SLOVENSKI STANDARD
SIST EN 12464-2:2025

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Svetloba in razsvetljava - Razsvetljava na delovnem mestu - 2. del: Delovna mesta na prostem

Light and lighting - Lighting of work places - Part 2: Outdoor work places

Licht und Beleuchtung - Beleuchtung von Arbeitsstätten - Teil 2: Arbeitsplätze im Freien

Lumière et éclairage - Éclairage des lieux de travail - Partie 2: Lieux de travail extérieurs

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ICS:

91.160.20	Zunanja razsvetljava stavb	Exterior building lighting

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Light and lighting - Lighting of work places - Part 2: Outdoor work places

Lumière et éclairage - Éclairage des lieux de travail - Partie 2: Lieux de travail extérieurs

Licht und Beleuchtung - Beleuchtung von Arbeitsstätten - Teil 2: Arbeitsplätze im Freien

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Contents

European foreword

This document (EN 12464-2:2024) 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of an identical text or by endorsement, at the latest by May 2025, and conflicting national standards shall be withdrawn at the latest by May 2025.

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 12464-2:2014.

EN 12464-2:2024 includes the following significant technical changes with respect to EN 12464-2:2014:

— A new Clause 4 is introduced to summarize “Symbols and abbreviations”.

— The recommendations given in the tables in Clause 6 are slightly revised, new applications are added where appropriate and take user needs more into account than in the past. Thus, the requirements for necessary illuminance according to Clause 6 are more differentiated including the relevance of context modifiers.

— Variability of light is given more accordance (5.1).

— A maximum for cell grid size is given (5.3.5).

— The graphical representation of the grid cell size as a function of calculation area dimension in Figure 1 (5.3.5) has been extended.

— The environmental zone E0 is introduced (5.5).

— Flicker and stroboscopic effect is updated (5.8).

— Sustainability is updated (5.10).

— A new informative Annex A is introduced to provide “Reflectances of some outdoor materials”.

— A new informative Annex B is introduced to provide additional information on the specific requirements for railway installations that are given in Table 22.

EN 12464, *Light and lighting — Lighting of work places* consists of the following parts:

— *Part 1: Indoor work places*

— *Part 2: Outdoor work places*

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

To enable people to perform outdoor visual tasks efficiently and accurately, especially during the night, adequate and appropriate lighting should be provided.

The degree of visibility and comfort required in a wide range of outdoor work places is governed by the type and duration of activity.

This document specifies requirements for lighting of tasks in most outdoor work places and their associated areas in terms of quantity and quality of illumination. In addition, recommendations are given for good lighting practice.

It is important that all clauses of the document are followed although the specific requirements are tabulated in the schedule of lighting requirements (see Clause 6).

All photometric quantities are based on photopic photometry.

The original standard EN 12464-2:2007 was already further developed in its first revision EN 12464-2:2014. It specifies the requirements for good lighting solutions rather than giving design guidelines. With the experience of applying the standard, next steps are taken in the development of this new edition and human and user needs are given broader acknowledgement. Technologically LED has taken over as the main light source from previous technologies. The revision of the standard is aligned to the parallel standard for indoor workplaces EN 12464-1:2021.

1 Scope

This document specifies lighting requirements for humans in outdoor work places, which meet the needs for visual comfort and performance of people having normal, or corrected to normal ophthalmic (visual) capacity. Usual visual tasks and the avoidance of obtrusive light are considered.

This document specifies requirements for lighting solutions for most outdoor work places and their associated areas in terms of quantity and quality of illumination. In addition, recommendations are given for good lighting practice. This document does not specify lighting requirements with respect to the safety and health of people at work and has not been prepared in the field of application of Article 153 of Treaty on the Functioning of the European Union although the lighting requirements, as specified in this document, usually fulfil safety needs.

NOTE Lighting requirements with respect to the safety and health of workers at work can be contained in Directives based on Article 153 of Treaty on the Functioning of the European Union, in national legislation of member states implementing these directives or in other national legislation of member states.

This document neither provides specific solutions, nor restricts the designers' freedom from exploring new techniques nor restricts the use of innovative equipment. The illumination can be provided by daylight, electric lighting or a combination of both.

This document is not applicable for the lighting of indoor work places and underground mining or emergency lighting. For indoor work places, see EN 12464-1 and for emergency lighting, see EN 1838 and EN 13032-3.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12665, *Light and lighting — Basic terms and criteria for specifying lighting requirements*

EN 17037, *Daylight in buildings*

ISO 3864-1, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

ISO/CIE TS 22012, *Light and lighting — Maintenance factor determination — Way of working*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12665, EN 17037 and the following apply.

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

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

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

3.1
activity area
area which contains one or more visual tasks

Note 1 to entry: Visual tasks can be different in type and/or position.

Note 2 to entry: A large area can contain one or more activity areas.

Note 3 to entry: The spatial orientation needs to be specified by the designer.

Note 4 to entry: An activity area is not to be considered as aggregation of a number of distinct task areas across a larger area.

[SOURCE: EN 12464-1:2021, 3.1, modified – Note 2 to entry has been adapted to outdoor work places]

3.2
modelling
effect of directional lighting to reveal the depth, shape and texture of an object or person

[SOURCE: CIE S 017:2020, 17-29-170]

3.3
pre-curfew
time before stricter requirements for the control of obtrusive light apply

Note 1 to entry: Curfew is defined as time interval during which stricter requirements for the control of obtrusive light apply. This is often a condition of use of lighting applied by a government controlling authority, usually the local government.

3.4
post-curfew
time after stricter requirements for the control of obtrusive light applied

Note 1 to entry: Curfew is defined as time interval during which stricter requirements for the control of obtrusive light apply. This is often a condition of use of lighting applied by a government controlling authority, usually the local government.

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

$\bar{E}_{\mathrm{m}}$	maintained illuminance[1]	5.3.3
d	relevant dimension of the area (m)	5.3.5
p	maximum grid cell size (m)	5.3.5
U_{o}	illuminance uniformity	5.3.6
U_{d}	illuminance diversity	5.3.6
L_{vl}	total veiling luminance ($\mathrm{cd \cdot m^{-2}}$)	5.4.2
E_{eye}	illuminance at the observer's eye	5.4.2
Θ	angle between the observer's line of sight and the direction of the light	5.4.2
L_{ve}	equivalent veiling luminance of the environment in $\mathrm{cd \cdot m^{-2}}$	5.4.2
E_{hav}	average horizontal illuminance of the area	5.4.2
ρ	average reflectance	5.4.2
R_{G}	CIE Glare Rating	5.4.2
R_{GL}	R_{G} limit value	5.4.2
E_{v}	maximum value of vertical illuminance on properties	5.5
I	Luminous intensity	5.5
R_{UL}	Upward light ratio	5.5
L_b	Luminance of the façade of a building	5.5
L_s	maximum average luminance of work related information signs	5.5
L_v	veiling luminance	5.5
TI	Threshold increment	5.5
T_{cp}	correlated colour temperature	5.7.2
R_{a}	colour rendering index	5.7.3
R_{i}	special colour rendering index	5.7.3
TLA	temporal lighting artefacts	5.8.1
$P_{\mathrm{st}}^{\mathrm{LM}}$	IEC short-term light modulation/flicker indicator	5.8.2
SVM	Stroboscopic Visibility Measure	5.8.3
$\bar{E}$	average illuminance	5.8.3
f_{m}	maintenance factor	5.9
$\bar{E}_{\mathrm{i}}$	initial illuminance	5.9

[1] According to EN 12655, $\bar{E}_{\mathrm{m}}$ is the value below which the average illuminance on a specified area shall not fall.

5 Lighting design criteria

5.1 Luminous environment

For good lighting practice it is essential that as well as the required illuminance, additional qualitative and quantitative needs are satisfied.

Lighting requirements are determined by the satisfaction of three basic human needs:

— Visual comfort, where the workers have a feeling of well-being; in an indirect way also contributing to a higher productivity level and a higher quality of work;

— Visual performance, where the workers are able to perform their visual tasks, even under difficult circumstances and during longer periods;

— Safety.

The main parameters determining the luminous environment with respect to electric lighting and daylighting are:

— Luminance distribution,

— Illuminance,

— Glare,

— Directionality of light,

— Colour rendering and colour appearance of the light,

— Flicker,

— Variability of light (levels and colour of light),

— Uniformity.

These criteria are further detailed in Clause 5, requirements and recommendations are given in Clause 6.

NOTE Intentionally improved and designed luminous environment, glare-free illumination, good colour rendering, high contrast markings and optical and tactile guiding systems can improve visibility and sense of direction and locality (see CIE 196:2011).

In addition to the lighting, there are other visual ergonomic parameters which influence visual performance, such as:

— The intrinsic task properties (size, shape, position, colour and reflectance properties of detail and background);

— Ophthalmic capacity of the person (visual acuity, depth perception, colour perception) (see CIE 227);

— For the visually impaired, for example those who are sensitive to glare, have visual field defects, adaptation and decreased contrast and colour vision where dimming, protection against glare and colour rendering are especially important factors to consider (see CIE 227).

Attention to these factors can enhance visual performance without the need for higher illuminance.

5.2 Luminance distribution

5.2.1 General

The luminance distribution in the visual field controls the adaptation level of the eyes, which affects task visibility.

A well balanced luminance distribution is needed to increase:

— Visual acuity (sharpness of vision),

— Contrast sensitivity (discrimination of small relative luminance differences),

— Efficiency of the ocular functions (such as accommodation, convergence, pupillary contraction, eye movements).

In an outdoor working environment lighting conditions can vary between bright and dark hours.

The luminance distribution in the visual field also affects visual comfort. The following should be avoided in both daytime and night-time hours for the reasons given:

— Sudden changes in luminance. Too slow adaptation to darker areas may result in reduced visibility. Especially in daylight conditions when moving from dim to bright areas the luminance contrast can become very high.

— Too high luminances and luminance contrasts which may give rise to glare.

— Hard shadows from daylight and electric light from narrow beamed light sources shall be avoided. Hard shadows from sunlight can provide shading objects and create bad working conditions due to low visibility and large differences in the luminous distribution.

The perceived luminous distribution and adaptation luminance depends mainly on the reflectance of outdoor surfaces, the luminous intensity distribution of the luminaire, and the number and location of luminaires assembled in the space.

Although luminance requirements would be a representative way of describing the visual environment, this document lists illuminance requirements as luminance requirements are more complex due to their dependence on exact material characteristics and viewing positions.

The lighting designer shall consider and select appropriate reflectance (5.2.2) and illuminance requirements for the exterior surfaces (5.2.3) based on the guidance below.

NOTE Weather conditions, e.g. snow, fog and rain will have a significant effect on luminance distribution.

5.2.2 Reflectance of surfaces

In design calculations, surface reflectances should be defined as close to the real surfaces as possible taking into account the variation in reflectance across the surface. Typical reflectances of major clean and diffuse surfaces commonly used outdoors are given in Annex A. However, dust and moisture can change the reflectances of surfaces over time.

NOTE Facade elements made of clear or mirrored glass often have only a low diffuse reflectance of less than 0,1. Nevertheless, depending on the viewing direction, the luminance of luminaires nearby or the sun can be reflected. These reflections can lead to high glare as well as light pollution (obtrusive light) and are reduced by repositioning the luminaire or by shading the surface of the window.

5.2.3 Illuminance on surface

Illuminances on surfaces together with surface reflectances (see 5.2.2) contribute to luminances.

5.3 Illuminance

5.3.1 General

The illuminance and its distribution on the task area and the surrounding area have a great impact on how quickly, safely and comfortably a person perceives and carries out the visual task.

All values of illuminances specified in this standard are maintained illuminances.

All illuminance average and uniformity values are dependent upon the grid definition (see 5.3.5).

5.3.2 Scale of illuminance

To give a perceptual difference the recommended steps of illuminance (in lx) are according to EN 12665:

2 – 3 - 5 - 7,5 - 10 – 15 - 20 - 30 - 50 - 75 - 100 - 150 - 200 - 300 - 500 - 750 - 1 000 - 1 500 - 2 000

NOTE In special occasions, such as to protect nocturnal species and enable the visibility of the night sky, it is sometimes relevant to plan with lighting illuminances lower than 2 lx.

5.3.3 Illuminance on the task and activity area

The values given in Clause 6 are maintained illuminances over the task area on the reference surface, which may be horizontal, vertical or inclined. The average illuminance for each task shall not fall below the value given in Clause 6, regardless of the age and condition of the installation.

The values are valid for normal visual conditions and take into account the following factors:

— Psycho-physiological aspects such as visual comfort and well-being;

— Requirements for visual tasks;

— Visual ergonomics;

— Practical experience;

— Safety;

— Economy.

As an example, an increase of one step is recommended if one or two of the conditions listed in Table 1 apply and an increase of two steps is recommended if more than two of these conditions apply. Obtrusive light shall be considered.

Table 1 — Context modifiers for increase of maintained illuminance

visual work is critical
visual task or worker is moving
errors are costly to rectify
accuracy, higher productivity or increased concentration is of great importance
the visual capacity of the worker is below normal
task details are of unusually small size or low contrast
the task is undertaken for an unusually long time

NOTE 1 Retinal illuminance declines with age due to reduced pupil size and increased spectral absorption of the crystalline lens. It is reasonable for lighting practitioners to increase task illuminance to help older people compensate for the age-related losses in retinal illuminance. More information can be found in CIE 227:2017.

The required $\bar{E}_{\mathrm{m}}$ in Clause 6 is a minimum value for normal working conditions.

Decreasing illuminance by one step may be considered when conditions from Table 2 apply. The reduced values for $\bar{E}_{\mathrm{m}}$ shall not fall below 2 lx.

Table 2 — Context modifiers for decrease of required maintained illuminance

task details are of an unusually large size or high contrast
the task is undertaken for an unusually short time

Using dimming will accommodate for possible future change in working conditions.

NOTE 2 For visually impaired people special requirements can be necessary with regard to illuminances and contrasts.

The size and position of the task or the activity area shall be stated and documented.

If the type of the task is not known, the designer has to make assumptions about the likely tasks and state task requirements.

If the whole area is lit to a given illuminance value then it is recommended that the lighting is controlled in defined appropriate zones.

When multiple tasks take place in the area, requirements for all these tasks shall be complied with.

This applies also to an activity area.

5.3.4 Illuminance of surroundings

The illuminance of surrounding areas shall be related to the illuminance of the task area and should provide a well-balanced luminance distribution in the visual field.

Large spatial variations in illuminances around the task area may lead to visual stress and discomfort.

The illuminance of the surrounding areas may be lower than the task illuminance but shall be not less than the values given in Table 3.

The surrounding area should be a band with a width of at least 2 m around the task area within the visual field.

Table 3 — Relationship of illuminances of surrounding areas to task area

Task illuminance lx	Illuminance of surrounding areas lx
≥ 500	100
300	75
200	50
150	30
$50 \leq \bar{E}_{\mathrm{m}} \leq 100$	20
< 50	no specification

In addition to the task illuminance the lighting shall provide adequate adaptation luminance in accordance with 5.2.

5.3.5 Illuminance grid

Grid systems shall be created to indicate the points at which the illuminance values are calculated and verified for the task and activity area(s) and surrounding area(s).

Grid cells approximating to a square are preferred, the ratio of length to width of a grid cell shall be kept between 0,5 and 2 (see also EN 12193 and EN 12464-1). The maximum grid cell size shall be:

$$p = 0{,}2 \times 5^{\log_{10} d} \quad (1)$$

where

- d is the longer dimension of the area (m), however if the ratio of the longer to the shorter side is 2 or more then d becomes the shorter dimension of the area;
- p is the maximum grid cell size (m).

The number of points in the relevant dimension is given by the nearest whole number of d/p.

The resulting spacing between the grid points is used to calculate the nearest whole number of grid points in the other dimension. This will give a ratio of length to width of a grid cell close to 1.

The illuminance values are calculated and verified at the centre point of grid rectangles.

The grid point spacing should not coincide with the luminaire spacing.

The maximum cell size should not exceed 5 m.

NOTE 1 Formula (1) (coming from CIE x005:1992) has been derived under the assumption that p is proportional to $\log_{10} d$, where:

p = 0,2 m for d = 1 m;

p = 1 m for d = 10 m;

p = *5* m for d = 100 m.

NOTE 2 Very large areas could be sub-divided into smaller reference areas to keep the grid cell spacing at appropriate sizes.