1 Scope

This European Standard specifies lighting requirements for humans in indoor work places, which meet the needs for visual comfort and performance of people having normal ophthalmic (visual) capacity. All usual visual tasks are considered, including Display Screen Equipment (DSE).

This European Standard specifies requirements for lighting solutions for most indoor work places and their associated areas in terms of quantity and quality of illumination. In addition recommendations are given for good lighting practice.

This European Standard 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 the EC treaty, although the lighting requirements, as specified in this European Standard, usually fulfil safety needs. Lighting requirements with respect to the safety and health of workers at work can be contained in Directives based on Article 153 of the EC treaty, in national legislation of member states implementing these directives or in other national legislation of member states.

This European Standard 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, artificial lighting or a combination of both.

This European Standard is not applicable for the lighting of outdoor work places and underground mining or emergency lighting. For outdoor work places, see EN 12464-2 and for emergency lighting, see EN 1838 and EN 13032-3.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12193, *Light and lighting — Sports lighting*

EN 12464-2, *Light and lighting — Lighting of work places — Part 2: Outdoor work places*

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

EN 13032-1, *Light and lighting — Measurement and presentation of photometric data of lamps and luminaires — Part 1: Measurement and file format*

EN 13032-2, *Light and lighting — Measurement and presentation of photometric data of lamps and luminaires — Part 2: Presentation of data for indoor and outdoor work places*

EN 15193, *Energy performance of buildings — Energy requirements for lighting*

EN ISO 9241-307, *Ergonomics of human-system interaction — Part 307: Analysis and compliance test methods for electronic visual displays (ISO 9241-307:2008)*

EN ISO 9680:2007, *Dentistry — Operating lights (ISO 9680:2007)*

ISO 3864-1, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs in workplaces and public areas*

3 Terms and definitions

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

3.1
activity area
area within which a specific activity is carried out

3.2
background area
area adjacent to the immediate surrounding area

3.3
display screen equipment
DSE
alphanumeric or graphic display screen, regardless of the display process employed

NOTE Adapted from 90/270/EEC.

3.4
immediate surrounding area
band surrounding the task area within the visual field

3.5
roof light
daylight opening in the roof or a horizontal surface of a building

3.6
shielding angle
angle between the horizontal plane and the first line of sight at which the luminous parts of the lamps in the luminaire are directly visible

3.7
task area
area within which the visual task is carried out

3.8
visual task
visual elements of the activity undertaken

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

3.9
window
daylight opening on a vertical or nearly vertical area of a room envelope

3.10
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 worker has access in the course of his employment

NOTE Adapted from 89/654/EEC.

3.11
work station
combination and spatial arrangement of work equipment, surrounded by the work environment under the conditions imposed by the work tasks

NOTE Adapted from EN ISO 6385:2004.

4 Lighting design criteria

4.1 Luminous environment

For good lighting practice it is essential that as well as the required illuminances, 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 this also contributes 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.

Main parameters determining the luminous environment with respect to artificial light and daylight are:

— luminance distribution;

— illuminance;

— directionality of light, lighting in the interior space;

— variability of light (levels and colour of light);

— colour rendering and colour appearance of the light;

— glare;

— flicker.

Values for illuminance and its uniformity, discomfort glare and colour rendering index are given in Clause 5; other parameters are described in Clause 4.

NOTE 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),

— 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 Guidelines for Accessibility: Visibility and Lighting Guidelines for Older Persons and Persons with Disabilities*.

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

4.2 Luminance distribution

4.2.1 General

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

A well balanced adaptation luminance 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, etc.).

The luminance distribution in the visual field also affects visual comfort. The following should be avoided for the reasons given:

— too high luminances which can give rise to glare;

— too high luminance contrasts which will cause fatigue because of constant re-adaptation of the eyes;

— too low luminances and too low luminance contrasts which result in a dull and non-stimulating working environment.

To create a well balanced luminance distribution the luminances of all surfaces shall be taken into consideration and will be determined by the reflectance and the illuminance on the surfaces. To avoid gloom and to raise adaptation levels and comfort of people in buildings, it is highly desirable to have bright interior surfaces particularly the walls and ceiling.

The lighting designer shall consider and select the appropriate reflectance and illuminance values for the interior surfaces based on the guidance below.

4.2.2 Reflectance of surfaces

Recommended reflectances for the major interior diffusely reflecting surfaces are:

— ceiling: 0,7 to 0,9;

— walls: 0,5 to 0,8;

— floor: 0,2 to 0,4.

NOTE The reflectance of major objects (like furniture, machinery, etc.) should be in the range of 0,2 to 0,7.

4.2.3 Illuminance on surfaces

In all enclosed places the maintained illuminances on the major surfaces shall have the following values:

— $\bar{E}_m$ > 50 lx with $U_o \geq 0{,}10$ on the walls and

— $\bar{E}_m$ > 30 lx with $U_o \geq 0{,}10$ on the ceiling.

NOTE 1 It is recognised that, in some places such as racked storage places, steelworks, railway terminals, etc., due to the size, complexity and operational constraints, the desired light levels on these surfaces will not be practical to achieve. In these places reduced levels of the recommended values are accepted.

NOTE 2 In some enclosed places such as offices, education, health care and general areas of entrance, corridors, stairs, etc., the walls and ceiling need to be brighter. In these places it is recommended that the maintained illuminances on the major surfaces should have the following values: $\bar{E}_m$ > 75 lx with U_o ≥ 0,10 on the walls and $\bar{E}_m$ > 50 lx with U_o ≥ 0,10 on the ceiling.

4.3 Illuminance

4.3.1 General

The illuminance and its distribution on the task area and on 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 European Standard are maintained illuminances and fulfil visual comfort and performance needs.

All maintained illuminance and uniformity values are dependent upon the grid definition (see 4.4).

4.3.2 Scale of illuminance

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

20 - 30 - 50 - 75 - 100 - 150 - 200 - 300 - 500 - 750 - 1 000 - 1 500 - 2 000 - 3 000 - 5 000

4.3.3 Illuminances on the task area

The values given in Clause 5 are maintained illuminances over the task area on the reference surface which can be horizontal, vertical or inclined. The average illuminance for each task shall not fall below the value given in Clause 5, 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;

— contribution to functional safety;

— economy.

The value of illuminance may be adjusted by at least one step in the scale of illuminances (see 4.3.2), if the visual conditions differ from the normal assumptions.

The required maintained illuminance should be increased when:

— visual work is critical;

— errors are costly to rectify;

— accuracy, higher productivity or increased concentration is of great importance;

— task details are of unusually small size or low contrast;

— the task is undertaken for an unusually long time;

— the visual capacity of the worker is below normal.

The required maintained illuminance may be decreased when:

— task details are of an unusually large size or high contrast;

— the task is undertaken for an unusually short time.

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

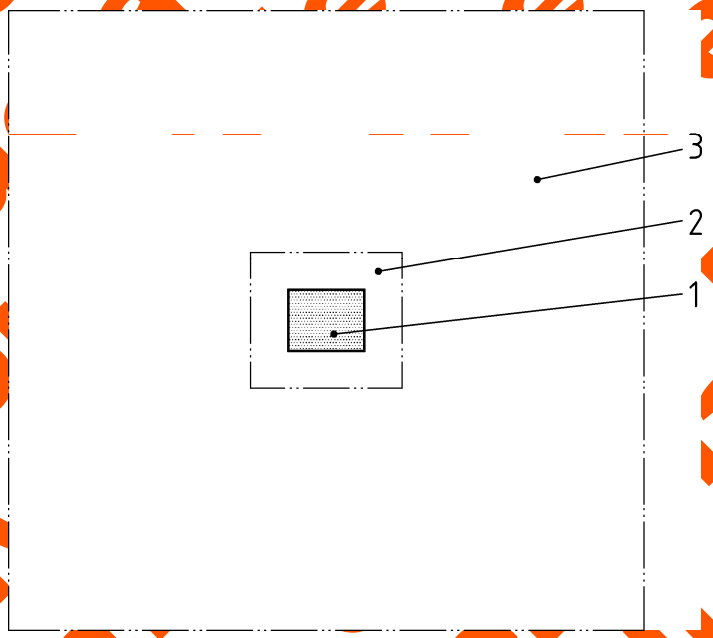
The size and position of the task area should be stated and documented.

For work stations where the size and/or location of the task area(s) is/are unknown, either:

— the whole area is treated as the task area or

— the whole area is uniformly ($U_o \geq 0{,}40$) lit to an illuminance level specified by the designer; if the task area becomes known, the lighting scheme shall be re-designed to provide the required illuminances.

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



Key

1 task area

2 immediate surrounding (band with a width of at least 0,5 m around the task area within the visual field)

3 background area (at least 3 m wide adjacent to the immediate surrounding area within the limits of the space)

Figure 1 — Minimum dimensions of immediate surrounding and background area in relation to task area

4.3.4 Illuminance on the immediate surrounding area

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

The illuminance of the immediate surrounding area shall be related to the illuminance of the task area and should provide a well-balanced luminance distribution in the visual field. The immediate surrounding area should be a band with a width of at least 0,5 m around the task area within the visual field.

The illuminance of the immediate surrounding area may be lower than the illuminance on the task area but shall be not less than the values given in Table 1.

In addition to the illuminance on the task area the lighting shall provide adequate adaptation luminance in accordance with 4.2.

The size and position of the immediate surrounding area should be stated and documented.

Table 1 — Relationship of illuminances on immediate surrounding to the illuminance on the task area

Illuminance on the task area E_{task} lx	Illuminance on immediate surrounding areas lx
≥ 750	500
500	300
300	200
200	150
150	E_{task}
100	E_{task}
≤ 50	E_{task}

Figure 1 illustrates the minimum dimension of immediate surrounding area in relation to task area.

4.3.5 Illuminance on the background area

In indoor work places, particularly those devoid of daylight, a large part of the area surrounding an active and occupied task area needs to be illuminated. This area known as the "background area" should be a band at least 3 m wide adjacent to the immediate surrounding area within the limits of the space and shall be illuminated with a maintained illuminance of 1/3 of the value of the immediate surrounding area.

The size and position of the background area should be stated and documented.

Figure 1 illustrates the minimum dimension of immediate background area in relation to task area.

4.3.6 Illuminance uniformity

In the task area, the illuminance uniformity (U_o) shall be not less than the minimum uniformity values given in the tables of Clause 5.

For lighting from artificial lighting or roof lights the illuminance uniformity:

— in the immediate surrounding area shall be $U_o \geq 0{,}40$;

— on the background area shall be $U_o \geq 0{,}10$.

For lighting from windows:

— in larger areas, activity areas and background areas the available daylight decreases rapidly with the distance from the window; the additional benefits of daylight (see 4.12) can compensate for the lack of uniformity.

4.4 Illuminance grid

Grid systems shall be created to indicate the points at which the illuminance values are calculated and verified for the task area(s), immediate surrounding area(s) and background 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 12464-2). The maximum grid size shall be:

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

where

$p \leq 10$ m

d is the longer dimension of the calculation 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, and

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.

A band of 0,5 m from the walls is excluded from the calculation area except when a task area is in or extends into this border area.

An appropriate grid size shall be applied to walls and ceiling and a band of 0,5 m may be applied also.

NOTE 1 The grid point spacing should not coincide with the luminaire spacing.

NOTE 2 Formula (1) (coming from CIE x005-1992) has been derived under the assumption that p is proportional to log (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 3 Typical values of grid point spacing are given in Table A.1.

4.5 Glare

4.5.1 General

Glare is the sensation produced by bright areas within the visual field, such as lit surfaces, parts of the luminaires, windows and/or roof lights. Glare shall be limited to avoid errors, fatigue and accidents. Glare can be experienced either as discomfort glare or as disability glare. In interior work places disability glare is not usually a major problem if discomfort glare limits are met.

Glare caused by reflections in specular surfaces is usually known as veiling reflections or reflected glare.

NOTE Special care is needed to avoid glare when the direction of view is above horizontal.

4.5.2 Discomfort glare

For the rating of discomfort glare from windows there is currently no standardized method.

The rating of discomfort glare caused directly from the luminaires of an indoor lighting installation shall be determined using the CIE Unified Glare Rating (UGR) tabular method, based on the formula:

$$UGR = 8 \log_{10} \left(\frac{0{,}25}{L_B} \sum \frac{L^2 \omega}{p^2} \right) \qquad (2)$$

where

L_B is the background luminance, calculated as $E_{ind} \cdot \pi^{-1}$, in which E_{ind} is the vertical indirect illuminance at the observer's eye in cd·m^{-2},

L is the luminance of the luminous parts of each luminaire in the direction of the observer's eye in cd·m^{-2},

ω is the solid angle in steradian of the luminous parts of each luminaire at the observer's eye,

p is the Guth position index for each individual luminaire which relates to its displacement from the line of sight.

All assumptions made in the determination of UGR shall be stated in the scheme documentation. The UGR value of the lighting installation shall not exceed the value given in Clause 5.

The recommended limiting values of the UGR form a series whose steps indicate noticeable changes in glare.

The series of UGR is: 10, 13, 16, 19, 22, 25, 28.

NOTE 1 The variations of UGR within the room can be determined using the comprehensive tables for different observer positions, as detailed in CIE 117-1995.

NOTE 2 If the maximum UGR value in the room is higher than the UGR limit given in Clause 5, information on appropriate positions for work stations within the room should be given.

NOTE 3 If the tabular method is not applicable and the observer position and the viewing directions are known the UGR value can be determined by using the formula. However limited research has been done, to determine the applicability of existing limiting values. Limits for this condition are under consideration.

4.5.3 Shielding against glare

Bright sources of light can cause glare and can impair the vision of objects. It shall be avoided for example by suitable shielding of lamps and roof lights, or suitable shading from bright daylight through windows.

For luminaires, the minimum shielding angles (see Figure 2) in the visual field given in Table 2 shall be applied for the specified lamp luminances.

NOTE The values given in Table 2 do not apply to up-lighters or to luminaires with a downward component only mounted below normal eye level.

Table 2 — Minimum shielding angles at specified lamp luminances

Lamp luminance $kcd \cdot m^{-2}$	Minimum shielding angle α
20 to < 50	15°
50 to < 500	20°
≥ 500	30°

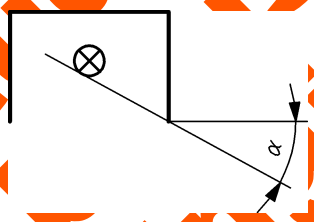


Figure 2 — Shielding angle α

4.5.4 Veiling reflections and reflected glare

High brightness reflections in the visual task can alter task visibility, usually detrimentally. Veiling reflections and reflected glare can be prevented or minimised by the following measures:

- arrangement of work stations with respect to luminaires, windows and roof lights;
- surface finish (matt surfaces);
- luminance restriction of luminaires, windows and roof lights;
- bright ceiling and bright walls.

4.6 Lighting in the interior space

4.6.1 General

In addition to task lighting the volume of space occupied by people should be lit. This light is required to highlight objects, reveal texture and improve the appearance of people within the space. The terms “mean cylindrical illuminance”, "modelling" and “directional lighting” describe the lighting conditions.

4.6.2 Mean cylindrical illuminance requirement in the activity space

Good visual communication and recognition of objects within a space require that the volume of space in which people move or work shall be illuminated. This is satisfied by providing adequate mean cylindrical illuminance, $\bar{E}_z$, in the space.

The maintained mean cylindrical illuminance (average vertical plane illuminance) in the activity and interior areas shall be not less than 50 lx with $U_o \geq 0{,}10$, on a horizontal plane at a specified height, for example 1,2 m for sitting people and 1,6 m for standing people above the floor.

NOTE In areas, where good visual communication is important, especially in offices, meeting and teaching areas, $\bar{E}_z$ should be not less than 150 lx with $U_o \geq 0{,}10$.

4.6.3 Modelling

The general appearance of an interior is enhanced when its structural features, the people and objects within it are lit so that form and texture are revealed clearly and pleasingly.

The lighting should not be too directional or it will produce harsh shadows, neither should it be too diffuse or the modelling effect will be lost entirely, resulting in a very dull luminous environment. Multiple shadows caused by directional lighting from more then one position should be avoided as this can result in a confused visual effect.

Modelling describes the balance between diffuse and directed light and should be considered.

NOTE 1 The ratio of cylindrical to horizontal illuminance at a point is an indicator of modelling. The grid points for cylindrical and horizontal illuminances should coincide.

NOTE 2 For uniform arrangement of luminaires or roof lights a value between 0,30 and 0,60 is an indicator of good modelling.

NOTE 3 Daylight is distributed predominantly horizontally from windows. The additional benefits of daylight (see 4.12) can compensate for its effect on modelling values, and modelling values from daylight can be extended from the range indicated.

4.6.4 Directional lighting of visual tasks

Lighting from a specific direction can reveal details within a visual task, increasing their visibility and making the task easier to perform. Unintended veiling reflections and reflected glare should be avoided, see 4.5.4.

Harsh shadows that interfere with the visual task should be avoided. But some shadows help to increase the visibility of the task.

4.7 Colour aspects

4.7.1 General

The colour qualities of a near-white lamp or transmitted daylight are characterised by two attributes:

— the colour appearance of the light;

— its colour rendering capabilities, which affect the colour appearance of objects and persons.

These two attributes shall be considered separately.

4.7.2 Colour appearance

The colour appearance of a lamp refers to the apparent colour (chromaticity) of the light emitted. It is quantified by its correlated colour temperature (T_{CP}).

Colour appearance of daylight varies throughout the day.

Colour appearance of artificial light can also be described as in Table 3.

Table 3 — Lamp colour appearance groups

Colour appearance	Correlated colour temperature T_{CP}
warm	below 3 300 K
intermediate	3 300 to 5 300 K
cool	above 5 300 K

The choice of colour appearance is a matter of psychology, aesthetics and what is considered to be natural. The choice will depend on illuminance level, colours of the room and furniture, surrounding climate and the application. In warm climates generally a cooler light colour appearance is preferred, whereas in cold climates a warmer light colour appearance is preferred.

In Clause 5, for specific applications a restricted band of suitable colour temperatures is given. These are applicable for daylighting as well as artificial lighting.

4.7.3 Colour rendering

For visual performance and the feeling of comfort and well being colours in the environment, of objects and of human skin, shall be rendered naturally, correctly and in a way that makes people look attractive and healthy.

To provide an objective indication of the colour rendering properties of a light source the general colour rendering index R_a is used. The maximum value of R_a is 100.

The minimum value of colour rendering index for distinct types of interiors (areas), tasks or activities are given in Tables 5.1 to 5.53.

Safety colours according to ISO 3864-1 shall always be recognisable as such.

NOTE 1 Colour rendering properties of light from a light source may be reduced by optics, glazing and coloured surfaces.

NOTE 2 For accurate rendition of colours of objects and human skin the appropriate individual special colour rendering index (R_i) should be considered.

4.8 Flicker and stroboscopic effects

Flicker causes distraction and can give rise to physiological effects such as headaches.

Stroboscopic effects can lead to dangerous situations by changing the perceived motion of rotating or reciprocating machinery.

Lighting systems should be designed to avoid flicker and stroboscopic effects.

4.9 Lighting of work stations with Display Screen Equipment (DSE)

4.9.1 General

The lighting for the DSE work stations shall be appropriate for all tasks performed at the work station, e.g. reading from the screen, reading printed text, writing on paper, keyboard work.

For these areas the lighting criteria and system shall be chosen in accordance with type of area, task or activity from the schedule in Clause 5.

Reflections in the DSE and, in some circumstances, reflections from the keyboard can cause disability and discomfort glare. It is therefore necessary to select, locate and arrange the luminaires to avoid high brightness reflections.

The designer shall determine the offending mounting zone and shall choose equipment and plan mounting positions which will cause no disturbing reflections.

4.9.2 Luminaire luminance limits with downward flux

Light can lower the contrast of the presentation on a DSE by:

— veiling reflection caused by the illuminance on the displays´ surface and

— luminances from luminaires and bright surfaces reflecting in the display.

EN ISO 9241-307 gives requirements for the visual qualities of displays concerning unwanted reflections.

This subclause describes luminance limits for luminaires which can be reflected in DSE for normal viewing directions.

Table 4 gives the limits of the average luminaire luminance at elevation angles of 65° and above from the downward vertical, radially around the luminaires, for work stations where display screens which are vertical or inclined up to 15° tilt angle are used.

Table 4 — Average luminance limits of luminaires, which can be reflected in flat screens

Screen high state luminance	High luminance screen $L > 200$ cd·m^{-2}	Medium luminance screen $L \leq 200$ cd·m^{-2}
Case A (positive polarity and normal requirements concerning colour and details of the shown information, as used in office, education, etc.)	≤ 3 000 cd·m^{-2}	≤ 1 500 cd·m^{-2}
Case B (negative polarity and/or higher requirements concerning colour and details of the shown information, as used for CAD colour inspection, etc.)	≤ 1 500 cd·m^{-2}	≤ 1 000 cd·m^{-2}
NOTE Screen high state luminance (see EN ISO 9241-302) describes the maximum luminance of the white part of the screen and this value is available from the manufacturer of the screen.		

If a high luminance screen is intended to be operated at luminances below 200 cd·m^{-2} the conditions specified for a medium luminance screen shall be considered.

Some tasks, activities or display screen technologies, particularly high gloss screens, require different lighting treatment (e.g. lower luminance limits, special shading, individual dimming, etc.).

In areas of industrial activities and crafts screens are sometimes protected by additional front glasses. The unwanted reflections on these protection glasses have to be reduced by suitable methods (such as anti-reflection treatment, tilting of the protection glass or by shutters).

4.10 Maintenance factor

The lighting scheme should be designed with an overall maintenance factor (MF) calculated for the selected lighting equipment, environment and specified maintenance schedule.

The recommended illuminance for each task is given as maintained illuminance. The maintenance factor depends on the maintenance characteristics of the lamp and control gear, the luminaire, the environment and the maintenance programme.

The lighting scheme should be designed with the overall MF for the selected lamp(s), luminaire(s), surface reflectances, environment and specified maintenance schedule.

For daylight calculations, reduction of glazing transmittance due to dirt deposition should be taken into account.

The designer shall:

— state the MF and list all assumptions made in the derivation of the value,

— specify lighting equipment suitable for the application environment and

— prepare a comprehensive maintenance schedule to include frequency of lamp replacement, luminaire, room and glazing cleaning intervals and cleaning method.

The MF has a great impact on energy efficiency. The assumptions made in the derivation of the MF shall be optimized in a way that leads to a high value. Guidance on the derivation of MF for artificial lighting systems can be found in CIE 97-2005.

4.11 Energy efficiency requirements

Lighting should be designed to meet the lighting requirements of a particular task or space in an energy efficient manner. It is important not to compromise the visual aspects of a lighting installation simply to reduce energy consumption. Light levels as set in this European Standard are minimum average illuminance values and need to be maintained.

Energy savings can be made by harvesting daylight, responding to occupancy patterns, improving maintenance characteristics of the installation, and making full use of controls.

The amount of daylight varies throughout the day depending on climate conditions. In addition, in interiors with side windows the available daylight decreases rapidly with the distance from the window. Supplementary lighting may be needed to ensure the required illuminance levels at the work station are achieved and to balance the luminance distribution within the room. Automatic or manual switching and/or dimming can be used to ensure appropriate integration between artificial lighting and daylight.

A procedure for the estimation of the energy requirements of a lighting installation is given in EN 15193. It gives a methodology for the calculation of a lighting energy numeric indicator (LENI), representing the energy performance of lighting of buildings. This indicator may be used for single rooms on a comparative basis only, as the benchmark values given in the EN 15193 are drawn up for a complete building.

4.12 Additional benefits of daylight

Daylight can supply all or part of the lighting for visual tasks, and therefore offers potential energy savings. Additionally, it varies in level, direction and spectral composition with time and provides variable modelling and luminance patterns, which is perceived as being beneficial for people in indoor working environments. Windows are strongly favoured in work places for the daylight they deliver, and for the visual contact they provide with the outside environment. However, it is also important to ensure windows do not cause visual or thermal discomfort, or a loss of privacy.

4.13 Variability of light

Light is important to people's health and wellbeing. Light affects the mood, emotion and mental alertness of people. It can also support and adjust the circadian rhythms and influence people's physiological and psychological state. Up to date research indicates that these phenomena, in addition to the lighting design criteria defined in EN 12464-1, can be provided by the so-called "non-image forming" illuminances and colour appearance of light. Varying lighting conditions in time by higher illuminance, luminance distribution and wider range of colour temperature than specified in this European Standard with daylight and/or dedicated artificial lighting solutions can stimulate people and enhance their wellbeing. The recommended bands of variation are under consideration.

5 Schedule of lighting requirements

5.1 Composition of the tables

Column 1 lists the **reference** number for each interior area, task or activity.