

BS EN 12464-1:2011



BSI Standards Publication

Light and lighting — Lighting of work places

Part 1: Indoor work places

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

raising standards worldwide™



National foreword

This British Standard is the UK implementation of EN 12464-1:2011. It supersedes BS EN 12464-1:2002 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CPL/34/10, Lamps and Related Equipment - Light and Lighting.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© BSI 2011

ISBN 978 0 580 68495 1

ICS 13.180; 91.160.10

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2011.

Amendments issued since publication

Date	Text affected
------	---------------

EUROPEAN STANDARD

EN 12464-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

June 2011

ICS 91.160.10

Supersedes EN 12464-1:2002

English Version

Light and lighting - Lighting of work places - Part 1: Indoor work places

Lumière et éclairage - Eclairage des lieux de travail - Partie
1: Lieux de travail intérieurs

Licht und Beleuchtung - Beleuchtung von Arbeitsstätten -
Teil 1: Arbeitsstätten in Innenräumen

This European Standard was approved by CEN on 14 April 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

	Page
Foreword.....	4
Introduction	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	7
4 Lighting design criteria	8
4.1 Luminous environment	8
4.2 Luminance distribution	9
4.2.1 General.....	9
4.2.2 Reflectance of surfaces	9
4.2.3 Illuminance on surfaces	9
4.3 Illuminance	10
4.3.1 General.....	10
4.3.2 Scale of illuminance	10
4.3.3 Illuminances on the task area.....	10
4.3.4 Illuminance on the immediate surrounding area.....	12
4.3.5 Illuminance on the background area	12
4.3.6 Illuminance uniformity	12
4.4 Illuminance grid	13
4.5 Glare.....	14
4.5.1 General.....	14
4.5.2 Discomfort glare	14
4.5.3 Shielding against glare	15
4.5.4 Veiling reflections and reflected glare.....	15
4.6 Lighting in the interior space	15
4.6.1 General.....	15
4.6.2 Mean cylindrical illuminance requirement in the activity space.....	16
4.6.3 Modelling	16
4.6.4 Directional lighting of visual tasks	16
4.7 Colour aspects	16
4.7.1 General.....	16
4.7.2 Colour appearance	17
4.7.3 Colour rendering.....	17
4.8 Flicker and stroboscopic effects.....	17
4.9 Lighting of work stations with Display Screen Equipment (DSE)	18
4.9.1 General.....	18
4.9.2 Luminaire luminance limits with downward flux.....	18
4.10 Maintenance factor	19
4.11 Energy efficiency requirements	20
4.12 Additional benefits of daylight	20
4.13 Variability of light.....	20
5 Schedule of lighting requirements.....	20
5.1 Composition of the tables.....	20
5.2 Schedule of interior areas, tasks and activities	21
5.3 Lighting requirements for interior areas, tasks and activities	23
6 Verification procedures.....	47

	Page
6.1 General	47
6.2 Illuminances	48
6.3 Unified Glare Rating	48
6.4 Colour rendering and colour appearance	48
6.5 Luminaire luminance	48
6.6 Maintenance schedule	48
Annex A (informative) Typical values of grid point spacing	49
Annex B (informative) A-deviation	50
Bibliography	51
Index of interior areas, tasks and activities	52

Foreword

This document (EN 12464-1:2011) has been prepared by Technical Committee CEN/TC 169 "Light and lighting", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2011, and conflicting national standards shall be withdrawn at the latest by December 2011.

This document supersedes EN 12464-1:2002.

The main technical changes in this revision are:

- importance of daylight is taken into account: Requirements for lighting are generally applicable independent if provided by artificial lighting, daylight or a combination of both;
- specification of a minimum illuminance on walls and ceilings;
- specification of cylindrical illuminance and detailed information on modelling;
- uniformity of illuminance is assigned to tasks and activities;
- definition of "background area" and lighting specification for this area;
- definition of an illuminance grid is in accordance with EN 12464-2;
- new luminance limits are set for luminaires used with Display Screen equipment (DSE), the description of display screens is according ISO 9214-307.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

Adequate and appropriate lighting enables people to perform visual tasks efficiently and accurately. The degree of visibility and comfort required in a wide range of work places is governed by the type and duration of the activity.

It is important that all clauses of this European Standard are followed although the specific requirements are tabulated in the schedule of lighting requirements (see Clause 5).

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

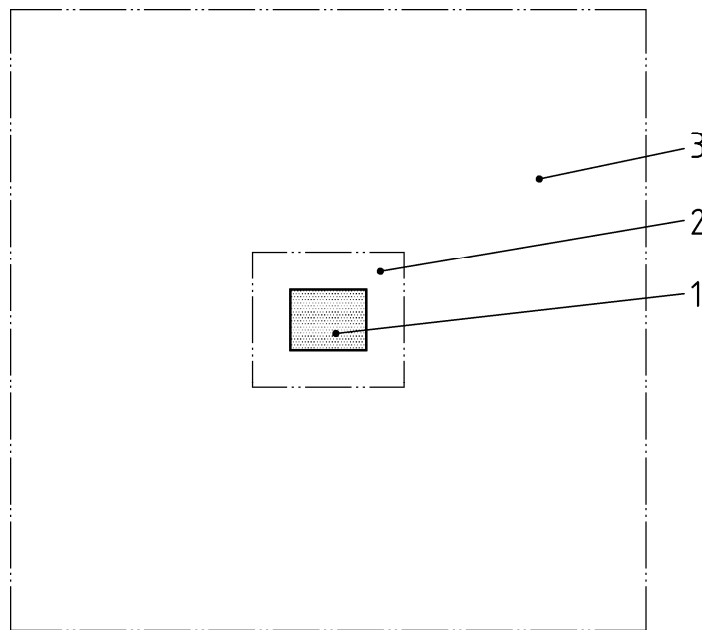
NOTE For visually impaired people special requirements can be necessary with regard to illuminances and contrasts.

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_0) 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

$$p \leq 10 \text{ m}$$

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:

$$p = 0,2 \text{ m for } d = 1 \text{ m};$$

$$p = 1 \text{ m for } d = 10 \text{ m};$$

$$p = 5 \text{ m for } d = 100 \text{ m}.$$

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:

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

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 $\text{cd}\cdot\text{m}^{-2}$,

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

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·m ⁻²	Minimum shielding angle α
20 to < 50	15°
50 to < 500	20°
≥ 500	30°

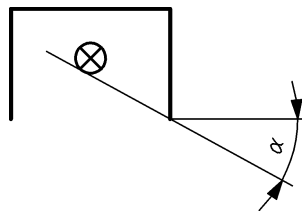


Figure 2 — Shielding angle α

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 than 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 $L > 200 \text{ cd}\cdot\text{m}^{-2}$	Medium luminance screen $L \leq 200 \text{ cd}\cdot\text{m}^{-2}$
Case A (positive polarity and normal requirements concerning colour and details of the shown information, as used in office, education, etc.)	$\leq 3\,000 \text{ cd}\cdot\text{m}^{-2}$	$\leq 1\,500 \text{ cd}\cdot\text{m}^{-2}$
Case B (negative polarity and/or higher requirements concerning colour and details of the shown information, as used for CAD colour inspection, etc.)	$\leq 1\,500 \text{ cd}\cdot\text{m}^{-2}$	$\leq 1\,000 \text{ cd}\cdot\text{m}^{-2}$
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 $200 \text{ cd}\cdot\text{m}^{-2}$ 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.

Column 2 lists those **areas, tasks or activities** for which specific requirements are given. If the particular interior area, task area or activity area is not listed, the values given for a similar, comparable situation should be adopted.

Column 3 gives the **maintained illuminance** \bar{E}_m on the reference surface (see 4.3) for the interior (area), task or activity given in Column 2.

NOTE 1 The maintained illuminance in some circumstances may need to be increased (see 4.3.3).

NOTE 2 Lighting control can be required to achieve adequate flexibility for the variety of tasks performed.

Column 4 gives the **maximum UGR limits** (Unified Glare Rating limit, UGR_l) that are applicable to the situation listed in Column 2.

Column 5 gives the **minimum illuminance uniformity** U_o on the reference surface for the maintained illuminance given in Column 3.

Column 6 gives the **minimum colour rendering indices** (R_a) (see 4.7.3) for the situation listed in Column 2.

Column 7 gives **specific requirements** for the situations listed in Column 2.

5.2 Schedule of interior areas, tasks and activities

Table 5.1 — Traffic zones inside buildings

Table 5.2 — General areas inside buildings – Rest, sanitation and first aid rooms

Table 5.3 — General areas inside buildings – Control rooms

Table 5.4 — General areas inside buildings – Store rooms, cold stores

Table 5.5 — General areas inside buildings – Storage rack areas

Table 5.6 — Industrial activities and crafts – Agriculture

Table 5.7 — Industrial activities and crafts – Bakeries

Table 5.8 — Industrial activities and crafts – Cement, cement goods, concrete, bricks

Table 5.9 — Industrial activities and crafts – Ceramics, tiles, glass, glassware

Table 5.10 — Industrial activities and crafts – Chemical, plastics and rubber industry

Table 5.11 — Industrial activities and crafts – Electrical and electronic industry

Table 5.12 — Industrial activities and crafts – Food stuffs and luxury food industry

Table 5.13 — Industrial activities and crafts – Foundries and metal casting

Table 5.14 — Industrial activities and crafts – Hairdressers

Table 5.15 — Industrial activities and crafts – Jewellery manufacturing

Table 5.16 — Industrial activities and crafts – Laundries and dry cleaning

Table 5.17 — Industrial activities and crafts – Leather and leather goods

Table 5.18 — Industrial activities and crafts – Metal working and processing

Table 5.19 — Industrial activities and crafts – Paper and paper goods

Table 5.20 — Industrial activities and crafts – Power stations

Table 5.21 — Industrial activities and crafts – Printers

Table 5.22 — Industrial activities and crafts – Rolling mills, iron and steel works

Table 5.23 — Industrial activities and crafts – Textile manufacture and processing

Table 5.24 — Industrial activities and crafts – Vehicle construction and repair

Table 5.25 — Industrial activities and crafts – Wood working and processing

Table 5.26 — Offices

Table 5.27 — Retail premises

Table 5.28 — Places of public assembly – General areas

Table 5.29 — Places of public assembly – Restaurants and hotels

Table 5.30 — Places of public assembly – Theatres, concert halls, cinemas, places for entertainment

Table 5.31 — Places of public assembly – Trade fairs, exhibition halls

Table 5.32 — Places of public assembly – Museums

Table 5.33 — Places of public assembly – Libraries

Table 5.34 — Places of public assembly – Public car parks (indoor)

Table 5.35 — Educational premises – Nursery school, play school

Table 5.36 — Educational premises – Educational buildings

Table 5.37 — Health care premises – Rooms for general use

Table 5.38 — Health care premises – Staff rooms

Table 5.39 — Health care premises – Wards, maternity wards

Table 5.40 — Health care premises – Examination rooms (general)

Table 5.41 — Health care premises – Eye Examination rooms

Table 5.42 — Health care premises – Ear Examination rooms

Table 5.43 — Health care premises – Scanner rooms

Table 5.44 — Health care premises – Delivery rooms

Table 5.45 — Health care premises – Treatment rooms (general)

Table 5.46 — Health care premises – Operating areas

Table 5.47 — Health care premises – Intensive care unit

Table 5.48 — Health care premises – Dentists

Table 5.49 — Health care premises – Laboratories and pharmacies

Table 5.50 — Health care premises – Decontamination rooms

Table 5.51 — Health care premises – Autopsy rooms and mortuaries

Table 5.52 — Transportation areas – Airports

Table 5.53 — Transportation areas – Railway installations

5.3 Lighting requirements for interior areas, tasks and activities

Table 5.1 — Traffic zones inside buildings

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L —	U_o —	R_a —	Specific requirements
5.1.1	Circulation areas and corridors	100	28	0,40	40	<ul style="list-style-type: none"> • Illuminance at floor level. • R_a and UGR similar to adjacent areas. • 150 lx if there are vehicles on the route. • The lighting of exits and entrances shall provide a transition zone to avoid sudden changes in illuminance between inside and outside by day or night. • Care should be taken to avoid glare to drivers and pedestrians.
5.1.2	Stairs, escalators, travelators	100	25	0,40	40	Requires enhanced contrast on the steps.
5.1.3	Elevators, lifts	100	25	0,40	40	Light level in front of the lift should be at least $\bar{E}_m = 200$ lx.
5.1.4	Loading ramps/bays	150	25	0,40	40	

Table 5.2 — General areas inside buildings – Rest, sanitation and first aid rooms

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L —	U_o —	R_a —	Specific requirements
5.2.1	Canteens, pantries	200	22	0,40	80	
5.2.2	Rest rooms	100	22	0,40	80	
5.2.3	Rooms for physical exercise	300	22	0,40	80	
5.2.4	Cloakrooms, washrooms, bathrooms, toilets	200	25	0,40	80	In each individual toilet if these are fully enclosed.
5.2.5	Sick bay	500	19	0,60	80	
5.2.6	Rooms for medical attention	500	16	0,60	90	$4\ 000\ K \leq T_{CP} \leq 5\ 000\ K$

Table 5.3 — General areas inside buildings – Control rooms

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.3.1	Plant rooms, switch gear rooms	200	25	0,40	60	
5.3.2	Telex, post room, switchboard	500	19	0,60	80	

Table 5.4 — General areas inside buildings – Store rooms, cold stores

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.4.1	Store and stockrooms	100	25	0,40	60	200 lx if continuously occupied.
5.4.2	Dispatch packing handling areas	300	25	0,60	60	

Table 5.5 — General areas inside buildings – Storage rack areas

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.5.1	Gangways: unmanned	20	-	0,40	40	Illuminance at floor level.
5.5.2	Gangways: manned	150	22	0,40	60	Illuminance at floor level.
5.5.3	Control stations	150	22	0,60	80	
5.5.4	Storage rack face	200	-	0,40	60	Vertical illuminance, portable lighting may be used.

Table 5.6 — Industrial activities and crafts – Agriculture

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.6.1	Loading and operating of goods, handling equipment and machinery	200	25	0,40	80	
5.6.2	Buildings for livestock	50	-	0,40	40	
5.6.3	Sick animal pens; calving stalls	200	25	0,60	80	
5.6.4	Feed preparation; dairy; utensil washing	200	25	0,60	60	

Table 5.7 — Industrial activities and crafts – Bakeries

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.7.1	Preparation and baking	300	22	0,60	80	
5.7.2	Finishing, glazing, decorating	500	22	0,70	80	

Table 5.8 — Industrial activities and crafts – Cement, cement goods, concrete, bricks

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.8.1	Drying	50	28	0,40	20	Safety colours shall be recognisable.
5.8.2	Preparation of materials; work on kilns and mixers	200	28	0,40	40	
5.8.3	General machine work	300	25	0,60	80	
5.8.4	Rough forms	300	25	0,60	80	

Table 5.9 — Industrial activities and crafts – Ceramics, tiles, glass, glassware

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.9.1	Drying	50	28	0,40	20	Safety colours shall be recognisable.
5.9.2	Preparation, general machine work	300	25	0,60	80	
5.9.3	Enamelling, rolling, pressing, shaping simple parts, glazing, glass blowing	300	25	0,60	80	
5.9.4	Grinding, engraving, glass polishing, shaping precision parts, manufacture of glass instruments	750	19	0,70	80	
5.9.5	Grinding of optical glass, crystal, hand grinding and engraving	750	16	0,70	80	
5.9.6	Precision work e.g. decorative grinding, hand painting	1 000	16	0,70	90	$4\,000\text{ K} \leq T_{CP} \leq 6\,500\text{ K}$
5.9.7	Manufacture of synthetic precious stones	1 500	16	0,70	90	$4\,000\text{ K} \leq T_{CP} \leq 6\,500\text{ K}$

Table 5.10 — Industrial activities and crafts – Chemical, plastics and rubber industry

Ref. no.	Type of area, task or activity	\bar{E}_m lx	GR_L –	U_o –	R_a –	Specific requirements
5.10.1	Remote-operated processing installations	50	-	0,40	20	Safety colours shall be recognisable.
5.10.2	Processing installations with limited manual intervention	150	28	0,40	40	
5.10.3	Constantly manned work stations in processing installations	300	25	0,60	80	
5.10.4	Precision measuring rooms, laboratories	500	19	0,60	80	
5.10.5	Pharmaceutical production	500	22	0,60	80	
5.10.6	Tyre production	500	22	0,60	80	
5.10.7	Colour inspection	1 000	16	0,70	90	4 000 K ≤ T_{CP} ≤ 6 500 K
5.10.8	Cutting, finishing, inspection	750	19	0,70	80	

Table 5.11 — Industrial activities and crafts – Electrical and electronic industry

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.11.1	Cable and wire manufacture	300	25	0,60	80	
5.11.2	Winding: - large coils - medium-sized coils - small coils	300 500 750	25 22 19	0,60 0,60 0,70	80 80 80	
5.11.3	Coil impregnating	300	25	0,60	80	
5.11.4	Galvanising	300	25	0,60	80	
5.11.5	Assembly work: - rough, e.g. large transformers - medium, e.g. switchboards - fine, e.g. telephones, radios, IT equipment (computers) - precision, e.g. measuring equipment, printed circuit boards	300 500 750 1 000	25 22 19 16	0,60 0,60 0,70 0,70	80 80 80 80	
5.11.6	Electronic workshops, testing, adjusting	1500	16	0,70	80	

Table 5.12 — Industrial activities and crafts – Food stuffs and luxury food industry

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.12.1	Work stations and zones in: - breweries, malting floor, - for washing, barrel filling, cleaning, sieving, peeling, - cooking in preserve and chocolate factories, - work stations and zones in sugar factories, - for drying and fermenting raw tobacco, fermentation cellar	200	25	0,40	80	
5.12.2	Sorting and washing of products, milling, mixing, packing	300	25	0,60	80	
5.12.3	Work stations and critical zones in slaughter houses, butchers, dairies mills, on filtering floor in sugar refineries	500	25	0,60	80	
5.12.4	Cutting and sorting of fruit and vegetables	300	25	0,60	80	
5.12.5	Manufacture of delicatessen foods, kitchen work, manufacture of cigars and cigarettes	500	22	0,60	80	
5.12.6	Inspection of glasses and bottles, product control, trimming, sorting, decoration	500	22	0,60	80	
5.12.7	Laboratories	500	19	0,60	80	
5.12.8	Colour inspection	1 000	16	0,70	90	$4\,000\text{ K} \leq T_{CP} \leq 6\,500\text{ K}$

Table 5.13 — Industrial activities and crafts – Foundries and metal casting

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.13.1	Man-size underfloor tunnels, cellars, etc.	50	-	0,40	20	Safety colours shall be recognisable.
5.13.2	Platforms	100	25	0,40	40	
5.13.3	Sand preparation	200	25	0,40	80	
5.13.4	Dressing room	200	25	0,40	80	
5.13.5	Work stations at cupola and mixer	200	25	0,40	80	
5.13.6	Casting bay	200	25	0,40	80	
5.13.7	Shake out areas	200	25	0,40	80	
5.13.8	Machine moulding	200	25	0,40	80	
5.13.9	Hand and core moulding	300	25	0,60	80	
5.13.10	Die casting	300	25	0,60	80	
5.13.11	Model building	500	22	0,60	80	

Table 5.14 — Industrial activities and crafts – Hairdressers

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.14.1	Hairdressing	500	19	0,60	90	

Table 5.15 — Industrial activities and crafts – Jewellery manufacturing

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.15.1	Working with precious stones	1 500	16	0,70	90	4 000 K ≤ T_{CP} ≤ 6 500 K
5.15.2	Manufacture of jewellery	1 000	16	0,70	90	
5.15.3	Watch making (manual)	1 500	16	0,70	80	
5.15.4	Watch making (automatic)	500	19	0,60	80	

Table 5.16 — Industrial activities and crafts – Laundries and dry cleaning

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.16.1	Goods in, marking and sorting	300	25	0,60	80	
5.16.2	Washing and dry cleaning	300	25	0,60	80	
5.16.3	Ironing, pressing	300	25	0,60	80	
5.16.4	Inspection and repairs	750	19	0,70	80	

Table 5.17 — Industrial activities and crafts – Leather and leather goods

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.17.1	Work on vats, barrels, pits	200	25	0,40	40	
5.17.2	Fleshing, skiving, rubbing, tumbling of skins	300	25	0,40	80	
5.17.3	Saddlery work, shoe manufacture: stitching, sewing, polishing, shaping, cutting, punching	500	22	0,60	80	
5.17.4	Sorting	500	22	0,60	90	$4\,000\text{ K} \leq T_{CP} \leq 6\,500\text{ K}$
5.17.5	Leather dyeing (machine)	500	22	0,60	80	
5.17.6	Quality control	1 000	19	0,70	80	
5.17.7	Colour inspection	1 000	16	0,70	90	$4\,000\text{ K} \leq T_{CP} \leq 6\,500\text{ K}$
5.17.8	Shoe making	500	22	0,60	80	
5.17.9	Glove making	500	22	0,60	80	

Table 5.18 — Industrial activities and crafts – Metal working and processing

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.18.1	Open die forging	200	25	0,60	80	
5.18.2	Drop forging	300	25	0,60	80	
5.18.3	Welding	300	25	0,60	80	
5.18.4	Rough and average machining: tolerances $\geq 0,1$ mm	300	22	0,60	80	
5.18.5	Precision machining; grinding: tolerances $< 0,1$ mm	500	19	0,70	80	
5.18.6	Scribing; inspection	750	19	0,70	80	
5.18.7	Wire and pipe drawing shops; cold forming	300	25	0,60	80	
5.18.8	Plate machining: thickness ≥ 5 mm	200	25	0,60	80	
5.18.9	Sheet metalwork: thickness < 5 mm	300	22	0,60	80	
5.18.10	Tool making; cutting equipment manufacture	750	19	0,70	80	
5.18.11	Assembly: - rough - medium - fine - precision	200 300 500 750	25 25 22 19	0,60 0,60 0,60 0,70	80 80 80 80	
5.18.12	Galvanising	300	25	0,60	80	
5.18.13	Surface preparation and painting	750	25	0,70	80	
5.18.14	Tool, template and jig making, precision mechanics, micro-mechanics	1 000	19	0,70	80	

Table 5.19 — Industrial activities and crafts – Paper and paper goods

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.19.1	Edge runners, pulp mills	200	25	0,40	80	
5.19.2	Paper manufacture and processing, paper and corrugating machines, cardboard manufacture	300	25	0,60	80	
5.19.3	Standard bookbinding work, e.g. folding, sorting, gluing, cutting, embossing, sewing	500	22	0,60	80	

Table 5.20 — Industrial activities and crafts – Power stations

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.20.1	Fuel supply plant	50	-	0,40	20	Safety colours shall be recognisable.
5.20.2	Boiler house	100	28	0,40	40	
5.20.3	Machine halls	200	25	0,40	80	
5.20.4	Side rooms, e.g. pump rooms, condenser rooms, etc.; switchboards (inside buildings)	200	25	0,40	60	
5.20.5	Control rooms	500	16	0,70	80	1. Control panels are often vertical. 2. Dimming may be required. 3. DSE-work, see 4.9.

Table 5.21 — Industrial activities and crafts – Printers

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.21.1	Cutting, gilding, embossing, block engraving, work on stones and platens, printing machines, matrix making	500	19	0,60	80	
5.21.2	Paper sorting and hand printing	500	19	0,60	80	
5.21.3	Type setting, retouching, lithography	1 000	19	0,70	80	
5.21.4	Colour inspection in multicoloured printing	1 500	16	0,70	90	5 000 K $\leq T_{CP} \leq$ 6 500 K
5.21.5	Steel and copper engraving	2 000	16	0,70	80	For directionality, see 4.6.4.

Table 5.22 — Industrial activities and crafts – Rolling mills, iron and steel works

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.22.1	Production plants without manual operation	50	-	0,40	20	Safety colours shall be recognisable.
5.22.2	Production plants with occasional manual operation	150	28	0,40	40	
5.22.3	Production plants with continuous manual operation	200	25	0,60	80	
5.22.4	Slab Store	50	-	0,40	20	Safety colours shall be recognisable.
5.22.5	Furnaces	200	25	0,40	20	Safety colours shall be recognisable.
5.22.6	Mill train; coiler; shear line	300	25	0,60	40	
5.22.7	Control platforms; control panels	300	22	0,60	80	
5.22.8	Test, measurement and inspection	500	22	0,60	80	
5.22.9	Underfloor man-sized tunnels; belt sections, cellars, etc.	50	-	0,40	20	Safety colours shall be recognisable.

Table 5.23 — Industrial activities and crafts – Textile manufacture and processing

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.23.1	Work stations and zones in baths, bale opening	200	25	0,60	60	
5.23.2	Carding, washing, ironing, devilling machine work, drawing, combing, sizing, card cutting, pre-spinning, jute and hemp spinning	300	22	0,60	80	
5.23.3	Spinning, plying, reeling, winding	500	22	0,60	80	Prevent stroboscopic effects.
5.23.4	Warping, weaving, braiding, knitting	500	22	0,60	80	Prevent stroboscopic effects.
5.23.5	Sewing, fine knitting, taking up stitches	750	22	0,70	80	
5.23.6	Manual design, drawing patterns	750	22	0,70	90	$4\ 000\ K \leq T_{CP} \leq 6\ 500\ K$
5.23.7	Finishing, dyeing	500	22	0,60	80	
5.23.8	Drying room	100	28	0,40	60	
5.23.9	Automatic fabric printing	500	25	0,60	80	
5.23.10	Burling, picking, trimming	1 000	19	0,70	80	
5.23.11	Colour inspection; fabric control	1 000	16	0,70	90	$4\ 000\ K \leq T_{CP} \leq 6\ 500\ K$
5.23.12	Invisible mending	1 500	19	0,70	90	$4\ 000\ K \leq T_{CP} \leq 6\ 500\ K$
5.23.13	Hat manufacturing	500	22	0,60	80	

Table 5.24 — Industrial activities and crafts – Vehicle construction and repair

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.24.1	Body work and assembly	500	22	0,60	80	
5.24.2	Painting, spraying chamber, polishing chamber	750	22	0,70	80	
5.24.3	Painting: touch-up, inspection	1 000	19	0,70	90	4 000 K ≤ T_{CP} ≤ 6 500 K
5.24.4	Upholstery manufacture (manned)	1 000	19	0,70	80	
5.24.5	Final inspection	1 000	19	0,70	80	
5.24.6	General vehicle services, repair and testing	300	22	0,60	80	Consider local lighting.

Table 5.25 — Industrial activities and crafts – Wood working and processing

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.25.1	Automatic processing e.g. drying, plywood manufacturing	50	28	0,40	40	
5.25.2	Steam pits	150	28	0,40	40	
5.25.3	Saw frame	300	25	0,60	60	Prevent stroboscopic effects.
5.25.4	Work at joiner's bench, gluing, assembly	300	25	0,60	80	
5.25.5	Polishing, painting, fancy joinery	750	22	0,70	80	
5.25.6	Work on wood working machines, e.g. turning, fluting, dressing, rebating, grooving, cutting, sawing, sinking	500	19	0,60	80	Prevent stroboscopic effects.
5.25.7	Selection of veneer woods	750	22	0,70	90	4 000 K ≤ T_{CP} ≤ 6 500 K
5.25.8	Marquetry, inlay work	750	22	0,70	90	4 000 K ≤ T_{CP} ≤ 6 500 K
5.25.9	Quality control, inspection	1 000	19	0,70	90	4 000 K ≤ T_{CP} ≤ 6 500 K

Table 5.26 — Offices

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L —	U_o —	R_a —	Specific requirements
5.26.1	Filing, copying, etc.	300	19	0,40	80	
5.26.2	Writing, typing, reading, data processing	500	19	0,60	80	DSE-work, see 4.9.
5.26.3	Technical drawing	750	16	0,70	80	
5.26.4	CAD work stations	500	19	0,60	80	DSE-work, see 4.9.
5.26.5	Conference and meeting rooms	500	19	0,60	80	Lighting should be controllable.
5.26.6	Reception desk	300	22	0,60	80	
5.26.7	Archives	200	25	0,40	80	

Table 5.27 — Retail premises

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L —	U_o —	R_a —	Specific requirements
5.27.1	Sales area	300	22	0,40	80	
5.27.2	Till area	500	19	0,60	80	
5.27.3	Wrapper table	500	19	0,60	80	

Table 5.28 — Places of public assembly – General areas

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L —	U_o —	R_a —	Specific requirements
5.28.1	Entrance halls	100	22	0,40	80	UGR only if applicable.
5.28.2	Cloakrooms	200	25	0,40	80	
5.28.3	Lounges	200	22	0,40	80	
5.28.4	Ticket offices	300	22	0,60	80	

Table 5.29 — Places of public assembly – Restaurants and hotels

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.29.1	Reception/cashier desk, porters desk	300	22	0,60	80	
5.29.2	Kitchen	500	22	0,60	80	There should be a transition zone between kitchen and restaurant.
5.29.3	Restaurant, dining room, function room	-	-	-	80	The lighting should be designed to create the appropriate atmosphere.
5.29.4	Self-service restaurant	200	22	0,40	80	
5.29.5	Buffet	300	22	0,60	80	
5.29.6	Conference rooms	500	19	0,60	80	Lighting should be controllable.
5.29.7	Corridors	100	25	0,40	80	During night-time lower levels are acceptable.

Table 5.30 — Places of public assembly – Theatres, concert halls, cinemas, places for entertainment

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.30.1	Practice rooms	300	22	0,60	80	
5.30.2	Dressing rooms	300	22	0,60	90	Lighting at mirrors for make-up shall be "glare-free". Disability glare should be avoided at mirrors for make-up.
5.30.3	Seating areas – maintenance, cleaning	200	22	0,50	80	Illuminance at floor level.
5.30.4	Stage area - rigging	300	25	0,40	80	Illuminance at floor level.

Table 5.31 — Places of public assembly – Trade fairs, exhibition halls

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.31.1	General lighting	300	22	0,40	80	

Table 5.32 — Places of public assembly – Museums

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.32.1	Exhibits, insensitive to light					Lighting is determined by the display requirements.
5.32.2	Exhibits sensitive to light					1. Lighting is determined by the display requirements. 2. Protection against damaging radiation is paramount.

Table 5.33 — Places of public assembly – Libraries

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.33.1	Bookshelves	200	19	0,40	80	
5.33.2	Reading area	500	19	0,60	80	
5.33.3	Counters	500	19	0,60	80	

Table 5.34 — Places of public assembly – Public car parks (indoor)

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.34.1	In/out ramps (during the day)	300	25	0,40	40	1. Illuminances at floor level. 2. Safety colours shall be recognisable.
5.34.2	In/out ramps (at night)	75	25	0,40	40	1. Illuminances at floor level. 2. Safety colours shall be recognisable.
5.34.3	Traffic lanes	75	25	0,40	40	1. Illuminances at floor level. 2. Safety colours shall be recognisable.
5.34.4	Parking areas	75	-	0,40	40	1. Illuminances at floor level. 2. Safety colours shall be recognisable. 3. A high vertical illuminance increases recognition of peoples faces and therefore the feeling of safety.
5.34.5	Ticket office	300	19	0,60	80	1. Reflections in the windows shall be avoided. 2. Glare from outside shall be prevented.

Table 5.35 — Educational premises – Nursery school, play school

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.35.1	Play room	300	22	0,40	80	High luminances should be avoided in viewing directions from below by use of diffuse covers.
5.35.2	Nursery	300	22	0,40	80	High luminances should be avoided in viewing directions from below by use of diffuse covers.
5.35.3	Handicraft room	300	19	0,60	80	

Table 5.36 — Educational premises – Educational buildings

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.36.1	Classrooms, tutorial rooms	300	19	0,60	80	Lighting should be controllable.
5.36.2	Classroom for evening classes and adults education	500	19	0,60	80	Lighting should be controllable.
5.36.3	Auditorium, lecture halls	500	19	0,60	80	Lighting should be controllable to accommodate various A/V needs.
5.36.4	Black, green and white boards	500	19	0,70	80	Specular reflections shall be prevented. Presenter/teacher shall be illuminated with suitable vertical illuminance.
5.36.5	Demonstration table	500	19	0,70	80	In lecture halls 750 lx.
5.36.6	Art rooms	500	19	0,60	80	
5.36.7	Art rooms in art schools	750	19	0,70	90	5 000 K < T_{CP} 6 500 K.
5.36.8	Technical drawing rooms	750	16	0,70	80	
5.36.9	Practical rooms and laboratories	500	19	0,60	80	
5.36.10	Handicraft rooms	500	19	0,60	80	
5.36.11	Teaching workshop	500	19	0,60	80	
5.36.12	Music practice rooms	300	19	0,60	80	
5.36.13	Computer practice rooms (menu driven)	300	19	0,60	80	DSE-work, see 4.9.
5.36.14	Language laboratory	300	19	0,60	80	
5.36.15	Preparation rooms and workshops	500	22	0,60	80	
5.36.16	Entrance halls	200	22	0,40	80	
5.36.17	Circulation areas, corridors	100	25	0,40	80	

Table 5.36 — Educational premises – Educational buildings *(continued)*

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.36.18	Stairs	150	25	0,40	80	
5.36.19	Student common rooms and assembly halls	200	22	0,40	80	
5.36.20	Teachers rooms	300	19	0,60	80	
5.36.21	Library: bookshelves	200	19	0,60	80	
5.36.22	Library: reading areas	500	19	0,60	80	
5.36.23	Stock rooms for teaching materials	100	25	0,40	80	
5.36.24	Sports halls, gymnasiums, swimming pools	300	22	0,60	80	See EN 12193 for training conditions.
5.36.25	School canteens	200	22	0,40	80	
5.36.26	Kitchen	500	22	0,60	80	

Table 5.37 — Health care premises – Rooms for general use

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
						Too high luminances in the patients' visual field shall be prevented.
5.37.1	Waiting rooms	200	22	0,40	80	
5.37.2	Corridors: during the day	100	22	0,40	80	Illuminance at floor level.
5.37.3	Corridors: cleaning	100	22	0,40	80	Illuminance at floor level.
5.37.4	Corridors: during the night	50	22	0,40	80	Illuminance at floor level.
5.37.5	Corridors with multi-purpose use	200	22	0,60	80	Illuminance at task/activity level.
5.37.6	Day rooms	200	22	0,60	80	
5.37.7	Elevators, lifts for persons and visitors	100	22	0,60	80	Illuminance at floor level.
5.37.8	Service lifts	200	22	0,60	80	Illuminance at floor level.

Table 5.38 — Health care premises – Staff rooms

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.38.1	Staff office	500	19	0,60	80	
5.38.2	Staff rooms	300	19	0,60	80	

Table 5.39 — Health care premises – Wards, maternity wards

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
						Too high luminances in the patients' visual field shall be prevented.
5.39.1	General lighting	100	19	0,40	80	Illuminance at floor level.
5.39.2	Reading lighting	300	19	0,70	80	
5.39.3	Simple examinations	300	19	0,60	80	
5.39.4	Examination and treatment	1 000	19	0,70	90	
5.39.5	Night lighting, observation lighting	5	-	-	80	
5.39.6	Bathrooms and toilets for patients	200	22	0,40	80	

Table 5.40 — Health care premises – Examination rooms (general)

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.40.1	General lighting	500	19	0,60	90	4 000 K $\leq T_{CP} \leq$ 5 000 K
5.40.2	Examination and treatment	1 000	19	0,70	90	

Table 5.41 — Health care premises – Eye Examination rooms

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.41.1	General lighting	500	19	0,60	90	4 000 K $\leq T_{CP} \leq$ 5 000 K
5.41.2	Examination of the outer eye	1 000	-	-	90	
5.41.3	Reading and colour vision tests with vision charts	500	16	0,70	90	

Table 5.42 — Health care premises – Ear Examination rooms

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.42.1	General lighting	500	19	0,60	90	
5.42.2	Ear examination	1 000	-	-	90	

Table 5.43 — Health care premises – Scanner rooms

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.43.1	General lighting	300	19	0,60	80	
5.43.2	Scanners with image enhancers and television systems	50	19	-	80	DSE-work, see 4.9.

Table 5.44 — Health care premises – Delivery rooms

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.44.1	General lighting	300	19	0,60	80	
5.44.2	Examination and treatment	1 000	19	0,70	80	

Table 5.45 — Health care premises – Treatment rooms (general)

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.45.1	Dialysis	500	19	0,60	80	Lighting should be controllable.
5.45.2	Dermatology	500	19	0,60	90	
5.45.3	Endoscopy rooms	300	19	0,60	80	
5.45.4	Plaster rooms	500	19	0,60	80	
5.45.5	Medical baths	300	19	0,60	80	
5.45.6	Massage and radiotherapy	300	19	0,60	80	

Table 5.46 — Health care premises – Operating areas

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L	U_o	R_a	Specific requirements
			–	–	–	
5.46.1	Pre-op and recovery rooms	500	19	0,60	90	
5.46.2	Operating theatre	1 000	19	0,60	90	
5.46.3	Operating cavity			-		\bar{E}_m : 10 000 lx to 100 000 lx

Table 5.47 — Health care premises – Intensive care unit

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L	U_o	R_a	Specific requirements
			–	–	–	
5.47.1	General lighting	100	19	0,60	90	Illuminance at floor level.
5.47.2	Simple examinations	300	19	0,60	90	Illuminance at bed level.
5.47.3	Examination and treatment	1 000	19	0,70	90	Illuminance at bed level.
5.47.4	Night watch	20	19	-	90	

Table 5.48 — Health care premises – Dentists

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L	U_o	R_a	Specific requirements
			–	–	–	
5.48.1	General lighting	500	19	0,60	90	Lighting should be glare-free for the patient.
5.48.2	At the patient	1 000	-	0,70	90	
5.48.3	Operating cavity	-	-	-	-	Specific requirements are given in EN ISO 9680.
5.48.4	White teeth matching	-	-	-	-	Specific requirements are given in EN ISO 9680.

Table 5.49 — Health care premises – Laboratories and pharmacies

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L	U_o	R_a	Specific requirements
			–	–	–	
5.49.1	General lighting	500	19	0,60	80	
5.49.2	Colour inspection	1 000	19	0,70	90	$6\,000\text{ K} \leq T_{CP} \leq 6\,500\text{ K}$

Table 5.50 — Health care premises – Decontamination rooms

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.50.1	Sterilisation rooms	300	22	0,60	80	
5.50.2	Disinfection rooms	300	22	0,60	80	

Table 5.51 — Health care premises – Autopsy rooms and mortuaries

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.51.1	General lighting	500	19	0,60	90	
5.51.2	Autopsy table and dissecting table	5 000	-	-	90	Values higher than 5 000 lx may be required.

Table 5.52 — Transportation areas – Airports

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.52.1	Arrival and departure halls, baggage claim areas	200	22	0,40	80	
5.52.2	Connecting areas	150	22	0,40	80	
5.52.3	Information desks, check-in desks	500	19	0,70	80	DSE-work, see 4.9.
5.52.4	Customs and passport control desks	500	19	0,70	80	Facial recognition has to be provided.

Table 5.52 — Transportation areas – Airports (continued)

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.52.5	Waiting areas	200	22	0,40	80	
5.52.6	Luggage store rooms	200	25	0,40	80	
5.52.7	Security check areas	300	19	0,60	80	DSE-work, see 4.9.
5.52.8	Air traffic control tower	500	16	0,60	80	1. Lighting should be dimmable. 2. DSE-work, see 4.9. 3. Glare from daylight shall be avoided. 4. Reflections in windows, especially at night shall be avoided.
5.52.9	Testing and repair hangars	500	22	0,60	80	.
5.52.10	Engine test areas	500	22	0,60	80	
5.52.11	Measuring areas in hangars	500	22	0,60	80	

Table 5.53 — Transportation areas – Railway installations

Ref. no.	Type of area, task or activity	\bar{E}_m lx	UGR_L –	U_o –	R_a –	Specific requirements
5.53.1	Fully enclosed platforms, small number of passengers	100	-	0,40	40	1. Special attention to the edge of the platform. 2. Avoid glare for vehicle drivers. 3. Illuminance at floor level.
5.53.2	Fully enclosed platforms, large number of passengers	200	-	0,50	60	1. Special attention to the edge of the platform. 2. Avoid glare for vehicle drivers. 3. Illuminance at floor level.
5.53.3	Passenger subways (underpasses), small number of passengers	50	28	0,50	40	Illuminance at floor level
5.53.4	Passenger subways (underpasses), large number of passengers	100	28	0,50	40	Illuminance at floor level.
5.53.5	Ticket hall and concourse	200	28	0,50	40	
5.53.6	Ticket and luggage offices and counters	300	19	0,50	80	
5.53.7	Waiting rooms	200	22	0,40	80	
5.53.8	Entrance halls, station halls	200	-	0,40	80	
5.53.9	Switch and plant rooms	200	28	0,40	60	Safety colours must be recognisable.
5.53.10	Access tunnels	50	-	0,40	20	Illuminance at floor level.
5.53.11	Maintenance and servicing sheds	300	22	0,50	60	

6 Verification procedures

6.1 General

Specified design criteria which are listed in this European Standard shall be verified by the following procedures.

In lighting design, calculations and measurements, certain assumptions including degree of accuracy have been made. These shall be declared.

The installation and the environment shall be checked against the design assumptions.

6.2 Illuminances

When verifying conformity to the illuminance requirements the measurement points shall coincide with any design points or grids used. Verification shall be made to the criteria of the relevant surfaces.

For subsequent measurements, the same measurement points shall be used.

Verification of illuminances that relate to specific tasks shall be measured in the plane of the task.

NOTE When verifying illuminances, account should be taken of the calibration of the light meters used, the conformity of the lamps and luminaires to the published photometric data, and of the design assumptions made about surface reflectance, etc., compared with the real values.

The average illuminance and uniformity shall be calculated and shall be not less than the values specified.

6.3 Unified Glare Rating

Authenticated UGR data produced by the tabular method shall be provided for the luminaire scheme by the manufacturer of the luminaire. The spacing shall be declared for the UGR-tables provided.

6.4 Colour rendering and colour appearance

Authenticated colour rendering index R_a and correlated colour temperatures T_{cp} data shall be provided for the lamps in the scheme by the manufacturer of the lamps. The lamps shall be checked against the design specifications.

6.5 Luminaire luminance

The average luminance of the luminous parts of the luminaire shall be measured and/or calculated in the C-plane (azimuth) at intervals of 15° starting at 0° and the γ -plane (elevation) for angles of 65°, 70°, 75°, 80° and 85°. Normally the manufacturer of the luminaire shall provide these data based on maximum (lamp/luminaire) output (see also EN 13032-1 and -2).

The values shall not exceed the limits specified in Table 4.

6.6 Maintenance schedule

The maintenance schedule shall be provided and should be according to 4.10.

Annex A (informative)

Typical values of grid point spacing

Typical values of grid point spacing are given in Table A.1 based on Formula (1) in 4.4.

Table A.1 — Recommended number of grid points

Length of the area m	Maximum distance between grid points m	Minimum number of grid points
0,40	0,15	3
0,60	0,20	3
1,00	0,20	5
2,00	0,30	6
5,00	0,60	8
10,00	1,00	10
25,00	2,00	12
50,00	3,00	17
100,00	5,00	20

Annex B (informative)

A-deviation

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN/ CENELEC member.

European Standard not under any EU Directive

This European Standard does not fall under any Directive of the EU.

In Denmark this A-deviation is valid instead of the provisions of the European Standard until it has been removed.

Denmark

Danish Building Regulations BR 08, published by the Danish Enterprise and Construction Authority

Related to Clauses 4, 5 and 6

According to legal Danish Building Regulations BR 08 the use of DS 700 is mandatory.

Bibliography

- [1] EN 1838, *Lighting applications — Emergency lighting*
- [2] EN 13032-3, *Light and Lighting — Measurement and presentation of photometric data of lamps and luminaires — Part 3: Presentation of data for emergency lighting of work places*
- [3] EN ISO 6385:2004, *Ergonomic principles in the design of work systems (ISO 6385:2004)*
- [4] EN ISO 9241-302, *Ergonomics of human-system interaction — Part 302: Terminology for electronic visual displays (ISO 9241-302:2008)*
- [5] EN ISO 14253-1, *Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformance or non-conformance with specifications (ISO 14253-1:1998)*
- [6] ISO 8995-1 (CIE S 008), *Lighting of work places — Part 1: Indoor*
- [7] ISO 15469:2004 (CIE S 011/E:2003), *Joint ISO/CIE Standard: Spatial distribution of daylight - CIE standard general sky*
- [8] CIE 016-1970. *Daylight*
- [9] CIE 017.4-1987, *International Lighting Vocabulary, 4th ed.* (Joint Publication IEC/CIE)
- [10] CIE 029.2-1986, *Guide on Interior Lighting; second edition*
- [11] CIE 040-1978, *Calculations for Interior Lighting: Basic Method*
- [12] CIE 060-1984, *Vision and the Visual Display Unit Work Station*
- [13] CIE 97-2005, *Guide on the Maintenance of Indoor Electric Lighting Systems*
- [14] CIE 110-1994, *Spatial Distribution of Daylight - Luminance Distributions of Various Reference Skies*
- [15] CIE 117-1995, *Discomfort Glare in Interior Lighting*
- [16] CIE 190-2010, *Calculation and Presentation of Unified Glare Rating Tables for Indoor Lighting Luminaires*
- [17] CIE x005-1992, *Proceedings of the CIE Seminar '92 on "Computer Programs for Light and Lighting"*
- [18] *CIE Guidelines for Accessibility: Visibility and Lighting Guidelines for Older Persons and Persons with Disabilities*, Draft:2009
- [19] 89/654/EEC *Council Directive of 30 November 1989 concerning the minimum safety and health requirements for the workplace (first individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC)*, OJ L 393, 30.12.1989, p. 1–12
- [20] 90/270/EEC, *Council directive of 29 May 1990 on the minimum safety and health requirements for work with display screen equipment (fifth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC)*, OJ L 156, 21.6.1990, p. 14–18

Index of interior areas, tasks and activities

Adjusting (Electrical industry)	5.11.6	Card cutting (Textile manufacture)	5.23.2
Agriculture	5.6	Cardboard manufacture (Paper and paper goods)	5.19.2
Access tunnels (Railways)	5.53.10	Carding (Textile manufacture)	5.23.2
Air traffic control tower (Airports)	5.52.8	Cashier desk (Restaurants and hotels)	5.29.1
Airports	5.52	Casting bay (Foundries, etc.)	5.13.6
Archives (Offices)	5.26	Cellars (Foundries, etc.)	5.13.1
Arrival halls (Airports)	5.52.1	Cellars (Rolling mills, etc.)	5.22.9
Art rooms (Education)	5.36.6	Cement	5.8
Art rooms in art schools (Education)	5.36.7	Cement goods	5.8
Assembly (Wood processing)	5.25.4	Ceramics	5.9
Assembly halls (Education)	5.36.19	Check-in desks (Airports)	5.52.3
Assembly, fine (Electrical industry)	5.11.5	Chemical industry	5.10
Assembly, fine (Metal processing)	5.18.11	Cigarettes, manufacture of (Food industry)	5.12.5
Assembly, medium (Electrical industry)	5.11.5	Cigars, manufacture of (Food industry)	5.12.5
Assembly, medium (Metal processing)	5.18.11	Cinemas	5.30
Assembly, precision (Electrical industry)	5.11.5	Circulation areas (Education)	5.36.17
Assembly, precision (Metal processing)	5.18.11	Circulation areas (Traffic zones)	5.1.1
Assembly, rough (Electrical industry)	5.11.5	Classroom, adults education (Education)	5.36.2
Assembly, rough (Metal processing)	5.18.11	Classroom, evening classes (Education)	5.36.2
Automatic processing (Wood processing)	5.25.1	Classrooms (Education)	5.36.1
Autopsy room, general lighting (Health care)	5.51.1	Cleaning (Food industry)	5.12.1
Autopsy rooms (Health care)	5.51	Cloakrooms (Places of public assembly)	5.28.2
Autopsy table (Health care)	5.51.2	Cloakrooms, general (Rest rooms, etc.)	5.2.4
Baggage claim areas (Airports)	5.52.1	Coil impregnating (Electrical industry)	5.11.3
Bakeries	5.7	Coiler (Rolling mills, etc.)	5.22.6
Baking (Bakeries)	5.7	Cold forming (Metal processing)	5.18.7
Bale opening (Textile manufacture)	5.23.1	Cold stores	5.4
Barrel filling (Food industry)	5.12.1	Colour inspection (Chemical industry)	5.10.7
Barrels, work on (Leather and leather goods)	5.17.1	Colour inspection (Food industry)	5.12.8
Bathrooms (Rest rooms, etc.)	5.2.4	Colour inspection (Health care)	5.49.2
Bathrooms for patients (Health care)	5.39.6	Colour inspection (Leather and leather goods)	5.17.7
Baths (Textile manufacture)	5.23.1	Colour inspection (Printers)	5.21.4
Belt sections (Rolling mills, etc.)	5.22.9	Colour inspection (Textile manufacture)	5.23.11
Black board (Education)	5.36.4	Colour vision tests (Health care)	5.41.3
Block engraving (Printers)	5.21.1	Combing (Textile manufacture)	5.23.2
Body assembly (Vehicle construction)	5.24.1	Computer practice rooms (Education)	5.36.13
Body work (Vehicle construction)	5.24.1	Concert halls	5.30
Boiler house (Power stations)	5.20.2	Concrete	5.8
Bookbinding, standard (Paper and paper goods)	5.19.3	Condenser rooms (Power stations)	5.20.4
Bookshelves (Libraries)	5.33.1	Conference rooms (Offices)	5.26
Bottles, inspection of (Food industry)	5.12.6	Conference rooms (Restaurants and hotels)	5.29.6
Braiding (Textile manufacture)	5.23.4	Connecting areas (Airports)	5.52.2
Breweries (Food industry)	5.12.1	Control panels (Rolling mills, etc.)	5.22.7
Bricks	5.8	Control platforms (Rolling mills, etc.)	5.22.7
Buffet (Restaurants and hotels)	5.29.5	Control rooms	5.3
Buildings for livestock (Agriculture)	5.6.2	Control rooms (Power stations)	5.20.5
Burling (Textile manufacture)	5.23.10	Control station (Storage rack areas)	5.5.3
Butchers (Food industry)	5.12.3	Cooking in chocolate factories (Food industry)	5.12.1
Cable manufacture (Electrical industry)	5.11.1	Cooking in preserve factories (Food industry)	5.12.1
CAD work stations (Offices)	5.26.4	Copper engraving (Printers)	5.21.5
Calving stalls (Agriculture)	5.6.3	Copying (Offices)	5.26.1
Canteens (Education)	5.36.25	Corridors (Education)	5.36.17
Canteens (Rest rooms, etc.)	5.2.1	Corridors (Restaurants and hotels)	5.29.7
Car parks, indoor	5.34	Corridors (Traffic zones)	5.1.1
		Corridors, during the day (Health care)	5.37.2
		Corridors, during the night (Health care)	5.37.3
		Corrugating machines (Paper and paper goods)	5.19.2

Counters (Libraries)	5.33.3	Embossing (Paper and paper goods)	5.19.3
Counters (Railways)	5.53.6	Embossing (Printers)	5.21.1
Cupola, work places at (Foundries, etc.)	5.13.5	Enamelling (Ceramics, etc.)	5.9.3
Customs desks (Airports)	5.52.4	Endoscopy rooms (Health care)	5.45.3
Cutting (Chemical industry)	5.10.8	Engine test areas (Airports)	5.52.11
Cutting (Leather and leather goods)	5.17.3	Engraving (Ceramics, etc.)	5.9.4
Cutting (Paper and paper goods)	5.19.4	Engraving by hand (Ceramics, etc.)	5.9.5
Cutting (Printers)	5.21.1	Entrance halls (Education)	5.36.16
Cutting (Wood processing)	5.25.6	Entrance halls (Places of public assembly)	5.28.1
Cutting equipment manufacture (Metal processing)	5.18.10	Entrance halls (Railways)	5.53.8
Cutting of fruit (Food industry)	5.12.4	Escalators (Airports)	5.52.2
Cutting of vegetables (Food industry)	5.12.4	Escalators (Traffic zones)	5.1.2
		Examination (Health care)	5.41.2
		Examination, delivery rooms (Health care)	5.44.2
Dairies mills (Food industry)	5.12.3	Examination, intensive care (Health care)	5.47.3
Dairy (Agriculture)	5.6.5	Examination, wards (Health care)	5.39.4
Data processing (Offices)	5.26.2	Examination of the outer eye (Health care)	5.42.2
Day rooms (Health care)	5.37.4	Examination rooms (Health care)	5.41
Decontamination rooms (Health care)	5.50	Examination rooms, general lighting (Health care)	5.41.1
Decorating (Bakeries)	5.7.2	Exhibition halls	5.31
Decoration (Food industry)	5.12.6	Exhibits, insensitive to light (Museums)	5.32.1
Decorative grinding (Ceramics, etc.)	5.9.6	Exhibits, light sensitive (Museums)	5.32.2
Delicatessen foods (Food industry)	5.12.5	Eye examination, general lighting (Health care)	5.41.1
Delivery rooms (Health care)	5.44	Eye examination rooms (Health care)	5.41
Delivery rooms, general lighting (Health care)	5.44.1		
Demonstration table (Education)	5.36.5	Fabric control (Textile manufacture)	5.23.11
Dentist, general lighting (Health care)	5.38.1	Fabric printing, automatic (Textile manufacture)	5.23.9
Dentist, lighting at the patient (Health care)	5.48.2	Fairs (Trade fairs, etc.)	5.31
Dentists (Health care)	5.48	Feed preparation (Agriculture)	5.6.4
Departure halls (Airports)	5.52.1	Fermentation cellar (Food industry)	5.12.1
Dermatology (Health care)	5.45.2	Fermenting raw tobacco (Food industry)	5.12.1
Design, manual (Textile manufacture)	5.23.6	Filing (Offices)	5.26.1
Devilling machine work (Textile manufacture)	5.23.2	Filtering floor in sugar refineries (Food industry)	5.12.3
Dialysis (Health care)	5.45.1	Finishing (Bakeries)	5.7.2
Die casting (Foundries, etc.)	5.13.10	Finishing (Chemical industry)	5.10.8
Dining room (Restaurants and hotels)	5.29.3	Finishing (Textile manufacture)	5.23.7
Disinfection rooms (Health care)	5.50.2	First aid rooms	5.2
Dispatch handling areas (Store rooms, etc.)	5.4.2	Fleshing of skins (Leather and leather goods)	5.17.2
Dispatch packing areas (Store rooms, etc.)	5.4.2	Fluting (Wood processing)	5.25.6
Dissecting table (Health care)	5.51.2	Folding (Paper and paper goods)	5.19.3
Drawing (Textile manufacture)	5.23.2	Food industry, luxury	5.12
Drawing patterns (Textile manufacture)	5.23.6	Food stuffs industry	5.12
Dressing (Wood processing)	5.25.6	Forging, drop (Metal processing)	5.18.2
Dressing rooms (Foundries, etc.)	5.13.4	Forging, open die (Metal processing)	5.18.1
Dressing rooms (Theatres, etc.)	5.30.1	Foundries	5.13
Dry cleaning	5.16.11	Fuel supply plant (Power stations)	5.20.1
Dry cleaning (Laundries and dry cleaning)	5.16.2	Function room (Restaurants and hotels)	5.29.3
Drying (Cement, etc.)	5.8.1	Furnaces (Rolling mills, etc.)	5.22.5
Drying (Ceramics, etc.)	5.9.1		
Drying (Wood processing)	5.25.1	Galvanising (Electrical industry)	5.11.4
Drying, raw tobacco (Food industry)	5.12.1	Galvanising (Metal processing)	5.18.12
Drying room (Textile manufacture)	5.23.8	Gangways, manned (Storage rack areas)	5.5.2
Dyeing (Textile manufacture)	5.23.7	Gangways, unmanned (Storage rack areas)	5.5.1
		General areas (Places of public assembly)	5.28
Ear examination (Health care)	5.42.2	General areas inside buildings	5.2-5.5
Ear examination, general lighting (Health care)	5.42.1	Gilding (Printers)	5.21.1
Ear examination rooms (Health care)	5.42	Glass	5.9
Edge runners (Paper and paper goods)	5.19.1	Glass blowing (Ceramics, etc.)	5.9.3
Educational buildings	5.36	Glass instruments (Ceramics, etc.)	5.9.4
Educational premises	5.35, 5.36	Glass polishing (Ceramics, etc.)	5.9.4
Electrical industry	5.11	Glasses, inspection of (Food industry)	5.12.6
Electronic workshops (Electrical industry)	5.11.6	Glassware	5.9

Glazing (Bakeries)	5.7.2	Laboratories (Food industry)	5.12.7
Glazing (Ceramics, etc.)	5.9.3	Laboratories (Health care)	5.49
Glove making (Leather and leather goods)	5.17.9	Laboratories, general lighting (Health care)	5.49.1
Gluing (Paper and paper goods)	5.19.3	Language laboratory (Education)	5.36.14
Gluing (Wood processing)	5.25.4	Laundries	5.16
Goods in (Laundries and dry cleaning)	5.16.1	Leather	5.17
Grinding (Ceramics, etc.)	5.9.4	Leather dyeing (Leather and leather goods)	5.17.5
Grinding (Metal processing)	5.18.5	Leather goods	5.17
Grinding, by hand (Ceramics, etc.)	5.9.5	Lecture hall (Education)	5.36.3
Grinding, crystal (Ceramics, etc.)	5.9.5	Libraries	5.33
Grinding, decorative (Ceramics, etc.)	5.9.6	Library: bookshelves (Education)	5.36.21
Grinding, optical glass (Ceramics, etc.)	5.9.5	Library: reading areas (Education)	5.36.22
Grooving (Wood processing)	5.25.6	Lithography (Printers)	5.21.3
Gymnasiums (Education)	5.36.24	Livestock, buildings for	5.6.2
		Loading bays (Traffic zones)	5.1.3
Hairdressers	5.14	Loading of goods (Agriculture)	5.6.1
Hairdressing (Hairdressers)	5.14.1	Loading ramps (Traffic zones)	5.1.3
Hand painting (Ceramics, etc.)	5.9.6	Lounges (Places of public assembly)	5.28.3
Hand printing (Printers)	5.21.2	Luggage offices (Railways)	5.53.6
Handicraft room (Nursery schools, etc.)	5.35.3	Luggage store rooms (Airports)	8.52.6
Handicraft rooms (Education)	5.36.10	Luxury food industry	5.12
Handling equipment (Agriculture)	5.6.1		
Handling machinery (Agriculture)	5.6.1	Machine halls (Power stations)	5.20.3
Hat manufacturing (Textile manufacture)	5.23.13	Machine work, general (Cement, etc.)	5.8.3
Health care premises	5.37-5.51	Machine work, general (Ceramics, etc.)	5.9.2
Hemp spinning (Textile manufacture)	5.23.2	Machinery (Agriculture)	5.6.1
Hotels	5.29	Machining, average (Metal processing)	5.18.4
		Machining, precision (Metal processing)	5.18.5
In/out ramps, at night (Public car parks)	5.34.2	Machining, rough (Metal processing)	5.18.4
In/out ramps, during the day (Public car parks)	5.34.1	Maintenance sheds (Railways)	5.53.11
Information desks (Airports)	5.52.3	Malting floor (Food industry)	5.12.1
Inlay work (Wood processing)	5.25.8	Marking (Laundries and dry cleaning)	5.16.1
Inspection (Chemical industry)	5.10.8	Marquetry (Wood processing)	5.25.8
Inspection (Laundries and dry cleaning)	5.16.4	Massage (Health care)	5.45.6
Inspection (Metal processing)	5.18.6	Materials, preparation of (Cement, etc.)	5.8.2
Inspection (Rolling mills, etc.)	5.22.8	Maternity wards (Health care)	5.39
Inspection (Vehicle construction)	5.24.5	Maternity wards, general lighting (Health care)	5.39.1
Inspection (Wood processing)	5.25.9	Matrix making (Printers)	5.21.1
Inspection of bottles (Food industry)	5.12.6	Measurement (Rolling mills, etc.)	5.22.8
Inspection of glasses (Food industry)	5.12.6	Measuring areas in hangars (Airports)	5.52.12
Intensive care unit (Health care)	5.47	Measuring room, precision (Chemical industry)	5.10.4
Intensive care unit, general lighting (Health care)	5.47.1	Mechanics, precision (Metal processing)	5.18.14
Iron works	5.22	Medical attention, rooms for (Rest rooms, etc.)	5.2.6
Ironing (Laundries and dry cleaning)	5.16.3	Medical baths (Health care)	5.45.5
Ironing (Textile manufacture)	5.23.2	Meeting rooms (Offices)	5.26.5
		Mending, invisible (Textile manufacture)	5.23.12
Jewellery (Jewellery manufacturing)	5.15.2	Metal casting	5.13
Jewellery manufacturing	5.15	Metal processing	5.18
Jig making (Metal processing)	5.18.14	Metal working	5.18
Joiner's bench (Wood processing)	5.25.4	Micro-mechanics (Metal processing)	5.18.14
Joinery, fancy (Wood processing)	5.25.5	Mill train (Rolling mills, etc.)	5.22.6
Jute spinning (Textile manufacture)	5.23.2	Milling (Food industry)	5.12.2
		Mixer (Foundries, etc.)	5.13.5
Kilns, work on (Cement, etc.)	5.8.2	Mixers, work on (Cement, etc.)	5.8.2
Kitchen (Education)	5.36.26	Mixing (Food industry)	5.12.2
Kitchen (Restaurants and hotels)	5.29.2	Model building (Foundries, etc.)	5.13.10
Kitchen work (Food industry)	5.12.5	Mortuaries (Health care)	5.51
Knitting (Textile manufacture)	5.23.4	Mortuaries, general lighting (Health care)	5.51.1
Knitting, fine (Textile manufacture)	5.23.5	Moulding, core (Foundries, etc.)	5.13.9
		Moulding, hand (Foundries, etc.)	5.13.9
Laboratories (Chemical industry)	5.10.4	Moulding, machine (Foundries, etc.)	5.13.8
Laboratories (Education)	5.36.9	Museums	5.32

Music practice rooms (Education)	5.36	Post room (Control rooms)	5.3.2
Night lighting (Health care)	5.39.5	Power stations	5.20
Night watch, intensive care (Health care)	5.47.4	Practical rooms (Education)	5.36.9
Nursery (Nursery school, etc.)	5.35.2	Practice rooms (Theatres, etc.)	5.30.1
Nursery school	5.35	Precious stones (Jewellery manufacturing)	5.15.1
Observation lighting (Health care)	5.39.5	Precious stones, synthetic (Ceramics, etc.)	5.9.7
Offices	5.26	Precision measuring rooms (Chemical industry)	5.10.4
Operating areas (Health care)	5.46	Precision parts, shaping (Ceramics, etc.)	5.9.4
Operating cavity (Health care)	5.46.3	Precision work (Ceramics, etc.)	5.9.6
Operating cavity, dentist (Health care)	5.48.3	Pre-op rooms (Health care)	5.46.1
Operating of goods (Agriculture)	5.6.1	Preparation (Bakeries)	5.7.1
Operating theatre (Health care)	5.46.2	Preparation (Ceramics, etc.)	5.9.2
Packing (Food industry)	5.12.2	Preparation of materials (Cement, etc.)	5.8.2
Painting (Metal processing)	5.18.13	Preparation rooms (Education)	5.36.15
Painting (Vehicle construction)	5.24.2	Pre-spinning (Textile manufacture)	5.23.2
Painting (Wood processing)	5.25.5	Pressing (Ceramics, etc.)	5.9.3
Painting, by hand (Ceramics, etc.)	5.9.6	Pressing (Laundries and dry cleaning)	5.16.3
Painting, inspection of (Vehicle construction)	5.24.3	Printers	5.21
Painting, touch-up of (Vehicle construction)	5.24.3	Printing machines (Printers)	5.21.1
Pantries (Rest rooms, etc.)	5.2.1	Processing installations, constantly manned (Chemical industry)	5.10.3
Paper	5.6	Processing installations, limited manual intervention (Chemical industry)	5.10.2
Paper goods	5.6	Processing installations, remote-operated (Chemical industry)	5.10.1
Paper machines (Paper and paper goods)	5.6.2	Product control (Food industry)	5.12.6
Paper manufacture (Paper and paper goods)	5.6.2	Production plants with continuous manual operation (Rolling mills, etc.)	5.22.3
Paper processing (Paper and paper goods)	5.6.2	Production plants with occasional manual operation (Rolling mills, etc.)	5.22.2
Paper sorting (Printers)	5.21.2	Production plants without manual operation (Rolling mills, etc.)	5.22.1
Parking areas (Public car parks)	5.34.4	Public assembly, places of	5.28-5.34
Passenger subways (underpasses), small number of passengers (Railways)	5.53.3	Public car parks	5.34
Passenger subways (underpasses), large number of passengers (Railways)	5.53.4	Pulp mills (Paper and paper goods)	5.19.1
Passport control desks (Airports)	5.52.4	Pump rooms (Power stations)	5.20.4
Peeling (Food industry)	5.12.1	Punching (Leather and leather goods)	5.17.3
Pharmaceutical production (Chemical industry)	5.10.5	Quality control (Leather and leather goods)	5.17.6
Pharmacies (Health care)	5.49	Quality control (Wood processing)	5.25.9
Pharmacies, general lighting (Health care)	5.49.1	Radiotherapy (Health care)	5.45.6
Physical exercise, rooms for (Rest rooms, etc.)	5.2.3	Railway installations	5.53
Picking (Textile manufacture)	5.23.10	Reading (Offices)	5.26.2
Pipe drawing shops (Metal processing)	5.18.7	Reading area (Libraries)	5.33.2
Pits, work on (Leather and leather goods)	5.17.1	Reading lighting (Health care)	5.39.2
Plant rooms (Control rooms)	5.3.1	Reading tests with vision charts (Health care)	5.41.3
Plant rooms (Railways)	5.53.9	Rebating (Wood processing)	5.25.6
Plaster rooms (Health care)	5.45.4	Reception desk (Offices)	5.26.6
Plastics industry	5.10	Reception desk (Restaurants and hotels)	5.29.1
Plate machining (Metal processing)	5.18.8	Recovery rooms (Health care)	5.46.1
Platens, work on (Printers)	5.21.1	Reeling (Textile manufacture)	5.23.3
Platforms (Foundries, etc.)	5.13.2	Repair hangars (Airports)	5.52.12
Platforms, fully enclosed, small number of passengers (Railways)	5.53.1	Repairs (Laundries and dry cleaning)	5.16.4
Platforms, fully enclosed, large number of passengers (Railways)	5.53.2	Rest rooms	5.2
Play room (Nursery school, etc.)	5.35.1	Rest rooms (Rest rooms, etc.)	5.2.2
Play school	5.35	Restaurant (Restaurants and hotels)	5.29.3
Plying (Textile manufacture)	5.13.3	Restaurants	5.29
Plywood manufacturing (Wood processing)	5.25.1	Retail premises	5.27
Polishing (Leather and leather goods)	5.17.3	Retouching (Printers)	5.21.3
Polishing (Wood processing)	5.25.5	Rolling (Ceramics, etc.)	5.9.3
Polishing chamber (Vehicle construction)	5.24.2	Rolling mills	5.22
Porters desk (Restaurants and hotels)	5.29.1		

Rooms for physical exercise (Rest rooms, etc.)	5.2.3	Sterilisation rooms (Health care)	5.50.1
Rough forms (Cement, etc.)	5.8.4	Stitches, taking up (Textile manufacture)	5.23.5
Rubber industry	5.10	Stitching (Leather and leather goods)	5.17.3
Rubbing of skins (Leather and leather goods)	5.17.2	Stockrooms (Store rooms, etc.)	5.4.1
		Stockrooms for teaching materials (Education)	5.36.23
Saddlery work (Leather and leather goods)	5.17.3	Stones, work on (Printers)	5.21.1
Sales area (Retail premises)	5.27.1	Storage rack areas	5.5
Sand preparation (Foundries, etc.)	5.13.3	Store rooms	5.4
Sanitation rooms	5.2	Store rooms (Store rooms, etc.)	5.4.1
Saw frame (Wood processing)	5.25.3	Student common rooms (Education)	5.36.19
Sawing (Wood processing)	5.25.6	Sugar factories (Food industry)	5.12.1
Scanner rooms (Health care)	5.43	Sugar refineries (Food industry)	5.12.3
Scanner rooms, general lighting (Health care)	5.43.1	Surface preparation (Metal processing)	5.18.13
Scanners with image enhancers (Health care)	5.43.2	Swimming pools (Education)	5.36.24
Scanners with television systems (Health care)	5.43.2	Switch gear, outdoor (Power stations)	5.20.6
School canteens (Education)	5.36.25	Switch gear rooms (Control rooms)	5.3.1
Scribing (Metal processing)	5.18.6	Switch rooms (Railways)	5.53.9
Security check areas (Airports)	5.52.7	Switchboard (Control rooms)	5.3.2
Selection of veneer woods (Wood processing)	5.25.7	Switchboards (Power stations)	5.20.4
Self-service restaurant (Restaurants and hotels)	5.29.4	Synthetic precious stones (Ceramics, etc.)	5.9.7
Servicing sheds (Railways)	5.53.11		
Sewing (Leather and leather goods)	5.17.3	Teachers rooms (Education)	5.36.20
Sewing (Paper and paper goods)	5.19.3	Teaching workshop (Education)	5.36.11
Sewing (Textile manufacture)	5.23.5	Technical drawing (Offices)	5.26.3
Shake out areas (Foundries, etc.)	5.13.7	Technical drawing rooms (Education)	5.36.8
Shaping (Leather and leather goods)	5.17.3	Telex room (Control rooms)	5.3.2
Shaping of precision parts (Ceramics, etc.)	5.9.4	Template making (Metal processing)	5.18.14
Shaping of simple parts (Ceramics, etc.)	5.9.3	Test (Rolling mills, etc.)	5.22.8
Shear line (Rolling mills, etc.)	5.22.6	Testing (Electrical industry)	5.11.6
Sheet metal work (Metal processing)	5.18.9	Testing hangars (Airports)	5.52.10
Shoe making (Leather and leather goods)	5.17.8	Textile manufacture	5.23
Shoe manufacture (Leather and leather goods)	5.17.3	Textile processing	5.23
Sick animal pens (Agriculture)	5.6.3	Theatres	5.30
Sick bay (Rest rooms, etc.)	5.2.5	Ticket hall and concourse (Railways)	5.53.5
Side rooms (Power stations)	5.20.4	Ticket office (Public car parks)	5.34.4
Sieving (Food industry)	5.12.1	Ticket offices (Places of public assembly)	5.28.4
Simple examinations, intensive care (Health care)	5.47.2	Ticket offices (Railways)	5.53.6
Simple examinations, wards (Health care)	5.39.3	Tiles	5.9
Sinking (Wood processing)	5.25.6	Till area (Retail premises)	5.27.2
Sizing (Textile manufacture)	5.23.2	Toilets (Rest rooms, etc.)	5.2.4
Skiving of skins (Leather and leather goods)	5.17.2	Toilets for patients (Health care)	5.39.6
Slab store (Rolling mills, etc.)	5.22.4	Tool making (Metal processing)	5.18.10
Slaughter houses (Food industry)	5.12.3	Tool making (Metal processing)	5.18.14
Sorting (Food industry)	5.12.6	Trade fairs	5.31
Sorting (Laundries and dry cleaning)	5.16.1	Traffic lanes (Public car parks)	5.34.3
Sorting (Leather and leather goods)	5.17.4	Traffic zones	5.1
Sorting (Paper and paper goods)	5.19.3	Transportation areas	5.52-5.53
Sorting of fruit (Food industry)	5.12.4	Travolators (Airports)	5.52.2
Sorting of products (Food industry)	5.12.2	Travolators (Traffic zones)	5.1.2
Sorting vegetables (Food industry)	5.12.4	Treatment rooms, general (Health care)	5.45
Spinning (Textile manufacture)	5.23.3	Treatment, delivery rooms (Health care)	5.44.2
Sports halls (Education)	5.36.24	Treatment, general (Health care)	5.40.2
Spraying chamber (Vehicle construction)	5.24.2	Treatment, intensive care (Health care)	5.47.3
Staff office (Health care)	5.38.1	Treatment, wards (Health care)	5.39.4
Staff rooms (Health care)	5.38	Trimming (Food industry)	5.12.6
Staff rooms (Health care)	5.38.2	Trimming (Textile manufacture)	5.23.10
Stairs (Education)	5.36.18	Tumbling of skins (Leather and leather goods)	5.17.2
Stairs (Traffic zones)	5.1.2	Turning (Wood processing)	5.25.6
Station halls (Railways)	5.53.8	Tutorial rooms (Education)	5.36.1
Steam pits (Wood processing)	5.25.2	Type setting (Printers)	5.21.3
Steel engraving (Printers)	5.21.5	Typing (Offices)	5.26.2
Steel works	5.22	Tyre production (Chemical industry)	5.10.6

Underfloor tunnels, man-size (Foundries, etc.)	5.13.1	Washrooms (Rest rooms, etc.)	5.2.4
Underfloor tunnels, man-size (Rolling mills, etc.)	5.22.9	Watch making, automatic (Jewellery manufact.)	5.15.4
Upholstery manufacture (Vehicle construction)	5.24.4	Watch making, manual (Jewellery manufacturing)	5.15.3
Utensil washing (Agriculture)	5.6.4	Weaving (Textile manufacture)	5.23.4
		Welding (Metal processing)	5.18.3
Vats, work on (Leather and leather goods)	5.17.1	White teeth matching (Health care)	5.48.4
Vehicle construction	5.24	Winding (Textile manufacture)	5.23.3
Veneer woods, selection of (Wood processing)	5.25.7	Winding of large coils (Electrical industry)	5.11.2
		Winding of medium-sized coils (Electrical ind.)	5.11.2
Waiting areas (Airports)	5.52.5	Winding of small coils (Electrical industry)	5.11.2
Waiting rooms (Health care)	5.37.1	Wire drawing shops (Metal processing)	5.18.7
Waiting rooms (Railways)	5.53.7	Wire manufacture (Electrical industry)	5.11.1
Wards (Health care)	5.39	Wood processing	5.25.1
Wards, general lighting (Health care)	5.39.1	Wood working	5.25
Warping (Textile manufacture)	5.23.4	Wood working machines (Wood processing)	5.25.6
Washing (Food industry)	5.12.1	Work shops (Education)	5.36.15
Washing (Laundries and dry cleaning)	5.16.2	Wrapper table (Retail premises)	5.27.3
Washing (Textile manufacture)	5.23.2	Writing (Offices)	5.26.2
Washing of products (Food industry)	5.12.2		

British Standards Institution (BSI)

BSI is the independent national body responsible for preparing British Standards and other standards-related publications, information and services.

It presents the UK view on standards in Europe and at the international level.

It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001

BSI offers Members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Tel: +44 (0)20 8996 7669 Fax: +44 (0)20 8996 7001

Email: plus@bsigroup.com

Buying standards

You may buy PDF and hard copy versions of standards directly using a credit card from the BSI Shop on the website www.bsigroup.com/shop. In addition all orders for BSI, international and foreign standards publications can be addressed to BSI Customer Services.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001

Email: orders@bsigroup.com

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Knowledge Centre.

Tel: +44 (0)20 8996 7004 Fax: +44 (0)20 8996 7005

Email: knowledgecentre@bsigroup.com

Various BSI electronic information services are also available which give details on all its products and services.

Tel: +44 (0)20 8996 7111 Fax: +44 (0)20 8996 7048

Email: info@bsigroup.com

BSI Subscribing Members are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.

Tel: +44 (0)20 8996 7002 Fax: +44 (0)20 8996 7001

Email: membership@bsigroup.com

Information regarding online access to British Standards via British Standards Online can be found at www.bsigroup.com/BSOL

Further information about BSI is available on the BSI website at www.bsigroup.com/standards

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI. This does not preclude the free use, in the course of implementing the standard of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained. Details and advice can be obtained from the Copyright & Licensing Manager.

Tel: +44 (0)20 8996 7070

Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Tel +44 (0)20 8996 9001

Fax +44 (0)20 8996 7001

www.bsigroup.com/standards

raising standards worldwide™

