standardization at the following addresses:

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

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

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. is 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 replaced]

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
<in the perceptual sense> 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 017:2020; 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 can 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

Note 1 to entry: The reaction time includes the time needed for perception, taking a decision and acting.

Note 2 to entry: The reaction time is expressed in seconds (s).

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 845-22-078 / 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 60050-845:2020 845-22-081 / CIE S 017:2020; 17-22-081]

3.1.18
temporal light artefact
TLA
change in visual perception, induced by a light stimulus the luminance or spectral distribution of which fluctuates with time, for a human observer in a specified environment

Note 1 to entry: The change of visual perception is a result of comparing the visual perception of the environment lit by the modulated light to the visual perception of the same person in the same environment, when the environment is lit by non-modulated light.

[SOURCE: CIE TN 006:2016; 2.4.1]

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

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”.

Note 4 to entry: Luminous flux is expressed in lumens (lm).

[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

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

where Φ_v is the luminous flux emitted in a specified direction, and Ω is the solid angle containing that direction

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:

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

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

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

where K_m is maximum luminous efficacy, $I_{e,\lambda}$ (λ)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”.

Note 5 to entry: Luminous intensity is expressed in candelas (cd = lm · sr $^{-1}$).

[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

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

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:

$$L_v = \lim_{A \to 0} \frac{\bar{I}_v}{A} \frac{1}{\cos \alpha}$$

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 $\bar{L}_v = \frac{\bar{I}_v}{A} \frac{1}{\cos \alpha}$ 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 $L_v = \frac{\mathrm{d}E_v}{\mathrm{d}\Omega} \frac{1}{\cos\theta}$ 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 $L_v = \frac{\mathrm{d}\Phi_v}{\mathrm{d}G}$ where Φ_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

$$\Phi_V = \iint L_v \cos\alpha \, \mathrm{d}A \, \mathrm{d}\Omega$$

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 $L_v n^{-2}$ 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 equation 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,

$$L_v(x, y, \vartheta, \varphi) = \frac{\partial^2 \Phi_v(x, y, \vartheta, \varphi)}{\partial A(x, y) \cos\alpha \, \partial\Omega(\vartheta, \varphi)}$$

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”.

Note 8 to entry: Luminance is expressed in candelas per square metre ($\mathrm{cd} \cdot \mathrm{m}^{-2} = \mathrm{lm} \cdot \mathrm{m}^{-2} \cdot \mathrm{sr}^{-1}$).

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

3.2.4
average luminance
L_{av}, $\bar{L}$, $L_{v,av}$, $\bar{L}_v$
luminance averaged over a specified surface

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.

Note 2 to entry: Average luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

[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

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

Note 2 to entry: Minimum luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

3.2.6
maximum luminance
L_{max}
highest luminance of any relevant point on the specified surface

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

Note 2 to entry: Maximum luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

3.2.7
maintained average luminance
maintained luminance
$\bar{L}_m$
value below which the average luminance of a specified surface is not permitted to fall

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

Note 2 to entry: Maintained average luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

[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
$\bar{L}_i$
average luminance of the specified surface when the lighting installation is new

Note 1 to entry: Initial average luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

[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),

$C = (L_1 - L_2) / (L_1 + L_2)$ 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

$$E_v = \frac{d\Phi_v}{dA}$$

where Φ_v is luminous flux and A is the area on which the luminous flux is incident

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, $E_{e,\lambda}(\lambda)$ 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”.

Note 3 to entry: Illuminance is expressed in lux ($lx = lm \cdot m^{-2}$).

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

3.2.11
average illuminance
$\bar{E}$, $E_{v,av}$, $\bar{E}_v$
illuminance averaged over a specified surface

Note 1 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.

Note 3 to entry: Average illuminance is expressed in lux (lx).

[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

Note 1 to entry: Minimum illuminance is expressed in lux (lx).

3.2.13
maximum illuminance
E_{max}
highest illuminance at any relevant point on the specified surface

Note 1 to entry: Maximum illuminance is expressed in lux (lx).

3.2.14
maintained average illuminance
maintained illuminance
$\overline{E}_{\mathrm{m}}$, $E_{\mathrm{v,av,m}}$, $\overline{E}_{\mathrm{v,m}}$, $E_{\mathrm{av,m}}$
value below which the average illuminance over a specified surface is not permitted to fall

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

Note 2 to entry: Maintained average illuminance is expressed in lux (lx).

[SOURCE: IEC 60050-845:2020 845-29-157 / CIE S 017:2020; 17-29-157; modified – second preferred term added]

3.2.15
initial average illuminance
$E_{\mathrm{v,av,i}}$, $\overline{E}_{\mathrm{v,i}}$, $E_{\mathrm{av,i}}$, $\overline{E}_{\mathrm{i}}$
average illuminance on the specified surface when the installation is new

Note 1 to entry: Initial average illuminance is expressed in lux (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

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.

Note 4 to entry: Spherical illuminance is expressed in lux (lx).

[SOURCE: IEC 60050-845:2020 845-21-066 / 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

Note 1 to entry: The base of the hemisphere is taken to be horizontal unless stated otherwise.

Note 2 to entry: Hemispherical illuminance is expressed in lux (lx).

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

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".

Note 3 to entry: Cylindrical illuminance is expressed in lux (lx).

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

3.2.19
semi-cylindrical illuminance
E_{sz}, $E_{v,sc}$, E_{sc}
<at a point> arithmetic mean of the vertical illuminances, $E_{v,v}$, at a point in the range of azimuth angles

$$-\frac{\pi}{2} \leq \varphi \leq \frac{\pi}{2}$$

$$E_{v,sc} = \frac{1}{\pi}\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} E_{v,v}\,d\varphi$$

Note 1 to entry: The axis of the semi-cylinder is taken to be vertical unless stated otherwise. The direction of the curved surface should be specified.

Note 2 to entry: Semi-cylindrical illuminance is expressed in lux (lx).

[SOURCE: IEC 60050-845:2020 845-21-064 / CIE S 017:2020; 17-21-064, modified - alternative symbol E_{sz} added, note 1 added]

3.2.20
reference surface
<in photometric or radiometric measurements> surface on which optical quantities are measured or specified

[SOURCE: IEC 60050-845:2020 845-29-067 / CIE S 017:2020; 17-29-067]

3.2.21
disability glare
glare that impairs the vision of objects without necessarily causing discomfort

[SOURCE: IEC 60050-845:2020 845-22-103 / CIE S 017:2020; 17-22-103]

3.2.22
discomfort glare
glare that causes discomfort without necessarily impairing the vision of objects

[SOURCE: IEC 60050-845:2020 845-22-102 / CIE S 017:2020; 17-22-102]

3.2.23
veiling reflection
specular reflection that appears on the object viewed and that partially or wholly obscures the details by reducing contrast

[SOURCE: IEC 60050-845:2020 845-22-101 / CIE S 017:2020; 17-22-101]

3.2.24
luminous environment
physical conditions of light in a scene considered in relation to its physiological and psychological effects on humans

Note 1 to entry: See also IEC 60050-845:2020 845-29-004 / CIE S 017:2020; 17-29-004 luminous environment.

3.2.25
colour rendering
<of a light source> effect of an illuminant on the perceived colour of objects by conscious or subconscious comparison with their perceived colour under a reference illuminant

Note 1 to entry: In German, the term “Farbwiedergabe” is also applied to colour reproduction.

[SOURCE: IEC 60050-845:2020 845-22-107 / CIE S 017:2020; 17-22-107, modified – Note 1 added]

3.2.26
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

Note 1 to entry: See also CIE 13.3 Method of Measuring and Specifying Colour Rendering Properties of Light Sources.

[SOURCE: IEC 60050-845:2020 845-22-111 / CIE S 017:2020; 17-22-111]

3.2.27
colour stimulus
visible radiation entering the eye and producing a sensation of either chromatic colour or achromatic colour

[SOURCE: IEC 60050-845:2020 845-23-002 / CIE S 017:2020; 17-23-002]

3.2.28
tristimulus values
<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: IEC 60050-845:2020 845-23-038 / CIE S 017:2020; 17-23-038]

3.2.29
chromaticity coordinates
coordinates expressing the quotients of each of a set of three tristimulus values and their sum

Note 1 to entry: As the sum of the three chromaticity coordinates is equal to 1, two of them are sufficient to define a chromaticity.

Note 2 to entry: In the CIE standard colorimetric systems, the chromaticity coordinates are represented by the symbols x, y, z and x_{10}, y_{10}, z_{10}.

[SOURCE: IEC 60050-845:2020 845-23-053 / CIE S 017:2020; 17-23-053]

3.2.30
chromaticity
property of a colour stimulus defined by its chromaticity coordinates, or by its dominant or complementary wavelength and purity taken together

[SOURCE: IEC 60050-845:2020 845-23-052 / CIE S 017:2020; 17-23-052]

3.2.31
colour temperature
T_c
temperature of a Planckian radiator whose radiation has the same chromaticity as that of a given stimulus

Note 1 to entry: Colour temperature is expressed in kelvin (K).

[SOURCE: IEC 60050-845:2020 845-23-067 / CIE S 017:2020; 17-23-067]

3.2.32
correlated colour temperature
CCT
T_{cp}
temperature of a Planckian radiator having the chromaticity nearest the chromaticity associated with the given spectral distribution on a modified 1976 UCS diagram where u', $\frac{2}{3}v'$ are the coordinates of the Planckian locus and the test stimulus

Note 1 to entry: The concept of correlated colour temperature should not be used if the chromaticity of the test source differs more than

$$\Delta C = \left[\left(u'_t - u'_p \right)^2 + \frac{4}{9} \left(v'_t - v'_p \right)^2 \right]^{\frac{1}{2}} = 5 \times 10^{-2}$$

from the Planckian radiator, where u'_t, v'_t refer to the test source, u'_p, v'_p to the Planckian radiator.

Note 2 to entry: Correlated colour temperature can be calculated by a simple minimum search computer program that searches for that Planckian temperature that provides the smallest chromaticity difference between the test chromaticity and the Planckian locus, or for example by a method recommended by Robertson, A.R. "Computation of correlated color temperature and distribution temperature", J. Opt. Soc. Am. 58, 1528-1535, 1968. (Note that the values in some of the tables in this reference are not up to date.)

Note 3 to entry: The chromaticity diagram originally used to determine the correlated colour temperature was the CIE 1960 uniform-chromaticity-scale diagram. The CIE 1976 uniform-chromaticity-scale diagram is a modified version of the CIE 1960 uniform chromaticity-scale diagram and is equivalent to the (u, 3/2 v) diagram.

Note 4 to entry: Correlated colour temperature is expressed in kelvin (K).

[SOURCE: IEC 60050-845:2020 845-23-068 / CIE S 017:2020; 17-23-068]

3.2.33
fusion frequency
critical flicker frequency
for a given set of conditions, the frequency of alternation of stimuli above which flicker is not perceptible

Note 1 to entry: Fusion frequency is expressed in hertz (Hz)

[SOURCE: IEC 60050-845:2020 845-22-093 / CIE S 017:2020; 17-22-093, Note 1 to entry added]

3.2.34
reflectance
total reflectance
ρ
quotient of reflected radiant flux Φ_r, and incident radiant flux Φ_m

$$\rho = \frac{\Phi_r}{\Phi_m}$$

Note 1 to entry: Reflectance is also defined spectrally in terms of wavelength, in which case, “spectral” is added before the quantity name.

Note 2 to entry: Due to energy conservation, $\alpha + \rho + \tau = 1$ except when polarized radiation is observed, where α is absorptance and τ is transmittance.

Note 3 to entry: Reflectance, ρ, is the sum of regular reflectance, ρ_r, and diffuse reflectance, ρ_d: $\rho = \rho_r + \rho_d$.

Note 4 to entry: Reflectance has unit one.

[SOURCE: IEC 60050-845:2020 845-24-064 / CIE S 017:2020; 17-24-064, modified – admitted term ‘total reflectance’ added]

3.2.35
transmittance
τ
quotient of transmitted radiant flux Φ_t, and incident radiant flux Φ_m

$$\tau = \frac{\Phi_t}{\Phi_m}$$

Note 1 to entry: Transmittance is also defined spectrally in terms of wavelength, in which case, “spectral” is added before the quantity name.

Note 2 to entry: Due to energy conservation, $\alpha + \rho + \tau = 1$ except when polarized radiation is observed, where α is absorptance and ρ is reflectance.

Note 3 to entry: Transmittance, τ, is the sum of regular transmittance, τ_r, and diffuse transmittance, τ_d: $\tau = \tau_r + \tau_d$.

Note 4 to entry: Transmittance has unit one.

[SOURCE: IEC 60050-845:2020 845-24-065 / CIE S 017:2020; 17-24-065]

3.2.36
absorptance
α
quotient of absorbed radiant flux Φ_a, and incident radiant flux Φ_m

$$\alpha = \frac{\Phi_a}{\Phi_m}$$

Note 1 to entry: The absorptance is also defined spectrally in terms of wavelength, in which case, “spectral” is added before the quantity name.

Note 2 to entry: Due to energy conservation, $\alpha + \rho + \tau = 1$ except when polarized radiation is observed, where ρ is reflectance and τ is transmittance.

Note 3 to entry: Absorptance has unit one.

[SOURCE: IEC 60050-845:2020 845-24-082 / CIE S 017:2020; 17-24-082]

3.2.37
photometry
measurement of quantities referring to radiation as evaluated according to a given spectral luminous efficiency, e.g. $V(\lambda)$ or $V'(\lambda)$

Note 1 to entry: The term "photometry" is sometimes used in a broader sense covering the science of optical radiation measurement (radiometry), but this use is deprecated.

[SOURCE: IEC 60050-845:2020 845-25-013 / CIE S 017:2020; 17-25-013]

3.2.38
access zone luminance
eye adaptation luminance in the access zone

Note 1 to entry: Access zone luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

3.2.39
contrast revealing coefficient
q_c
<of a tunnel lighting installation> quotient of the luminance, L_v, of a road surface and the vertical illuminance, $E_{v,v}$, at a specific location in a tunnel

Note 1 to entry: Contrast revealing coefficient is expressed in candelas per square metre per lux ($cd \cdot m^{-2} \cdot lx^{-1}$) which may be simplified to steradian to the power minus one (sr^{-1}).

[SOURCE: IEC 60050-845:2020 845-31-098 / CIE S 017:2020; 17-31-098; modified – note 1 to entry modified]

3.2.40
diversity
extreme uniformity
U_d
quotient of minimum illuminance and maximum illuminance on a surface, or of minimum luminance and maximum luminance of a surface

Note 1 to entry: See also 3.2.53 illuminance uniformity.

[SOURCE: IEC 60050-845:2020 845-31-143 / CIE S 017:2020; 17-31-143, modified - alternative term added, note to entry added]

3.2.41
equivalent veiling luminance
L_{ve}
<for disability glare or veiling reflections> luminance that, when added by superposition to the luminance of both the adapting background and the object, makes the luminance threshold or the luminance difference threshold the same under the two following conditions: (1) glare present, but no additional luminance; (2) additional luminance present, but no glare

Note 1 to entry: Equivalent veiling luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

[SOURCE: IEC 60050-845:2020 845-22-104 / CIE S 017:2020; 17-22-104]

3.2.42
glare rating limit
GR_L
$R_{G,L}$
maximum allowed value given by the CIE Glare Rating system

Note 1 to entry: See also CIE 112-1994 Glare Evaluation System for Use within Outdoor Sports- and Area Lighting.

[SOURCE: IEC 60050-845:2020 845-22-106 / CIE S 017:2020; 17-22-106]

3.2.43
interior zone luminance
$\bar{L}_{in}$
<of a road tunnel> average road surface luminance of a transverse strip at a given location in the interior zone of the tunnel (as a function of the measurement grid)

Note 1 to entry: Interior zone luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

3.2.44
L_{20} access luminance
<of a road tunnel> average luminance contained in a conical field of view, subtending an angle of 20° with the apex at the position of the eye of an approaching driver and aimed at the centre of the tunnel mouth

Note 1 to entry: L_{20} access luminance is assessed from a point at a distance equal to the stopping distance from the tunnel portal at the middle of the relevant carriageway or traffic lane.

Note 2 to entry: L_{20} access luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

3.2.45
longitudinal uniformity
U_l
<of road surface luminance of a carriageway> lowest of the ratios determined for each driving lane of the carriageway as the ratio of the lowest to the highest road surface luminance found in a line in the centre along the driving lane

3.2.46
obtrusive light
spill light, which, because of quantitative, directional or spectral attributes in a given context, gives rise to annoyance, discomfort, distraction, or reduction in the ability to see essential information

Note 1 to entry: In the case of outdoor sports lighting installations, obtrusive light is considered around the installation and not for spectators, referees or players within the sports area.

Note 2 to entry: In the case of large tertiary buildings with predominantly glazed facades, interior lighting can be considered as obtrusive light if it gives rise to annoyance, discomfort, distraction or a reduction in the ability to see essential information due to light spilling outside of the building structure.

3.2.47
spill light
stray light
<in a lighting installation> light emitted by a lighting installation that falls outside the boundaries of the property or area for which the lighting installation is designed

[SOURCE: IEC 60050-845:2020 845-29-185 / CIE S 017:2020; 17-29-185, modified – “or area” added]

3.2.48
threshold zone luminance
$\bar{L}_{th}$
average road surface luminance of a transverse strip at a given location in the threshold zone of the tunnel (as a function of the measurement grid)

Note 1 to entry: Threshold zone luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

3.2.49
threshold zone luminance ratio
k
<at a point> ratio between the threshold zone luminance $\bar{L}_{th}$ and the L_{20} access zone luminance

$$k = \frac{\bar{L}_{th}}{L_{20}\ \text{access zone luminance}}$$

where

k is the threshold zone luminance ratio at a point;

$\bar{L}_{th}$ is the threshold zone luminance

3.2.50
transition zone luminance
$\bar{L}_{tr}$
average road surface luminance of a transverse strip at a given location in the transition zone of the tunnel (as a function of the measurement grid)

Note 1 to entry: Transition zone luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

3.2.51
unified glare rating limit
R_{UGL}
upper limit of glare by the CIE Unified Glare Rating system

3.2.52
windscreen luminance
L_{winds}
light veil as a result of the scatter in the vehicle windscreen expressed as a luminance

Note 1 to entry: Windscreen luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

3.2.53
illuminance uniformity
uniformity ratio of illuminance
U_o
quotient of minimum illuminance and average illuminance on a surface

Note 1 to entry: Illuminance uniformity has unit one.

[SOURCE: IEC 60050-845:2020 845-29-160 / CIE S 017:2020; 17-29-160]

3.2.54
luminance uniformity
U_o
quotient of minimum luminance and average luminance of a surface

Note 1 to entry: Luminance uniformity has unit one.

[SOURCE: IEC 60050-845:2020 845-29-154 / CIE S 017:2020; 17-29-154]

3.2.55
reflection
<of radiation> process by which radiation is returned by a surface or a medium, without change in the frequency of its monochromatic components

Note 1 to entry: Part of the radiation falling on a medium is reflected at the surface of the medium ("surface reflection"); another part can be scattered back from the interior of the medium ("volume reflection").

Note 2 to entry: The frequency is unchanged only if there is no Doppler effect due to the motion of the materials from which the radiation is returned.

[SOURCE: IEC 60050-845:2020 845-24-047 / CIE S 017:2020; 17-24-047]

3.2.56
average road surface luminance
L
<of a carriageway of a road> luminance of the road surface averaged over the carriageway

Note 1 to entry: Average road surface luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

3.2.57
threshold increment
TI
f_{TI}
<glare evaluation> measure of disability glare expressed as the percentage increase in luminance contrast threshold required between an object and its background for it to be seen equally well with a source of glare present

Note 1 to entry: Increasing values of threshold increment correspond to increasing disability glare.

[SOURCE: IEC 60050-845:2020 845-31-145 / CIE S 017:2020; 17-31-145, modified – abbreviation added]

3.2.58
edge illuminance ratio
EIR
R_{EI}
<of illumination of a strip adjacent to the carriageway of a road> average horizontal illuminance on a strip just outside the edge of a carriageway in proportion to the average horizontal illuminance on a strip inside the edge, where the strips have the width of one driving lane of the carriageway

Note 1 to entry: Separate values apply for each of the two sides of a carriageway, and for each of the two sides of both carriageways of a dual carriageway. When a minimum requirement is made for the EIR of a lighting installation, each of the separate values shall meet the requirement.

3.2.59
vertical illuminance
$E_{v,v}$, E_v
illuminance on a vertical plane

Note 1 to entry: Vertical illuminance is expressed in lux (lx).

[SOURCE: IEC 60050-845:2020 845-21-062 / CIE S 017:2020; 17-21-062]

3.2.60
vertical photometric angle
γ
angle between the light path and the downward vertical axis both passing through the luminaire photometric centre

Note 1 to entry: The direction $\gamma = 0$ is therefore oriented to the nadir.

Note 2 to entry: Vertical photometric angle is expressed in radians or degrees.

3.2.61
azimuth
C
angle between the vertical half plane passing through the light path and the reference half plane

Note 1 to entry: Azimuth is expressed in radians or degrees.

EXAMPLE The vertical half plane passing through the second axis of a luminaire, when the luminaire is at its tilt during measurement.

3.2.62
angle of incidence
incidence angle
angle of irradiation
ε
angle that a light path makes with the normal to the plane of incidence

Note 1 to entry: Angle of incidence is expressed in radians or degrees.

[SOURCE: IEC 60050-845:2020 845-25-078 / CIE S 017:2020; 17-25-078]

3.2.63
angle of deviation
β
angle between the oriented vertical planes through the observer to the point of observation and from the point of observation through the luminaire (with respect to luminance coefficient)

Note 1 to entry: Angle of deviation is expressed in radians or degrees.

3.2.64
luminance coefficient
q
quotient of the luminance of a surface element in a given direction by the illuminance on the surface element

Note 1 to entry: $q = L/E$

where q is the luminance coefficient, in reciprocal steradians, L is the luminance, in candelas per square metre, and E is the illuminance, in lux.

Note 2 to entry: Luminance coefficient is expressed in steradian to the power minus one (sr^{-1}).

3.2.65
reduced luminance coefficient
r
luminance coefficient multiplied by the cube of the cosine of the angle of incidence of the light on a point on a surface

Note 1 to entry: The reduced luminance coefficient can be expressed by the equation: $r = q \cos^3\varepsilon$ where q is the luminance coefficient in steradian to the power minus one (sr^{-1}), and ε is the angle of incidence, in degrees (°).

Note 2 to entry: The angle of observation, α, affects the value of r. By convention this angle is fixed at 1° for road lighting calculations.

Note 3 to entry: Reduced luminance coefficient is expressed in steradian to the power minus one (sr^{-1}).

[SOURCE: IEC 60050-845:2020 845-21-103 / CIE S 017:2020; 17-21-103]

3.2.66
tilt during measurement
θ_m
<of a luminaire> angle between a defined datum axis related to the luminaire and the horizontal when the luminaire is mounted for photometric measurement

Note 1 to entry: The defined datum axis can be any feature of the luminaire, but it will usually relate to a feature that is nominally aligned with the horizontal such as an axis through the luminous opening or an axis through an array of LEDs or a fixing spigot entry axis.

Note 2 to entry: Tilt during measurement is expressed in radians or degrees.

[SOURCE: IEC 60050-845:2020 845-25-112 / CIE S 017:2020; 17-25-112]

3.2.67
tilt for calculation
δ
difference in angle between the tilt in application and the tilt during measurement of a luminaire

Note 1 to entry: Tilt for calculation is expressed in radians or degrees.

3.2.68
tilt in application
θ_f, θ_m
<of a luminaire> angle between a defined datum axis on the luminaire and the horizontal when the luminaire is mounted for field use

Note 1 to entry: The defined datum axis can be any feature of the luminaire but it will usually relate to a feature that is nominally aligned with the horizontal such as an axis through the luminous opening or an axis through an array of LEDs or a fixing spigot entry axis.

Note 2 to entry: The tilt in application is the actual tilt of the luminaire when it is mounted for field use and should not be confused with "tilt normal in application" or "designed attitude" (see EN 13032-1).

Note 3 to entry: Tilt in application is expressed in radians or degrees.

[SOURCE: IEC 60050-845:2020 845-25-113 / CIE S 017:2020; 17-25-113, modified – symbol θ_f added, reference in Note 2 to entry changed]

3.2.69
longitudinal direction
<of a road> direction parallel to the axis of the road

[SOURCE: IEC 60050-845:2020 845-31-138 / CIE S 017:2020; 17-31-138]

3.2.70
transverse direction
<of a road> direction at right angles to the axis of the road

Note 1 to entry: On a curved road the transverse direction is that of the radius of curvature at the point of interest on the road.

[SOURCE: IEC 60050-845:2020 845-31-139 / CIE S 017:2020; 17-31-139]

3.2.71
adaptive lighting
lighting responding to circumstances or according to predefined conditions, while maintaining the lighting quality within the specified requirements for these circumstances or conditions

Note 1 to entry: The requirements can focus on different aspects such as energy efficiency, dynamic user needs, visual task or ambience.

Note 2 to entry: The terms "smart lighting" and "intelligent lighting" are sometimes used with a similar meaning.

Note 3 to entry: When applied to road lighting this includes temporal changes in relation to traffic volume, time and weather.

[SOURCE: IEC 60050-845:2020 845-29-027 / CIE S 017:2020; 17-29-027, modified – note 3 added]

3.2.72
annual energy consumption indicator
AECI
D_E
<of a lighting installation in a specific year> total electrical energy consumed by a lighting installation throughout a specific year in proportion to the total area to be illuminated by the lighting installation

Note 1 to entry: Annual energy consumption indicator is expressed in Watt hours per square metre (unit: $Wh \cdot m^{-2}$).

3.2.73
total spectral radiant flux
Φ_λ
<of a light source> spectral concentration of the geometrically-total (4π steradian) radiant flux Φ of a light source:

$$\Phi_\lambda(\lambda) = \frac{\mathrm{d}\Phi}{\mathrm{d}\lambda}$$

Note 1 to entry: Total spectral radiant flux is expressed in watts per nanometre (W nm^{-1}).

3.2.74
partial luminous flux
$\Phi_{\mathrm{v,p},\alpha}$, Φ_α
<of a light source> luminous flux emitted within a specified cone angle α, determined from the luminous intensity distribution $I(\theta, \varphi)$ of the light source:

$$\Phi_{\mathrm{v,p},\alpha} = \int_{\varphi=0}^{2\pi}\int_{\theta=0}^{\alpha/2} I_{\mathrm{v}}(\theta,\varphi)\sin\theta\,\mathrm{d}\theta\mathrm{d}\varphi$$

Note 1 to entry: $(\theta, \varphi) = (0,0)$ is the direction of the cone axis, which can be coincident with the mechanical axis or optical beam axis of the light source or any other direction, and should be specified.

Note 2 to entry: The cone angle, α, which can be expressed either in degrees (°) or radians (rad), is given by the full conic angle and has to be specified, e.g. $\Phi_{\mathrm{p},90°}$ or $\Phi_{\mathrm{p},\pi/2}$.

Note 3 to entry: The term "cone luminous flux" is also used in some applications, with the same meaning.

Note 4 to entry: Partial luminous flux is expressed in lumens (lm).

[SOURCE: IEC 60050-845:2020 845-21-110 / CIE S 017:2020; 17-21-110, modified – note 4 deleted, note 5 renumbered]

3.2.75
absolute photometry
process for measuring photometric quantities directly in SI units

Note 1 to entry: This term is often used in goniophotometry of luminaires, in contrast with relative photometry.

Note 2 to entry: Absolute measurements require instruments calibrated for the appropriate SI units.

3.2.76
relative photometry
measurement obtained as a quotient of two photometric quantities

Note 1 to entry: This term is often used in goniophotometry of luminaires, where luminous intensity distribution is measured as relative values normalized by total luminous flux of the lamps used, and reported in the unit cd/klm.

Note 2 to entry: This method is not applicable to LED light sources and LED luminaires with integrated LED light sources.

3.2.77
traceability
property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty

Note 1 to entry: The International Laboratory Accreditation Cooperation (ILAC) considers the elements for confirming metrological traceability to be an unbroken metrological traceability chain to an international measurement standard or a national measurement standard, a documented measurement uncertainty, a documented measurement procedure, accredited technical competence, metrological traceability to the SI, and calibration intervals (see ILAC P-10:2002).

Note 2 to entry: The expression "traceability to the SI" means "metrological traceability to a measurement unit of the International System of Units'.

Note 3 to entry: In ISO/IEC Guide 99:2007 this definition is termed "metrological traceability".

[SOURCE: ISO/IEC Guide 99:2007, 2.41, modified - NOTE 1 to NOTE 6 and NOTE 8 omitted, NOTE 7 renumbered as Note 1 to entry, Note 2 to entry added, Note 3 to entry added]

3.2.78
tolerance interval
interval of permissible values of a property

Note 1 to entry: Unless otherwise stated in a specification, the tolerance limits belong to the tolerance interval.

Note 2 to entry: The term `tolerance interval' as used in conformity assessment has a different meaning from the same term as it is used in statistics.

[SOURCE: ISO/IEC Guide 98-4:2012, 3.3.5, modified – note 3 to entry omitted]

3.2.79
acceptance interval
interval of permissible measured quantity values

Note 1 to entry: Unless otherwise stated in the specification, the acceptance limits belong to the acceptance interval.

[SOURCE: ISO/IEC Guide 98-4:2012, 3.3.9, modified – note 2 to entry omitted]

3.2.80
luminous area
projected area of the light emitting parts of a source visible to an eye in a given position and direction of view

Note 1 to entry: Luminous area is expressed in square metres (m^2).

3.3 Lighting equipment

3.3.1
electric lamp
electric light source provided with at least one cap

Note 1 to entry: For products that have the same physical characteristics as electric lamps for general lighting, but that are built to emit optical radiation mainly in the IR or UV spectrum, the term "IR lamp" or "UV lamp" is often used.

Note 2 to entry: In IEC standards, “lamp” is commonly used with the same meaning.

[SOURCE: IEC 60050-845:2020 845-27-008 / CIE S 017:2020; 17-27-008]

3.3.2
ballast
unit inserted between the power supply and at least one discharge lamp that by means of inductance, capacitance or resistance, single or in combination, serves mainly to limit the current of the discharge lamp(s) to the required value

Note 1 to entry: A ballast can also include means for transforming from the power supply voltage and arrangements which help to provide starting voltage and preheating current, to prevent cold starting, to reduce stroboscopic effect, to correct the power factor and to suppress radio interference.

[SOURCE: IEC 60050-845:2020 845-28-044 / CIE S 017:2020; 17-28-044]

3.3.3
luminaire
apparatus which distributes, filters or transforms the light transmitted from at least one source of optical radiation and which includes, except the sources themselves, all the parts necessary for fixing and protecting the sources and, where necessary, circuit auxiliaries together with the means for connecting them to the power supply

[SOURCE: IEC 60050-845:2020 845-30-001 / CIE S 017:2020; 17-30-001]

3.3.4
reference ballast
special ballast designed for the purpose of providing comparison standards for use in testing ballasts, for the selection of reference lamps and for testing electric lamps from regular production under standardized conditions

Note 1 to entry: A reference ballast is typically inductive for electric lamps operating on AC mains frequencies or resistive for electric lamps operating on high frequency or low frequency square waves.

Note 2 to entry: A reference ballast operated at its rated frequency has a stable voltage/current ratio that is relatively uninfluenced by variations in current, temperature and magnetic surroundings.

[SOURCE: IEC 60050-845:2020 845-28-046 / CIE S 017:2020; 17-28-046]

3.3.5
reference lamp
<for testing ballasts> electric lamp selected for testing ballasts which, when associated with a reference ballast, has electrical characteristics which are close to the rated values as stated in the relevant lamp standard

[SOURCE: IEC 60050-845:2020 845-27-096 / CIE S 017:2020; 17-27-096]

3.3.6
rated luminous flux
<of a type of lamp or luminaire> value of the initial luminous flux of a given type of lamp or luminaire declared by the manufacturer or the responsible vendor, the lamp or luminaire being operated under specified conditions

Note 1 to entry: The initial luminous flux is the luminous flux of a lamp or luminaire after a short ageing period as specified in the relevant standard.

Note 2 to entry: The rated luminous flux is sometimes marked on the lamp or luminaire.

Note 3 to entry: In French, formerly “flux lumineux nominal”.

Note 4 to entry: Luminous flux is expressed in lumens (lm).

3.3.7
luminous efficacy
η_v, η
<of a light source> quotient of the emitted luminous flux and the power consumed

$$\eta_v = \frac{\Phi_v}{P}$$

where Φ_v is luminous flux and P is the power consumed by the light source

Note 1 to entry: It has to be specified whether or not the power dissipated by auxiliary equipment such as ballasts, if any, is included in the power consumed by the light source.

Note 2 to entry: Luminous efficacy of a source is expressed in lumens per Watt ($lm \cdot W^{-1}$).

[SOURCE: IEC 60050-845:2020 845-21-089 / CIE S 017:2020; 17-21-089]

3.3.8
light output ratio
LOR
luminaire efficacy
R_{LO}
<of a luminaire> quotient of the total luminous flux of the luminaire, measured under specified practical conditions with its own lamp(s) and equipment, and the sum of the individual luminous fluxes of the same lamp(s) when operated outside the luminaire with the same equipment, under specified conditions

Note 1 to entry: For luminaires using incandescent lamps only, the optical light output ratio and the light output ratio are the same in practice.

Note 2 to entry: LOR can be determined for LED luminaires using interchangeable sources (e.g. LED lamps) in some cases. The use of LOR is disregarded for LED luminaires with non-replaceable LED light sources. For LED luminaires with non-replaceable LED light sources, only the total flux of the luminaire can be measured, in which case, LOR is 100 % as a consequence and not significant.

[SOURCE: IEC 60050-845:2020 845-29-052 / CIE S 017:2020; 17-29-052, modified – note 2 added]

3.3.9
(Entry deleted)

3.3.10
ballast lumen factor
BLF
$F_{Ballast}$
quotient of the luminous flux emitted by a reference lamp when operated with a particular production ballast and the luminous flux emitted by the same reference lamp when operated with its reference ballast

[SOURCE: IEC 60050-845:2020 845-29-082 / CIE S 017:2020; 17-29-082, modified – Symbol added, notes to entry 1, 2 and 3 omitted]

3.3.11
downward light output ratio
DLOR
R_{DLO}
quotient of the downward luminous flux of a luminaire, measured under specified practical conditions with its own lamps and equipment, and the sum of the individual luminous fluxes of the same lamps when operated outside the luminaire with the same equipment, under specified conditions

Note 1 to entry: The luminaire attitude should be declared so that appropriate corrections to the DLOR can be made if in application the installed attitude is different.

[SOURCE: IEC 60050-845:2020 845-29-053 / CIE S 017:2020; 17-29-053, modified – notes to entry 1, 2 and 3 omitted, new note 1 to entry added, Symbol added]

3.3.12
upward light output ratio
ULOR
R_{ULO}
quotient of the upward luminous flux of a luminaire, measured under specified conditions with its own lamp(s) and equipment, and the sum of the individual luminous fluxes of the same lamp(s) when operated outside the luminaire with the same equipment, under specified practical conditions

Note 1 to entry: The upward light output ratio has unit one.

Note 2 to entry: The luminaire attitude should be declared so that appropriate corrections to the ULOR can be made if in application the installed attitude is different.

[SOURCE: IEC 60050-845:2020 845-29-065 / CIE S 017:2020; 17-29-065, modified – note 2 added, Symbol added]

3.3.13
luminous intensity distribution
distribution of luminous intensity
spatial distribution of luminous intensity
presentation, by means of curves or tables, of the values of the luminous intensity of a source as a function of direction in space

[SOURCE: IEC 60050-845:2020 845-29-037 / CIE S 017:2020; 17-29-037, modified – note 1 deleted]

3.3.14
utilization factor
coefficient of utilization
F_U
<of an installation > quotient of the luminous flux received by a reference surface and the sum of the rated individual luminous fluxes of the lamps of the installation

Note 1 to entry: The utilization factor has unit one.

[SOURCE: IEC 60050-845:2020 845-29-069 / CIE S 017:2020; 17-29-069, modified – Symbol added]

3.3.15
utilance
U
<of an installation > quotient of the luminous flux received by a reference surface and the sum of the individual output fluxes of the luminaires of the installation

[SOURCE: IEC 60050-845:2020 845-29-070 / CIE S 017:2020; 17-29-070]

3.3.16
lamp lumen maintenance factor
lamp luminous flux maintenance factor
LLMF
f_{LLM}
quotient of the luminous flux of a lamp at a given time in its operational life and the initial luminous flux

Note 1 to entry: The lamp luminous flux maintenance factor has unit one.

[SOURCE: IEC 60050-845:2020 845-29-147 / CIE S 017:2020; 17-29-147, modified – term "lamp lumen maintenance factor" added and made preferred]

3.3.17
lamp survival factor
LSF
f_{LS}
fraction of the total number of lamps which continue to operate at a given instant under defined conditions and switching frequency

Note 1 to entry: The lamp survival factor has unit one.

Note 2 to entry: See also CIE 97.

[SOURCE: IEC 60050-845:2020 845-29-149 / CIE S 017:2020; 17-29-149, modified – note 2 to entry added]

3.3.18
luminaire maintenance factor
LMF
f_{LM}
quotient of the efficiency of a luminaire at a given instant and the initial efficiency value

Note 1 to entry: The luminaire maintenance factor has unit one.

Note 2 to entry: The luminaire maintenance factor does not include depreciation in the luminous flux output of the light source.

Note 3 to entry: See also CIE 97.

[SOURCE: IEC 60050-845:2020 845-29-148 / CIE S 017:2020; 17-29-148, modified – note 3 added]

3.3.19
cut-off
technique used for concealing light source(s) and surfaces of high luminance from direct view in order to reduce glare, or to reduce light emission above the horizontal

Note 1 to entry: In outdoor lighting, cut-off classifications define the luminous intensity limits in two illumination zones that occur within the range of 80° to 180° above nadir. Light emitted in the 80° to 90° zone is more likely to contribute to glare, and light emitted above the horizontal is more likely to contribute to sky glow.

Note 2 to entry: In public lighting, distinction is made between full-cut-off luminaires, semi-cut-off luminaires and non-cut-off luminaires.

[SOURCE: IEC 60050-845:2020 845-30-034 / CIE S 017:2020; 17-30-034]

3.3.20
cut-off angle
<of a luminaire> angle, measured up from nadir, between the vertical axis and the first line of sight at which the light source(s) and the surfaces of high luminance are not visible

Note 1 to entry: The cut-off angle is expressed in radian (rad) or degree (°).

Note 2 to entry: The complementary angle to the cut-off angle is named shielding angle.

[SOURCE: IEC 60050-845:2020 845-30-035 / CIE S 017:2020; 17-30-035, modified – note 2 added]

3.3.21
circuit luminous efficacy of a source
η_c
quotient of the luminous flux emitted by the power absorbed by the source and associated circuits

Note 1 to entry: Circuit luminous efficacy of a source is expressed in lumens per Watt ($lm \cdot W^{-1}$).

3.3.22
control gear
controlgear
<for an electric light source> unit inserted between the power supply and at least one light source, which serves to supply the light source(s) with its (their) rated voltage or rated current, and which can consist of one or more separate components

Note 1 to entry: A control gear can include means for igniting, dimming, correcting the power factor and suppressing radio interference, and further control functions.

Note 2 to entry: A control gear can consist of a power supply and a control unit.

Note 3 to entry: A control gear can be partly or totally integrated in the light source.

Note 4 to entry: The terms “control gear” and “controlgear” are interchangeable. In IEC standards, the term “controlgear” is commonly used.

[SOURCE: IEC 60050-845:2020 845-28-048 / CIE S 017:2020; 17-28-048]

3.3.23
correction factor
factor to modify the luminaire data as presented on a particular photometric data sheet to those of similar luminaires

EXAMPLE Ballast lumen factor, length, lumen corrections.

3.3.24
emergency mode ballast lumen factor
F_{EBallast}
quotient of the emergency luminous flux of the electric lamp supplied by the emergency ballast and the luminous flux of the same electric lamp operated with the appropriate reference ballast at its rated voltage and frequency

Note 1 to entry: The emergency mode ballast lumen factor is the minimum of the values measured from the point of failure of the normal power supply continuously to the end of the rated time duration.

Note 2 to entry: The emergency mode ballast lumen factor has unit one.

[SOURCE: IEC 60050-845:2020 845-29-083, CIE S 017:2020; 17-29-083, modified – symbol added]

3.3.25
emergency lighting charging power
$P_{\text{e},i}$
input power to the charging circuit of emergency luminaires when the lamps are not operating

Note 1 to entry: Emergency lighting charging power is expressed in watts (W).

3.3.26
essential data
lamp and luminaire data required for the verification of conformity to requirements

3.3.27
minimum value emergency factor
F_{min}
worst case of the emergency time dependent factors

3.3.28
lamp code
combination of letters and numbers by which the lamp type is identified

3.3.29
lamp dimensions
dimensions of the lamp that are relevant for the luminaire design

3.3.30
luminaire code
combination of letters and numbers by which the luminaire type is identified

3.3.31
luminaire luminous efficacy
η_{l}
quotient of the total luminous flux of the luminaire, measured with its own light source(s) and equipment, and the power absorbed by the light source(s) and associated circuits of the luminaire under specified conditions

Note 1 to entry: Luminaire luminous efficacy is expressed in lumens per Watt ($\text{lm} \cdot \text{W}^{-1}$).

3.3.32
luminaire standby energy consumption
$W_{P,t}$
standby energy consumed in period *t*, by the luminaire emergency lighting charging circuit plus the standby control system controlling the luminaires when the lamps are not operating

Note 1 to entry: Luminaire standby energy consumption is expressed in kilowatt hours (kWh).

3.3.33
luminaire standby power
$P_{p,i}$
input power consumed by the charging circuit of emergency lighting luminaires and the standby power for automatic controls in the luminaire when lamps are not operating

$$P_{p,i} = P_{c,i} + P_{e,i}$$

where

$P_{p,i}$ is the luminaire standby power consumed by the luminaire with the lamps off, expressed in watts;

$P_{c,i}$ is the standby power of the controls only during the time with the lamps off, expressed in watts;

$P_{e,i}$ is the emergency lighting charging power, expressed in watts

Note 1 to entry: Luminaire standby power is expressed in watts (W).

3.3.34
luminaire power
P_i
input power consumed by the light source(s), controlgear and control circuit in or associated with the luminaire, which includes any standby power when the luminaire is turned on

Note 1 to entry: The rated luminaire power (P_i) for a specific luminaire can be obtained from the luminaire manufacturer.

Note 2 to entry: Luminaire power is expressed in watts (W).

3.3.35
nominal lamp wattage
W_{lamp}
approximate wattage used to designate or identify the lamp

Note 1 to entry: Nominal lamp wattage is expressed in watts (W).

3.3.36
standby power of the controls (with the lamps off)
$P_{c,i}$
standby input power to the control system in the luminaires during the period with the lamps not operating

Note 1 to entry: Standby power of the controls is expressed in watts (W).

3.3.37
practical emergency light source flux
Φ_{PEL}
lowest luminous flux of the light source observed during the rated duration of the emergency mode

Note 1 to entry: For discharge lamps $\Phi_{PEL} = \Phi \times f_{EBL}$ where Φ is the rated luminous flux of fluorescent or discharge lamp and f_{EBL} the ballast emergency lumen factor.

Note 2 to entry: For LED light sources:

a) if f_{EOx} is given $\Phi_{PEL} = \Phi \times f_{EOx}$

b) if $I_{emergency}$ from constant current control gear is defined: $\Phi_{PEL} = \Phi \times (I_{emergency} / I_{normal\ mode})$

where Φ is the luminous flux of the LED module under the condition corresponding to the operation in the luminaire (identical t_p) operated at the same current ($I_{normal\ mode}$), $I_{emergency}$ is the current operating in emergency mode and $I_{normal\ mode}$ is the current operating in mains healthy mode.

Note 3 to entry: Practical emergency light source flux is expressed in lumens (lm).

3.3.38
shielding angle
complementary angle of the cut-off angle

Note 1 to entry: The shielding angle is the angle measured from the horizontal, down to which the light source(s) is (are) screened by the luminaire.

Note 2 to entry: Shielding angle is expressed in radians or degrees.

[SOURCE: IEC 60050-845:2020 845-30-036 / CIE S 017:2020; 17-30-036]

3.3.39
light source
surface or object emitting light

Note 1 to entry: A light source can be self-emitting (primary light source, IEC 60050-845:2020 845-27-002 / CIE S 017:2020; 17-27-002) or non-self-emitting (secondary light source, IEC 60050-845:2020 845-27-003 / CIE S 017:2020; 17-27-003).

[SOURCE: IEC 60050-845:2020 845-27-001 / CIE S 017:2020; 17-27-001, modified – references to IEC 60050-845:2020 / CIE S 017:2020 added to note 1]

3.3.40
useful data
lamp and luminaire data beneficial to the designers and users in the planning and operation of lighting installations

3.3.41
(Entry deleted)

3.3.42
diffuse reflectance
ρ_d
quotient of the diffusely reflected part of the (whole) reflected flux and the incident flux

Note 1 to entry: Reflectance, ρ, is the sum of regular reflectance, ρ_r, and diffuse reflectance, ρ_d: $\rho = \rho_r + \rho_d$.

Note 2 to entry: The diffuse reflectance has unit one.

[SOURCE: IEC 60050-845:2020 845-24-068 / CIE S 017:2020; 17-24-068]

3.3.43
specular reflectance
regular reflectance
ρ_r
quotient of the regularly reflected part of the (whole) reflected flux and the incident flux

Note 1 to entry: Reflectance, ρ, is the sum of regular reflectance, ρ_r, and diffuse reflectance, ρ_d: $\rho = \rho_r + \rho_d$.

[SOURCE: IEC 60050-845:2020 845-24-066 / CIE S 017:2020; 17-24-066, modified – 'specular reflectance' added as an alternate term]

3.3.44
cold spot
<of a fluorescent lamp> coldest point on the discharge tube that determines the Hg pressure in the discharge tube

3.3.45
electric light source
primary light source with the means for connecting to the power supply and usually designed to be incorporated into a luminaire

Note 1 to entry: In IEC standards, "light source" is also commonly used with the same meaning.

Note 2 to entry: An electric light source can be an electric lamp, or LED module designed to be connected by terminals, connectors or similar devices.

[SOURCE: IEC 60050-845:2020 845-27-004 / CIE S 017:2020; 17-27-004]

3.3.46
LED light engine
integrated assembly or set consisting of LED module(s) and LED controlgear for direct connection to the electrical supply system

Note 1 to entry: A LED light engine typically shall have defined electrical, mechanical, thermal and control interfaces, and specific photometric properties.

Note 2 to entry: A LED light engine may incorporate a heat sink or not.

3.3.47
tuneable LED device
device with independent channels where the spectra of the emitted light can be deliberately modified

Note 1 to entry: This means chromaticity coordinates are changeable.

Note 2 to entry: For devices with independent channels and changeable chromaticity coordinates the colorimetric figures are usually determined for the gamut corners, for changeable correlated colour temperature devices the minimum and maximum correlated colour temperature and for any additional setup (defined by applicant).

3.3.48
initial value
characteristic measured at the end of the ageing period and stabilization time

Note 1 to entry: The initial value can refer to a photometric, colorimetric or electrical quantity.

[SOURCE: IEC 60050-845:2020 845-27-107 / CIE S 017:2020; 17-27-107]

3.3.49
t_p-point
designated location of the point where to measure the performance temperatures t_p at the surface of the LED module

Note 1 to entry: The location of t_p and t_c can be different.

3.3.50
integrated LED lamp
LEDi lamp
LED lamp, incorporating controlgear, and any additional elements necessary for stable operation of the light source, designed for direct connection to the supply voltage

[SOURCE: IEC 60050-845:2020 845-27-055 / CIE S 017/E:2020; 17-27-055]

3.3.51
useful luminous flux
$\Phi_{u,\alpha}$
Φ_{use}
<for a light source> part of the luminous flux of a light source which contributes predominantly to the lighting task

Note 1 to entry: For non-directional light sources the useful luminous flux is the total luminous flux of the source.

Note 2 to entry: For directional light sources the useful luminous flux is the partial luminous flux in a defined open cone, the axis of the cone being the optical beam axis of the light source, the axis about which the luminous intensity is substantially symmetrical. In general, a cone is defined by its solid angle expressed in steradian. It may also be described by the full opening angle or cone angle, α, expressed in degrees or radian, if the cone has a circular shape or by 2 full plain angles (the two planes coinciding with the major and minor axes) if elliptical. The cone angle value(s) has to be specified as a subscript of the useful luminous flux symbol e.g. $\Phi_{u,\pi/2}$ or $\Phi_{u,90°}$.

Note 3 to entry: For the calculation of energy efficiency of directional light sources, Annex III, point 1.1 of regulation (EU) No 1194/2012 specifies to consider useful flux in 90° or 120° cones depending the product characteristics stated in the regulation itself. Symbol used: Φ_{use}.

Note 4 to entry: Useful luminous flux is expressed in lumens (lm).

3.3.52
emergency output factor
EOF_X
<for electronic controlgear for LED light sources> ratio of the electrical output parameter when the controlgear is operated in emergency mode to the output electrical parameter when the controlgear is operated with the normal lighting conditions

Note 1 to entry: The electrical output parameter can be current (EOF_I), voltage (EOF_U) or power (EOF_P) at the output(s) of the controlgear (depending on the module it could be constant current, constant voltage or constant power).

Note 2 to entry: The emergency output factor is the minimum of the values measured at the appropriate time after failure of the normal supply and continuously to the end of rated duration of the emergency mode.

[SOURCE: IEC 61347-2-13:2014, 3.13, modified - note 2 to entry modified]

3.3.53
LED device
generic term to designate LED lamps, LED modules, LED light engines or LED luminaires

3.3.54
rated maximum temperature
t_c
<of a component> highest permissible safety related temperature which may occur on the outer surface of the component (LED module or control gear) (at the indicated position, if marked) under normal operating conditions and at the rated voltage/current/power or the maximum of the rated voltage/current/power range

Note 1 to entry: Rated maximum temperature is expressed in degrees Celsius (°C).

3.3.55
luminous efficacy of radiation
K, <for photopic vision>
K', <for scotopic vision>
$K_{mes;m}$, <for mesopic vision>
K_{10}, <for the CIE 10° photopic photometric observer>
K_M, <for the CIE 1988 modified 2° spectral luminous efficiency function for photopic vision>
<for a specified photometric condition> quotient of luminous flux and the corresponding radiant flux for a specified photometric condition

Note 1 to entry: The photometric condition should be specified (e.g. photopic, scotopic, mesopic). If it is not specified, photopic vision is assumed and the symbol K is used. For other photometric conditions, the respective symbol for identification shall be used.

Note 2 to entry: Luminous efficacy of radiation for photopic vision is expressed by

$$K = \frac{\Phi_v}{\Phi_e}$$

where Φ_v is luminous flux and Φ_e is radiant flux.

Note 3 to entry: The value of the luminous efficacy of radiation for photopic vision for monochromatic radiation of frequency $\nu_{cd} = 540 \times 10^{12}$ Hz is defined as 683 lm·W^{-1} and denoted as K_{cd}. The corresponding wavelength,

$$\lambda_{cd} = n^{-1} \cdot c_0 \cdot \nu_{cd}^{-1}$$

(where n is refractive index and c_0 is the speed of light in vacuum) in standard air, i.e. dry air at 15 °C and 101 325 Pa, containing 0,045 % of carbon dioxide by volume (see P.E. Ciddor: R*efractive index of air: new equations for the visible and near infrared*, Appl. Opt. Vol 35, No. 9, 1996, pp. 1566-1573), is accepted to be 555,017 nm (rounded from 555,017 069 nm). This is very close to 555 nm, the wavelength where $V(\lambda)$ reaches its maximum. For photometric measurements made in air under real environmental conditions, the influence of the variation of the refractive index on λ_{cd} with respect to standard air is typically in the range of a few picometres and can be neglected in most cases.

Note 4 to entry: See also "spectral luminous efficacy".

Note 5 to entry: The luminous efficacy of radiation is expressed in lumen per watt ($lm \cdot W^{-1}$).

[SOURCE: IEC 60050-845:2020 845-21-090 / CIE S 017:2020; 17-21-090]

3.3.56
spectral luminous efficacy
$K(\lambda)$, <for photopic vision>
$K'(\lambda)$, <for scotopic vision>
$K_{mes;m}(\lambda)$, <for mesopic vision>
$K_{10}(\lambda)$, <for the CIE 10° photopic photometric observer>
$K_M(\lambda)$, <for the CIE 1988 modified 2° spectral luminous efficiency function for photopic vision>
< for a specified photometric condition > product of spectral luminous efficiency and maximum luminous efficacy for a specified photometric condition

Note 1 to entry: The photometric condition should be specified (e.g. photopic, scotopic, mesopic). If it is not specified, photopic vision is assumed and the symbol *K(λ)* is used. For other photometric conditions, the respective symbol for identification shall be used.

Note 2 to entry: Spectral luminous efficacy for photopic vision is expressed by

$$K(\lambda) = K_m \, V(\lambda)$$

where K_m is maximum luminous efficacy, *V(λ)* is spectral luminous efficiency and λ is wavelength.

Note 3 to entry: The spectral luminous efficacy is expressed in lumen per watt ($lm \cdot W^{-1}$).

[SOURCE: IEC 60050-845:2020 845-21-091 / CIE S 017:2020; 17-21-091]

3.3.57
maximum luminous efficacy
K_m, <for photopic vision>
K'_m, <for scotopic vision>
$K_{mes;m}$, <for mesopic vision>
$K_{m,10}$, <for the CIE 10° photopic photometric observer>
$K_{m,M}$, <for the CIE 1988 modified 2° spectral luminous efficiency function for photopic vision>
< for a specified photometric condition > maximum value of spectral luminous efficacy for a specified photometric condition

Note 1 to entry: The photometric condition should be specified (e.g. photopic, scotopic, mesopic). If it is not specified, photopic vision is assumed and the symbol K_m is used. For other photometric conditions, the respective symbol for identification shall be used.

Note 2 to entry: The value of maximum luminous efficacy for photopic vision is calculated by

$$K_{\mathrm{m}} = \frac{683}{V\left(\lambda_{\mathrm{cd}}\right)} \mathrm{cd} \cdot \mathrm{sr} \cdot \mathrm{W}^{-1} \approx 683 \,\mathrm{lm} \cdot \mathrm{W}^{-1}$$

where $V(\lambda)$ is the spectral luminous efficiency for photopic vision and λ_{cd} is the wavelength in air corresponding to the frequency 540×10^{12} Hz specified in the definition of the SI unit candela.

Note 3 to entry: The maximum luminous efficacy is expressed in lumen per watt ($\mathrm{lm} \cdot \mathrm{W}^{-1}$).

[SOURCE: IEC 60050-845:2020 845-21-092 / CIE S 017:2020; 17-21-092]

3.4 Daylight

3.4.1
solar radiation
electromagnetic radiation from the sun

[SOURCE: IEC 60050-845:2020 845-29-096 / CIE S 017:2020; 17-29-096]

3.4.2
direct solar radiation
part of extraterrestrial solar radiation that, as a collimated beam, reaches the Earth's surface after selective attenuation by the atmosphere

[SOURCE: IEC 60050-845:2020 845-29-099 / CIE S 017:2020; 17-29-099]

3.4.3
diffuse sky radiation
part of solar radiation that reaches the Earth as a result of being scattered by air molecules, aerosol particles, cloud particles or other particles

[SOURCE: IEC 60050-845:2020 845-29-100 / CIE S 017:2020; 17-29-100]

3.4.4
global solar radiation
combined direct solar radiation and diffuse sky radiation

[SOURCE: IEC 60050-845:2020 845-29-101 / CIE S 017:2020; 17-29-101]

3.4.5
sunlight
part of direct solar radiation capable of causing a visual sensation

[SOURCE: IEC 60050-845:2020 845-29-103 / CIE S 017:2020; 17-29-103]

3.4.6
skylight
part of sky radiation capable of causing a visual sensation

[SOURCE: IEC 60050-845:2020 845-29-104 / CIE S 017:2020; 17-29-104]

3.4.7
daylight
part of global solar radiation capable of causing a visual sensation

[SOURCE: IEC 60050-845:2020 845-29-105 / CIE S 017:2020; 17-29-105]

3.4.8
daylight factor
D
quotient of the illuminance at a point on a given plane due to the light received directly and indirectly from a sky of assumed or known luminance distribution and the illuminance on a horizontal plane due to an unobstructed hemisphere of this sky, where the contribution of direct sunlight to both illuminances is excluded

Note 1 to entry: Glazing, dirt effects, etc. are included.

Note 2 to entry: When calculating the lighting of interiors, the contribution of direct sunlight has to be considered separately.

Note 3 to entry: The term daylight factor is normally used when considering an overcast sky as sky type 1 or 16 in ISO 15469:2004.

[SOURCE: IEC 60050-845:2020 845-29-121 / CIE S 017:2020; 17-29-121, modified – note 3 to entry added]

3.4.9
atmospheric luminance
L_{atm}
light veil as a result of the scatter in the atmosphere expressed as a luminance

Note 1 to entry: Atmospheric luminance is expressed in candelas per square metre ($cd \cdot m^{-2}$).

3.4.10
daylight screen
daylight louvre
<tunnel lighting> device that transmits (part of) the ambient daylight

Note 1 to entry: It might be applied for the lighting of the threshold zone and/or the entrance zone of a tunnel.

3.4.11
sun-tight screen
<tunnel lighting> screen that is constructed in such a fashion that direct sunlight can never reach the road or wall surface under the screen

3.4.12
daylight provision
level of illuminance achieved across a fraction of a reference plane for a fraction of daylight hours within a space

3.4.13
no-ground line for view
divider between the part of the space from which the ground can be seen directly by a sitting person and the part from which it cannot

3.4.14
no-sky line for view
divider between the part of the space from which the sky can be seen directly by a sitting person and the part from which it cannot

3.4.15
obstruction
<of a building> object outside a building that prevents the direct view of part of the sky

[SOURCE: IEC 60050-845:2020 845-29-138 / CIE S 017:2020; 17-29-138]

3.4.16
outside distance of view
distance from the inner surface of view opening to opposite major obstructions located in front of the opening

3.4.17
reference plane
<in a space> plane in a space on which illuminances and/or daylight factors are calculated, specified or measured

3.4.18
reference point for view
position from which the view is assessed

3.4.19
solar altitude
vertical angle between the line passing through the centre of the solar disc and the horizontal plane measured from the reference/observation point

3.4.20
solar azimuth
horizontal angle between vertical plane passing through the geographical north and vertical plane passing through the centre of the solar disc

Note 1 to entry: Solar azimuth is measured clockwise from due North from 0° to 360°.

3.4.21
sunlight exposure
sum of the time within a given period (e.g. on a given day) during which the sun is above the actual horizon with a cloudless sky, which may be limited by permanent obstructions like mountains, buildings, etc

Note 1 to entry: Sunlight exposure is expressed in hours (h).

3.4.22
utilized area
fraction of the space intended to be occupied

3.4.23
view
visual contact with the surrounding through an opening in the surface of a building, providing information about the surrounding landscape/cityscape, possibility to experience the weather changes and to follow the time over the day

3.4.24
view opening
any area in the building envelope admitting a view, including glazed walls, glazed doors, etc

3.5 Lighting installations

3.5.1
general lighting
substantially uniform lighting of an area without provision for special local requirements

[SOURCE: IEC 60050-845:2020 845-29-007 / CIE S 017:2020; 17-29-007]

3.5.2
localized lighting
lighting designed to illuminate the functionally defined area with higher illuminance at certain specified positions

Note 1 to entry: An example of a specified position could be those at which work is carried out.

[SOURCE: IEC 60050-845:2020 845-29-009 / CIE S 017:2020; 17-29-009, modified – example moved from main definition to note]

3.5.3
local lighting
lighting for a specific visual task, additional to and controlled separately from the general lighting

[SOURCE: IEC 60050-845:2020 845-29-008 / CIE S 017:2020; 17-29-008]

3.5.4
spacing
<in an installation> distance between the light centres of adjacent luminaires of the installation

[SOURCE: IEC 60050-845:2020 845-29-086 / CIE S 017:2020; 17-29-086]

3.5.5
spacing to height ratio
ratio of spacing to the height of the geometric centres of the luminaires above the reference plane

Note 1 to entry: For indoor lighting the reference plane is usually the horizontal working plane; for exterior lighting the reference plane is usually the ground.

3.5.6
emergency lighting
lighting provided for use when the power supply to the normal electric lighting fails

[SOURCE: IEC 60050-845:2020 845-29-010 / CIE S 017:2020; 17-29-010]

3.5.7
direct lighting
lighting by means of luminaires having a distribution of luminous intensity such that the fraction of the emitted luminous flux directly reaching the working plane, assumed to be of infinite extent, is 90 % to 100 %

3.5.8
semi-direct lighting
lighting by means of luminaires having a distribution of luminous intensity such that the fraction of the emitted luminous flux directly reaching the working plane, assumed to be of infinite extent, is 60 % to 90 %

[SOURCE: IEC 60050-845:2020 845-29-015 / CIE S 017:2020; 17-29-015]

3.5.9
general diffused lighting
lighting by means of luminaires having a distribution of luminous intensity such that the fraction of the emitted luminous flux directly reaching the working plane, assumed to be of infinite extent, is 40 % to 60 %

[SOURCE: IEC 60050-845:2020 845-29-016 / CIE S 017:2020; 17-29-016]

3.5.10
semi-indirect lighting
lighting by means of luminaires having a distribution of luminous intensity such that the fraction of the emitted luminous flux directly reaching the working plane, assumed to be of infinite extent, is 10 % to 40 %

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

3.5.11
indirect lighting
lighting by means of luminaires having a distribution of luminous intensity such that the fraction of the emitted luminous flux directly reaching the working plane, assumed to be of infinite extent, is 0 % to 10 %

[SOURCE: IEC 60050-845:2020 845-29-018 / CIE S 017:2020; 17-29-018]

3.5.12
directional lighting
lighting in which the light on the working plane or on an object is incident predominantly from a particular direction

[SOURCE: IEC 60050-845:2020 845-29-019 / CIE S 017:2020; 17-29-019]

3.5.13
diffused lighting
lighting in which the light on the working plane or on an object is not incident predominantly from a particular direction

[SOURCE: IEC 60050-845:2020 845-29-020 / CIE S 017:2020; 17-29-020]

3.5.14
floodlighting
lighting of a scene or object in order to increase considerably its luminance relative to its surroundings

[SOURCE: IEC 60050-845:2020 845-29-021 / CIE S 017:2020; 17-29-021]

3.5.15
spotlighting
lighting designed to increase considerably the illuminance of a limited area or of an object relative to the surroundings, with minimum diffused lighting

[SOURCE: IEC 60050-845:2020 845-29-022 / CIE S 017:2020; 17-29-022]

3.5.16
stroboscopic effect
apparent change of motion and/or appearance of a moving object when the object is illuminated by a light of varying intensity

Note 1 to entry: To obtain apparent immobilization or constant change of movement, it is necessary that both the object movement and the light intensity variation are periodic, and some specific relation between the object movement and light variation frequencies exists. The effect is only observable if the amplitude of the light variation is above certain limits. The motion of the object can be rotational or translational.

3.5.17
installed loading
installed power of the lighting installation per unit area (for interior and exterior areas) or per unit length (for road lighting)

Note 1 to entry: Installed loading is expressed in watts per square metre for areas ($W \cdot m^{-2}$) or kilowatts per kilometre for road lighting ($kW \cdot km^{-1}$).

3.5.18
maintenance factor
MF
DEPRECATED: light loss factor
DEPRECATED: depreciation factor
f_m
<of a lighting installation> quotient of illuminance produced by the lighting installation after a certain time interval and the illuminance produced by the installation when new

Note 1 to entry: The English term “light loss factor” and the French term “facteur de perte de lumière” are no longer used.

Note 2 to entry: The English term “depreciation factor” and the French term “facteur de dépréciation” were formerly used to designate the reciprocal of the above quotient.

Note 3 to entry: The maintenance factor takes into account light losses caused by dirt accumulation on luminaires and room surfaces (in interiors) or other relevant surfaces (in exteriors, where appropriate), and the decrease of the luminous flux of lamps.

Note 4 to entry: The maintenance factor has unit one.

[SOURCE: IEC 60050-845:2020 845-29-146]

3.5.19
room surface maintenance factor
RSMF
F_{RSM}
quotient of the light reflected by the surfaces of a room after a certain time interval and light reflected when the installation is considered conventionally as new

Note 1 to entry: The room surface maintenance factor is based on a simplified model for the effects of the deterioration of room surface reflectance properties and does not accurately account for room geometry and configuration.

[SOURCE: IEC 60050-845:2020 845-29-150 / CIE S 017:2020; 17-29-150]

3.5.20
life of lighting installation
period after which the installation cannot be restored to satisfy the required performance because of non-recoverable deteriorations

3.5.21
maintenance cycle
repetition of lamp replacement, lamp/luminaire cleaning and room surface cleaning intervals

Note 1 to entry: See also CIE 97.

3.5.22
maintenance schedule
set of instructions specifying maintenance cycle and servicing procedures

Note 1 to entry: See also CIE 97.

3.5.23
absence factor
F_A
factor indicating the proportion of time that a space is unoccupied

3.5.24
access zone
<of a road tunnel> part of the open road immediately outside (in front of) the entrance portal, covering the distance over which an approaching driver must be able to see into a road tunnel

Note 1 to entry: The access zone begins at the stopping distance point ahead of the entrance portal and it ends at the entrance portal.

[SOURCE: IEC 60050-845:2020 845-31-082 / CIE S 017:2020; 17-31-082]

3.5.25
access zone length
<tunnel lighting> length of the access zone that begins at the stopping distance point ahead of the portal and ends at the portal

Note 1 to entry: Access zone length is expressed in metres (m).

3.5.26
annual operating time
t_o
number of hours per annum for which the lamps are operating

$$t_o = t_D + t_N$$

where

t_o is the annual operating time, in hours;

t_D is the daylight time usage, expressed in hours;

t_N is the non-daylight time usage, expressed in hours

Note 1 to entry: Annual operating time is expressed in hours (h).

3.5.27
background area
area in the workplace adjacent to the immediate surrounding area

3.5.28
built-in luminaire
fixed luminaire installed into structure or equipment to provide illumination

3.5.29
carriageway
part of the road normally used by vehicular traffic

3.5.30
constant illuminance factor
F_C
ratio of the average input power over a given time to the initial installed power to the luminaire

3.5.31
curfew
time interval during which stricter requirements for the control of obtrusive light apply

Note 1 to entry: This is often a condition of use of lighting applied by a government controlling authority, usually the local government.

[SOURCE: IEC 60050-845:2020 845-29-175 / CIE S 017:2020; 17-29-175, modified – note 1 added]

3.5.32
daylight dependency factor
F_D
level of efficiency with which a control system or control strategy exploits the saving potential of daylight in a space

3.5.33
daylight time usage
t_D
annual operating hours during the daylight time

Note 1 to entry: Daylight time usage is expressed in hours (h).

3.5.34
design speed
speed adopted for a particular stated purpose in designing a road

Note 1 to entry: Design speed is expressed in kilometres per hour ($km \cdot h^{-1}$).

3.5.35
display screen equipment
DSE
alphanumeric or graphic display screen, regardless of the display process employed

[SOURCE: 90/270/EEC]

3.5.36
emergency escape lighting
part of emergency lighting that provides illumination for visibility of the escape route and of safety signage for fire-fighting and safety equipment and for the guidance and the safety of people leaving a location to a place of safety or attempting to terminate a potentially hazardous process or situation before doing so

3.5.37
emergency exit
way out marked with a safety sign that is intended to be used during an emergency leading to a defined place of safety

3.5.38
emergency lane
hard shoulder
lane parallel to the traffic lane(s) provided for emergency and/or broken-down vehicles only

3.5.39
emergency lighting charge time
t_{em}
operating hours during which the emergency lighting batteries are being charged

Note 1 to entry: Emergency lighting charge time is expressed in hours (h).

3.5.40
energy consumption used for illumination
$W_{L,t}$
energy consumed in period *t*, by the luminaires when the lamps are operating, to fulfil the illumination function and purpose in the building

Note 1 to entry: Energy consumption used for illumination usage is expressed in kilowatt hours (kWh).

3.5.41
entrance portal
<of a road tunnel> part of a road tunnel construction that corresponds to the beginning of the covered part of the road tunnel or, when open sun screens are used, to the beginning of the sun screens

[SOURCE: IEC 60050-845:2020 845-31-093 / CIE S 017:2020; 17-31-093]

3.5.42
entrance zone
<of a road tunnel > combination of the threshold zone and the first transition zone

3.5.43
escape route
designated route, used to evacuate in case of an emergency, to a place of safety

3.5.44
escape route lighting
part of emergency escape lighting provided to ensure that the escape route can be effectively identified and safely used when the location is occupied

3.5.45
exit portal
<of a road tunnel> part of a road tunnel construction that corresponds to the end of the covered part of the road tunnel or, when open sun screens are used, to the end of the sun screens

[SOURCE: IEC 60050-845:2020 845-31-094 / CIE S 017:2020; 17-31-094]

3.5.46
exit zone
<of a road tunnel> part of a road tunnel where, during daytime, the vision of a driver approaching the exit is predominantly influenced by the brightness outside the road tunnel

Note 1 to entry: The exit zone begins at the end of the interior zone. It ends at the exit portal of the road tunnel.

[SOURCE: IEC 60050-845:2020 845-31-087 / CIE S 017:2020; 17-31-087]

3.5.47
exit zone lighting
<of a road tunnel> lighting that provides the visual contact for the driver still in a road tunnel with the open road beyond the road tunnel

Note 1 to entry: It is assumed that visual contact will provide adaptation to the external condition.

[SOURCE: IEC 60050-845:2020 845-31-092 / CIE S 017:2020; 17-31-092, modified – note 1 to entry added]

3.5.48
externally illuminated safety sign
safety sign that is illuminated, when it is required, by an external emergency luminaire

3.5.49
grid points for measurement and calculation
arrangement of calculation and measurement points and their number in each dimension of the reference surface or plane

3.5.50
high-risk task area lighting
part of emergency lighting that provides illumination for the safety of people involved in a potentially dangerous process or situation and to enable proper shut down procedures for the safety of the operator and other occupants of the building

Note 1 to entry: In EN 12193 it is referred to as ‘Safety lighting for participants’.

3.5.51
integral lighting system
<of a machine> lighting system consisting of lamp(s), luminaire(s) and associated mechanical and electrical control devices, which forms a permanent part of the machine, designed to provide illumination in and/or at the machine

3.5.52
interior zone
<of a road tunnel> part of a road tunnel directly following the transition zone that stretches from the end of the transition zone to the beginning of the exit zone

[SOURCE: IEC 60050-845:2020 845-31-086 / CIE S 017:2020; 17-31-086]

3.5.53
interior zone lighting
lighting of the interior zone of the tunnel which provides adequate visibility in the interior of the tunnel, irrespective of the use of vehicle headlights

3.5.54
internally illuminated safety sign
safety sign that is illuminated, when it is required, by an internal light source

3.5.55
light centre
point used as origin for photometric measurements and calculations

[SOURCE: IEC 60050-845:2020 845-29-084 / CIE S 017:2020; 17-29-084]

3.5.56
lighting energy numeric indicator
LENI
numeric indicator of the total annual lighting energy required in the building

Note 1 to entry: The LENI can be used to make direct comparisons of the lighting energy used in buildings that have similar functions but are of different size and configuration.

Note 2 to entry: Lighting energy numeric indicator is expressed in kilowatt hours per square metre per year ($kWh \cdot m^{-2} \cdot year^{-1}$).

3.5.57
lighting scheme design
design process in which the lighting designer selects the lighting criteria for the place of interest, chooses the lighting solution, makes lighting calculations, configures the layouts, produces drawings of the lighting scheme and specifies the operating functions of the lighting system

3.5.58
lighting system
lighting equipment or lighting solution (lamps, ballast, luminaire and controls) required for the lighting scheme, its installation and operation during the life of the scheme

3.5.59
machinery
machine
assembly of linked parts or components, at least one of which moves, with the appropriate machine actuators, control and power circuits, etc. joined together for a specific application, in particular for the processing, treatment, moving or packaging of a material

Note 1 to entry: The term “machinery” also covers an assembly of machines, which, in order to achieve one and the same end, are arranged and controlled so that they function as an integral whole.

3.5.60
mixed traffic
traffic that consists of motor vehicles, cyclists, pedestrians, etc

3.5.61
motor traffic
motorized traffic
traffic that consists of motorized vehicles only

Note 1 to entry: It depends on national legislation which vehicle types are included in this classification.

Note 2 to entry: In some countries it only includes vehicles which are capable of maintaining a minimum speed. In others, mopeds are not considered as motorized traffic.

3.5.62
non-daylight time usage
t_N
annual operating hours during the non-daylight time

Note 1 to entry: Non-daylight time usage is expressed in hours (h).

3.5.63
occupancy dependency factor
F_O
factor indicating the proportion of time that a space is occupied and lighting is required

3.5.64
open area (anti-panic) lighting
part of emergency escape lighting provided to avoid panic and provide illumination allowing people to reach a place where an escape route can be identified

3.5.65
operating time
t
time period for the energy consumption

Note 1 to entry: Operating time is expressed in hours (h).

3.5.66
parting zone
<of a road tunnel> first part of the open road directly after the exit portal of a road tunnel

Note 1 to entry: The parting zone is not a part of the road tunnel, but it is closely related to the road tunnel lighting. The parting zone begins at the exit portal. It is advised that the length of the parting zone is equal to 2 times the stopping distance. A length of more than 200 m is not necessary.

[SOURCE: IEC 60050-845:2020 845-31-085 / CIE S 017:2020; 17-31-085]

3.5.67
principal area
$A_{Principle}$
actual playing area needed for the performance of a certain sport

Note 1 to entry: Usually this means the actual marked out “field” area for that sport (for instance football), but in some cases this area comprises an extra playing area around the marked area (e.g. tennis, volleyball, table tennis). The dimensions of the particular area should be checked at the time when a lighting installation is being installed.

3.5.68
reference area
area defined per sports on which the main lighting requirements apply including the marking lines and any extra area centred around the marked area

Note 1 to entry: The dimensions of this area are generally based on P4, for the relevant sport and level of competition. For most sports this reference area is limited by a rectangle in the horizontal plane of the ground.

3.5.69
rooflight
skylight <of a building>
daylight opening on the roof or on a horizontal surface of a building

[SOURCE: IEC 60050-845:2020 845-29-141 / CIE S 017:2020; 17-29-141]

3.5.70
safety sign
sign that gives a general safety message, obtained by a combination of colour and geometric shape and which, by the addition of a graphical symbol, gives a particular safety message

[SOURCE: ISO 3864-1:2011, 3.12]

3.5.71
(Entry deleted)

3.5.72
speed limit
maximum legally allowed speed

Note 1 to entry: Speed limit is expressed in kilometres per hour ($km \cdot h^{-1}$).

3.5.73
standard year time
t_y
time taken for one standard year to pass, taken as 8 760 h

3.5.74
standby lighting
stand-by lighting
part of emergency lighting provided to enable normal activities to continue substantially unchanged

[SOURCE: IEC 60050-845:2020 845-29-013 / CIE S 017:2020; 17-29-013]

3.5.75
stopping distance
distance needed to bring a vehicle, driving at design speed, to a complete standstill

Note 1 to entry: The stopping distance is usually defined in national legislation or regulation.

Note 2 to entry: The stopping distance includes both the distance covered while reacting and the distance covered while braking.

Note 3 to entry: Stopping distance is expressed in metres (m).

3.5.76
surrounding area
immediate surrounding area
strip surrounding the task area within the field of vision

Note 1 to entry: In exterior applications this strip should have a width of at least 2 m.

[SOURCE: IEC 60050-845:2020 845-29-172 / CIE S 017:2020; 17-29-172, modified – synonym 'immediate surrounding area' added]

3.5.77
task area
partial area in the work place in which the visual task is carried out

Note 1 to entry: For work places where the size and/or location of the task area are unknown, the area where the task might be performed is the task area.

[SOURCE: IEC 60050-845:2020 845-29-171 / CIE S 017:2020; 17-29-171]

3.5.78
threshold zone
<of a road tunnel> first part of a road tunnel, directly after the entrance portal

Note 1 to entry: The threshold zone starts either at the beginning of the road tunnel or at the beginning of the sun screen when a sun screen is installed. The length of the threshold zone is at least equal to the stopping distance.

3.5.79
threshold zone lighting
lighting of the threshold zone of the tunnel which allows drivers to see into the tunnel whilst in the access zone

3.5.80
total area
A_{Total}
area generally comprising the principal area plus an additional safety area outside the principal area

Note 1 to entry: This term may be used in addition to and in relation to playing area and reference area in sports lighting.

3.5.81
total energy used for lighting
W_t
energy consumed in period *t*, by the luminaires, when the lamps are operating plus the standby loads when the lamps are not operating, in a room or zone

Note 1 to entry: Total energy used for lighting is expressed in kilowatt hours (kWh).

3.5.82
total installed charging power of the emergency lighting luminaires in the room or zone
P_{em}
input charging power of all emergency lighting luminaires

$$P_{em} = \sum_i P_{e,i}$$

where

P_{em} is the total installed charging power of the emergency lighting luminaires in the room or zone, expressed in watts;

$P_{e,i}$ is the emergency lighting charging power, expressed in watts

Note 1 to entry: Total installed charging power of the emergency lighting luminaires in the room or zone is expressed in watts (W).

3.5.83
total installed lighting power in the room or zone
P_n
power of all luminaires

$$P_n = \sum_i P_i$$

where

P_n is the total installed lighting power in the room or zone, expressed in watts;

P_i is the luminaire power expressed in watts

Note 1 to entry: Total installed lighting power in the room or zone is expressed in watts (W).

3.5.84
total installed standby power of the controls in the room or zone
P_{pc}
input power of all control systems in luminaires when the lamps are not operating

$$P_{pc} = \sum_i P_{c,i}$$

where

P_{pc} is the total installed standby power of the controls in the room or zone, expressed in watts;

$P_{c,i}$ is the standby power of the controls only during the time with the lamps off, expressed in watts

Note 1 to entry: Total installed standby power of the controls in the room or zone is expressed in watts (W).

3.5.85
traffic lane
strip of carriageway intended to accommodate a single line of moving vehicles

3.5.86
transition zone
<of a road tunnel> part of a road tunnel that follows directly after the threshold zone and ends at the beginning of the interior zone

Note 1 to entry: In the transition zone, the lighting level is decreasing from the level at the end of the threshold zone to the level of the interior zone.

[SOURCE: IEC 60050-845:2020 845-31-084 / CIE S 017:2020; 17-21-084]

3.5.87
transition zone lighting
lighting of the transition zone which helps drivers to adapt to the lighting level in the zones ahead

3.5.88
traffic
number of vehicles passing a specific point in a stated time in stated direction(s)

Note 1 to entry: In tunnel design, peak hour traffic is used, expressed in vehicles per hour per lane.

3.5.89
upward flux ratio
UFR
ratio between the flux from all considered luminaires above the horizontal plane passing through the luminaires in their installed position on site plus their flux reflected by the ground and the minimal irreducible flux reflected towards the sky by the sole reference surface

3.5.90
upward flux maximum
maximum possible value of flux in an installation that is potentially emitted above the horizontal both directly from the luminaire(s) mounted in their installed attitude, and indirectly due to reflection from lit surfaces within the space

Note 1 to entry: Upward flux maximum is expressed in lumens (lm).

3.5.91
upward flux minimum
UPF_{min}
minimum possible value of flux in an installation that is emitted above the horizontal

Note 1 to entry: This value assumes no upward flux is directly emitted from the luminaire(s) and the task area is lit to just the required level with no spill light onto adjacent areas. UPF_{min} is therefore the flux reflected by the task area under these conditions.

Note 2 to entry: Upward flux minimum is expressed in lumens (lm).

3.5.92
upward light ratio
R_{UL}
proportion of the total luminaire flux that is emitted above the horizontal by all luminaires to the total luminaire flux from all luminaires in an installation, when the luminaires are mounted in their installed attitudes

3.5.93
useful area
A
floor area inside the outer walls excluding non-habitable cellars and un-illuminated spaces

Note 1 to entry: Useful area is expressed in square metres (m^2).

3.5.94
window
daylight opening on a vertical, nearly vertical, or sloped area of a room envelope

[SOURCE: IEC 60050-845:2020 845-29-140 / CIE S 017:2020; 17-29-140, modified – inclusion of sloped area of a room envelope]

3.5.95
work place
place intended to house work stations on the premises of the undertaking and/or establishment and any other place within the area of undertaking and/or establishment to which the workers have access in the course of their employment

[SOURCE: IEC 60050-845:2020 845-29-173 / CIE S 017:2020; 17-29-173]

3.5.96
working plane
work plane
utilization plane
reference surface defined as the plane at which work is normally done

[SOURCE: IEC 60050-845:2020 845-29-068 / CIE S 017:2020; 17-29-068]

3.5.97
work station
combination and spatial arrangement of work equipment, surrounded by the work environment under the conditions imposed by the work tasks

[SOURCE: IEC 60050-845:2020 845-29-174 / CIE S 017:2020; 17-29-174]

3.5.98
(Entry deleted)

3.5.99
daylight opening
any area in the building envelope that is capable of admitting daylight to an interior

Note 1 to entry: See EN 1873:2014 + A1:2016, 3.1 individual plastic rooflight.

Note 2 to entry: See EN 14963:2006, 3.1 continuous plastic rooflight.

Note 3 to entry: See EN 12519:2018, 2.33 roof window.

Note 4 to entry: See EN 12519:2018, 2.45 window.

Note 5 to entry: See EAD 220021-00-0402:July 2015, Tubular daylighting device (TDD).

3.5.100
place of safety
designated place normally outside the building where escaping people can assemble safely and are not at risk of the emergency status

3.5.101
local area lighting
part of emergency lighting that provides illumination for people allowed to remain temporarily in a premise during a mains supply failure if it is risk assessed for the activities that are allowed to be performed

3.5.102
final emergency exit
termination of an escape route from a building or premises giving direct access to a street, passageway, walkway or open space, and sited to ensure the rapid dispersal of persons from the vicinity of a building or premises

3.5.103
adaptive emergency escape lighting system
AEELS
electrically operated escape lighting system which provides directional guidance and adequate illuminance by means of a set of emergency lighting luminaires and directional indication that can manually or automatically change the escape route direction and improve the conspicuity of the emergency signage and optionally adapt the lighting level on escape routes

3.5.104
adaptive safety sign
internally illuminated escape route safety sign that interacts together with luminaires to change the information it displays to indicate an alternative escape route or to indicate that the route is closed or not available for use

3.5.105
roof window
window intended for installation in a roof

Note 1 to entry: Roof windows have the same characteristics as windows installed in walls with regard to function, cleaning, maintenance and durability.

[SOURCE: EN 12519:2018, 2.33]

3.6 Lighting measurements

3.6.1
photometer
instrument for measuring photometric quantities

[SOURCE: IEC 60050-845:2020 845-25-019 / CIE S 017:2020; 17-25-019]

3.6.2
colorimeter
instrument for measuring colorimetric quantities, such as the tristimulus values of a colour stimulus

[SOURCE: IEC 60050-845:2020 845-25-022 / CIE S 017:2020; 17-25-022]

3.6.3
illuminance meter
instrument for measuring illuminance

[SOURCE: IEC 60050-845:2020 845-25-020 / CIE S 017:2020; 17-25-020]

3.6.4
luminance meter
instrument for measuring luminance

[SOURCE: IEC 60050-845:2020 845-25-021 / CIE S 017:2020; 17-25-021]

3.6.5
reflectometer
instrument for measuring quantities pertaining to reflection

[SOURCE: IEC 60050-845:2020 845-25-030 / CIE S 017:2020; 17-25-030]

3.6.6
measurement field
<of a photometer> area including all points in object space, radiating towards the acceptance area of the detector

3.6.7
***V*(λ) correction**
correction of the spectral responsivity of a detector to match the photopic spectral sensitivity of the human eye

Note 1 to entry: See also IEC 60050-845:2020 845-21-036 / CIE S 017:2020; 17–21-036, IEC 60050-845:2020 845-21-035 / CIE S 017:2020; 17–21-035.

3.6.8
cosine correction
correction of a detector for the influence of the incident direction of the light

Note 1 to entry: For the ideal detector, the measured illuminance is proportional to the cosine of the angle of incidence of the light. The angle of incidence is the angle between the direction of the light and the normal to the surface of the detector.

3.6.9
image luminance measuring device
ILMD
digital electronic device, equipped with a lens, an adequate photometric matching filter, a sensor made by a matrix of detector (pixel), and calibrated for measuring the luminance distributions of the framed scene

Note 1 to entry: Every pixel is calibrated to determine the luminance values of the space imaged on its surface by the lens system.

Note 2 to entry: The matrix of pixel is generally realized with CCD (charge coupled device) or CMOS (complementary metal oxide semiconductor) sensors.

Note 3 to entry: In literature different terms can be found to describe ILMD such as multi-channel luminance meter, luminance mapper, array (or matrix) luminance meter, video photometer, photo luminance meter, CCD luminance meter, luminance camera, multidirectional luminance meter, spatial luminance profile device.

3.6.10
measurement lamp
lamp used for the photometric characterization of a luminaire

3.6.11
photometer head
combination of a detector and facilities for the spectral weighting of the detected radiation

Note 1 to entry: It might also contain facilities for directional evaluation of the light, e.g. diffusing windows, lenses, and apertures.

4 Framework for the specification of lighting requirements

4.1 General

The principal design parameters that shall be considered when determining the lighting requirements for a specific application are described in 4.2 to 4.9. These parameters shall be specified in the form defined in 4.2 to 4.9. For some of these parameters it has been possible to give a preferred set of values that shall be used. Additional parameters may be required for some specific applications.

4.2 Illuminance

Illuminance shall be specified as maintained illuminance and shall take one of the following values:

1×10^N lx; $1{,}5 \times 10^N$ lx; $2{,}0 \times 10^N$ lx; $3{,}0 \times 10^N$ lx; $5{,}0 \times 10^N$ lx; $7{,}5 \times 10^N$ lx (where N is an integer).

The area over which the illuminance is to be calculated or measured shall be specified.

4.3 Luminance

Luminance shall be specified as maintained luminance and shall take one of the following values of $\bar{L}_{\mathrm{m}}$:

1×10^N cd · m^{-2}; $1{,}5 \times 10^N$ cd · m^{-2}; $2{,}0 \times 10^N$ cd · m^{-2}; $3{,}0 \times 10^N$ cd · m^{-2}; $5{,}0 \times 10^N$ cd · m^{-2}; $7{,}5 \times 10^N$ cd · m^{-2} (where N is an integer).

The area over which the luminance is to be calculated or measured shall be specified.

4.4 Glare

4.4.1 Disability glare

Disability glare may be expressed in a number of different ways. If threshold increment is used the following values of threshold increment shall be used (see CIE 31):

5 %; 10 %; 15 %; 20 %; 25 %; 30 %.

If glare rating is used the following values of glare rating shall be used (see CIE 112):

10; 20; 30; 40; 45; 50; 55; 60; 70; 80; 90.

4.4.2 Discomfort glare

Discomfort glare may be expressed by means of a 'psychometric scale' derived from psychophysical experiments.

If it is expressed using the unified glare rating the following values of unified glare rating shall be used (see CIE 117):

10; 13; 16; 19; 22; 25; 28.

4.5 Colour

4.5.1 Colour rendering

For design purposes, colour rendering requirements shall be specified using the general colour rendering index and shall take one of the following values of R_a:

20; 40; 60; 80; 90.

4.5.2 Light source colour

The colour of a light source can be expressed by its correlated colour temperature.

4.6 Energy

The energy consumed by a lighting installation to meet the lighting requirements depends on the installed loading, the hours of use and the control regime. Energy targets, in kWh per year per unit area or length, should be set to encourage energy efficiency.

4.7 Maintenance

4.7.1 Maintenance

A procedure for servicing the lighting system at defined intervals shall be specified.

4.7.2 Maintenance factor

A maintenance factor indicating the proportion of the initial light output available at the specified time shall be specified (see CIE 97 and CIE 154).

4.8 Measurements and calculations

Measurement and/or calculation procedures shall be given for all lighting application parameters required to be measured as set out in standards. The measurement procedures shall also consider the uncertainty of measurements. The calculation procedures shall also consider the tolerances of the relevant parameters.

Annex A
(informative)

Additional explanation of defined terms

NOTE For convenient use of this annex the numbering of the subclauses of this annex corresponds to the numbering in Clause 3.

A.3.1.1 adaptation

Process which takes place as the visual system adjusts to the luminance and colour of the visual field or the final state of this process.

A.3.1.2 accommodation

Adjustment of the power of the lens of the eye for the purpose of focussing an image of an object on the retina.

A.3.1.3 visual acuity

Capacity for seeing distinctly fine details that have very small angular subtends at the eye.

NOTE Quantitatively, it can be expressed by the reciprocal of the angle, in minutes of arc, subtended at the entrance of the pupil by the extremities of the detail separation which is just visible.

A.3.1.4 brightness

Attribute of the visual sensation associated with the amount of light emitted from a given area. It is the subjective correlate of luminance.

A.3.1.8 glare

See also 3.2.22 and 3.2.23.

A.3.2.1 luminous flux

Quantity derived from radiant flux (radiant power) by evaluating the radiation according to the spectral sensitivity of the human eye (as defined by the CIE standard photometric observer). It is the light power emitted by a source or received by a surface, unit: lumen (lm).

NOTE 1 In this definition, the values used for the spectral sensitivity of the CIE standard photometric observer are those of the spectral luminous efficiency function $V(\lambda)$.

NOTE 2 See IEC 60050-845:2020 845-21-035 / CIE S 017:2020; 17–21-035 for the definition of spectral luminous efficiency, IEC 60050-845:2020 845-21-036 / CIE S 017:2020; 17-21-036 for the definition of the CIE standard photometric observer and IEC 60050-845:2020 845-21-089 / CIE S 017:2020; 17–21-089 for the definition of luminous efficacy of radiation. See EN ISO/CIE 11664-1.

A.3.2.2 luminous intensity (of a point source in a given direction)

Luminous flux per unit solid angle in the direction in question, i.e. the luminous flux on a small surface, divided by the solid angle that the surface subtends at the source (see also IEC 60050-845:2020 845-21-045 / CIE S 017:2020; 17-21-045).

unit: cd = lm · sr^{-1} (cd = candela, sr = steradian)

NOTE The candela is the fundamental SI photometric unit. For its definition, see IEC 60050-845:2020 845-21-083 / CIE S 017:2020; 17-21-083.

A.3.2.3 luminance

Luminous flux per unit solid angle transmitted by an elementary beam passing through the given point and propagating in the given direction, divided by the area of a section of that beam normal to the direction of the beam and containing the given point (see also IEC 60050-845:2020 845-21-050 / CIE S 017:2020; 17-21-050).

It can also be defined as:

a) the luminous intensity of the light emitted or reflected in a given direction from an element of the surface, divided by the area of the element projected in the same direction;

b) the illuminance produced by the beam of light on a surface normal to its direction, divided by the solid angle of the source as seen from the illuminated surface.

It is the physical measurement of the stimulus which produces the sensation of brightness.

A.3.2.10 illuminance

The orientation of the surface might be defined, e.g. horizontal, vertical, hence horizontal illuminance, vertical illuminance.

A.3.2.20 reference surface

Optical properties may include illuminance, reflectance, transmittance, luminance, etc.

A.3.2.21 disability glare

Disability glare can be produced directly or by reflection.

A.3.2.22 discomfort glare

Discomfort glare can be produced directly or by reflection.

A.3.2.25 colour rendering (of a light source)

Effect of a light source on the colour appearance of objects compared with their colour appearance under a reference light source.

A.3.2.26 general colour rendering index (of a light source)

Value intended to specify the degree to which objects illuminated by a light source have an expected colour relative to their colour under a reference light source.

NOTE R_a is derived from the colour rendering indices for a specified set of 8 test colour samples. R_a has a maximum of 100, which generally occurs when the spectral distributions of the light source and the reference light source are substantially identical. (See CIE Publication 13.3).

A.3.2.28 tristimulus values

See also CIE 15.

A.3.2.29 chromaticity coordinates

See also CIE 15.

A.3.2.30 chromaticity

See also CIE 15.

A.3.2.31 colour temperature

See also CIE 15.

A.3.2.34 reflectance

Ratio of the luminous flux reflected from a surface to the luminous flux incident on it.

NOTE The reflectance generally depends on the direction and spectral distribution of the incident light and on the surface finish.

A.3.2.35 transmittance

Ratio of the luminous flux transmitted through a body to the luminous flux incident on it.

NOTE The transmittance generally depends on the direction and spectral distribution of the incident light and on the surface finish.

A.3.2.36 absorptance

Ratio of the luminous flux absorbed in a body to the luminous flux incident on it.

NOTE The absorptance generally depends on the direction and spectral distribution of the incident light and on the surface finish.

A.3.2.37 photometry

Measurement of quantities referring to radiation evaluated according to the spectral sensitivity of the human eye (as defined by the CIE standard photometric observer).

NOTE 1 The values usually used for the spectral sensitivity of the CIE standard photometric observer are those of the spectral luminous efficiency function $V(\lambda)$.

NOTE 2 See IEC 60050-845:2020 845-21-035 / CIE S 017:2020; 17–21-035 for the definition of spectral luminous efficiency, IEC 60050-845:2020 845-21-036 / CIE S 017:2020; 17–21-036 for the definition of the CIE standard photometric observer and IEC 60050-845:2020 845-21-089 / CIE S 017:2020; 17–21-089 for the definition of luminous efficacy of radiation. See EN ISO/CIE 11664-1.

A.3.3.1 lamp

For LED technology lamps may be replaceable (LED lamp) or non-replaceable (built-in or integral LED module), depending upon the design of the luminaire. See EN 62504.

A.3.3.6 rated lamp luminous flux

For most lamps, in reference conditions the lamp is usually operating at an ambient temperature of 25°C in still air, freely suspended in a defined burning position and with a reference ballast, but see the relevant IEC standard for the particular lamp.

A.3.3.7 luminous efficacy (of a source)

If not otherwise specified, the measurement conditions should be the reference conditions specified in the relevant IEC standard (see 3.3.6).

A.3.3.13 (spatial) distribution of luminous intensity (of a source)

Luminous intensity of a source (lamp or luminaire) as a function of direction in space.

A.3.3.14 utilization factor (of an installation)

Ratio of the luminous flux received by the reference surface to the sum of the rated lamp luminous fluxes of the lamps of the installation.

A.3.5.4 spacing (in an installation)

See IEC 60050-845:2020 845-29-084 / CIE S 017:2020; 17-29-084 for definition of light centre.

A.3.5.18 maintenance factor (of a lighting installation)

Ratio of maintained illuminance to initial illuminance (see CIE 97).

NOTE Maintenance factor of an installation depends on lamp lumen maintenance factor, lamp survival factor, luminaire maintenance factor and (for an interior lighting installation) room surface maintenance factor.

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