SLOVENSKI STANDARD
oSIST prEN 16163:2023

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Nadomešča:
SIST-TS CEN/TS 16163:2014

Ohranjanje kulturne dediščine - Smernice in postopki za izbiro ustrezne razsvetljave za razstave v zaprtih prostorih

Conservation of Cultural Heritage - Guidelines and procedures for choosing appropriate lighting for indoor exhibitions

Erhaltung des kulturellen Erbes - Leitlinien und Verfahren für die Auswahl geeigneter Beleuchtung für Innenausstellungen

Conservation du patrimoine culturel - Lignes directrices et procédures concernant le choix d'un éclairage adapté pour les expositions en intérieur

Ta slovenski standard je istoveten z: **prEN 16163**

ICS:

91.160.10	Notranja razsvetljava	Interior lighting
97.195	Umetniški in obrtniški izdelki. Kulturne dobrine in kulturna dediščina	Items of art and handicrafts. Cultural property and heritage

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 16163

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ICS 97.195

Will supersede CEN/TS 16163:2014

English Version

Conservation of Cultural Heritage - Guidelines and procedures for choosing appropriate lighting for indoor exhibitions

Conservation du patrimoine culturel - Lignes directrices et procédures concernant le choix d'un éclairage adapté pour les expositions en intérieur

Erhaltung des kulturellen Erbes - Leitlinien und Verfahren für die Auswahl geeigneter Beleuchtung für Innenausstellungen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 346.

If this draft becomes a European Standard, 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.

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

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European foreword

This document (prEN 16163:2023) has been prepared by Technical Committee CEN/TC 346 “Conservation of Cultural Heritage”, the secretariat of which is held by UNI.

This document is currently submitted to the CEN Enquiry.

This document will supersede CEN/TS 16163:2014.

prEN 16163:2023 includes the following significant technical changes with respect to CEN/TS 16163:2014:

since the publication of the CEN/TS 16163 in 2014, the technology of lighting has evolved considerably and an update of the content has proven to be necessary. In addition to taking into account technological advances and new calculation methods in the field of lighting in recent years, the present version of prEN 16163 contains the elements of good practices for the exhibition lighting design, in its subjective form, as an element of museography, which had not found its place in the previous version.

Introduction

Lighting is needed for many specific functions in museums and other cultural heritage buildings, such as research, conservation and permanent or temporary exhibitions. Lighting is one of the most important factors enabling visitors to fully enjoy works of art and other cultural property. In fact, lighting is a key medium in which visitors interpret and appreciate cultural heritage. Light is needed to see well but this may present a challenge when what is being viewed will deteriorate in the presence of light. When displaying exhibits as a part of Cultural Heritage, it is essential to consider a controlled use of light, to preserve them for the future generations. Indeed, light is an environmental factor, which is a threat to many objects. Alone or in combination with other environmental factors (temperature, humidity, pollution, etc.) light causes fading, discoloration and embrittlement of a wide range of materials. This damage is cumulative and irreversible: no conservation treatment can restore original appearance of colours and the material characteristics. Therefore, the challenge of museum exhibition lighting is to find an appropriate compromise between the long term preservation of the object and the needs of visitors to view them within a suitable exhibition design. As an integral part of exhibition lighting, the following aspects should be considered, mentioned below without priority:

— the conservation aspect, related to the sensitivity of the exhibit at different wavelengths of the incident radiant energy, the spectral composition of the light source and the total luminous exposure,

— the visual aspect, related to the impact of lighting on the visitor experience: lighting has to allow visitors to see exhibits on display, with the correct colour perceptions without glare, reflections or insufficient illumination.

— the design aspect related to the concept and position of the exhibition architecture, the point of view of the curator and all others involved in the purpose and/or didactic objectives of the exhibition.

This document uses terms defined in European and International (CIE International lighting vocabulary) terminology standards, but their definitions have been adapted to the intended users of this specification.

1 Scope

This document defines the procedures as well as the means to implement adequate lighting, with regard to the exhibition lighting and the conservation policy. This also includes security and cleaning lighting. It takes visual, exhibition and conservation aspects into account and it also discusses the implications of the lighting design on the safeguarding of cultural heritage. This document gives recommendations on luminous exposure values. It aims to provide a tool for setting up a common European policy and a guide to help curators, conservators and project managers to assess the correct lighting that can ensure the safeguarding of the objects. This document covers indoor lighting for heritage objects on exhibition in both public and private sites and does not consider lighting in other cultural heritage contexts such as open-air collections, etc.

This document does not cover back of house activities such as conservation-restoration, storage, emergency lighting and research.

2 Normative references

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

EN 13032-1:2004+A1:2012, *Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 1: Measurement and file format*

prEN 15999-1, *Conservation of cultural heritage — Guidelines for design of showcases for exhibition and preservation of objects — Part 1: General requirements*

prEN 15999-2, *Conservation of cultural heritage – Guidelines for design of showcases for exhibition and preservation of objects – Part 2: Technical aspects*

ISO/CIE 19476:2014, *Characterization of the performance of illuminance meters and luminance meters*

3 Terms and definitions

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

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

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

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

3.1
accent lighting
directional lighting to emphasize a particular *exhibit* (3.18) or to draw attention to a spot in the field of vision

[SOURCE: CIE S 017/E:2020, modified]

3.2
annual luminous exposure
total luminous exposure (3.45) per year (unit: lux hours per years, lx · a^{-1})

Note 1 to entry: One year of museum display is approximately 3 000 h. See also 3.34.

3.3
blue wool test: test for light fastness
certified set of eight pieces of wool each dyed with a different specific blue dye graded to fade after a set exposure to *light* (3.24)

[SOURCE: ISO 105-B08:1995]

Note 1 to entry: This system is usually referred to as the Blue Wool Standard (BWS) and it is used in museums to assess the radiation exposure of materials. The eight wool pieces are numbered #1 to #8, each about 2 to 3 times as sensitive as the next. High sensitivity is defined as materials rated #1, #2, or #3; medium as #4, #5, or #6; and low as #7, #8. A panel of selected blue wool samples is left at the measurement point and after a period of time it can be seen which samples have faded and the dose of light (3.24) received approximated.

3.4
colour rendering
<of a light source>
effect of an illuminant on the perceived colour of *exhibits* (3.18) by conscious or subconscious comparison with their perceived colour under a reference illuminant

[SOURCE: CIE S 017/E:2011, modified]

3.5
colour rendering index
R_a

derived from the *colour rendering* (3.4) indices for a specified set of 8 test colour samples

Note 1 to entry: see Annex F Colour rendering index, fidelity index and gamut index.

3.6
colour fidelity index
R_f
derived from the colour fidelity indices for a specified set of 99 test colour samples

Note 1 to entry: see Annex F Colour rendering index, fidelity index and gamut index.

Note 2 to entry: see CIE 224:2017 for further information.

3.7
gamut index
R_g
the R_g gamut index provides information about the relative range of colours that can be produced by a white *light source* (3.25). A score close to 100 indicates that, on average, the *light source* (3.25) reproduces colours with similar levels of saturation as a reference source of the same *correlated colour temperature* (3.9)

Note 1 to entry: see Annex F Colour rendering index, fidelity index and gamut index index.

3.8
colour temperature
T_c
temperature of a Planckian radiator whose radiation has the same chromaticity as that of a given stimulus (unit: K)

[SOURCE: CIE S 017/E:2020, modified – 3 notes deleted]

3.9
correlated colour temperature
CCT
temperature of the Planckian radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions (unit: K)

Note 1 to entry: Based on EN 12665 and modified for specific use.

3.10
cultural heritage
tangible and intangible entities of significance to present and future generations

Note 1 to entry: The term "*object*" (3.34) is used in this standard for cultural heritage. In specific professional contexts, other terms are used: e.g. "artefact", "cultural property", "item".

[SOURCE: EN 15898:2019, modified: note 1 to entry added]

3.11
damage potential
P_{dm}
ratio of *effective damaging irradiance* E_{dm} (3.17) and the *illuminance* E (3.21) at a point on the surface for a specific *light source* (3.25) (unit: W/lm)

3.12
daylight
part of global solar radiation capable of causing a visual sensation

Note 1 to entry: When dealing with actinic effects of optical radiation, this term is commonly used for radiations extending beyond the visible region of the spectrum.

[SOURCE: CIE ILV:2020, 17-29-105 modified: Note 1 to entry added]

3.13
daylighting
lighting for which *daylight* (3.12) is the *light source* (3.25)

Note 1 to entry: it means that window or other devices are taken into consideration

[SOURCE: CIE S 017/E:2011 modified: original Note 1 to entry deleted]

3.14
daylight factor
D
ratio of the *illuminance* (3.21) at a point on a given plane due to the *light* (3.24) received directly or indirectly from a sky of assumed or known *luminance* (3.31) distribution, to the *illuminance* (3.21) on a horizontal plane due to an unobstructed hemisphere of this sky, excluding the contribution of direct sunlight to both *illuminances* (3.21)

[SOURCE: EN 12665:2018]

3.15
diversity
extreme uniformity (syn.)
Ud
ratio of minimum *illuminance* (3.21) (*luminance* (3.31)) to maximum *illuminance* (3.21) (*luminance* (3.31)) on (of) a surface

Note 1 to entry: Diversity has unit one.

[SOURCE: EN 12665, Note 1 and SOURCE modified]

3.16
dosimeter
indicator revealing the effects of total irradiant exposure during a given time

Note 1 to entry: The above definition is valid in the context of the present European standard and concerns lighting field only.

3.17
effective damaging irradiance
E_{dm}
part of the *irradiance* (3.23) causing damaging photochemical reaction. It takes account of the spectrum of the incident radiation and the spectral response of the receiving material (unit: watt per square metre, W m^{-2})

Note 1 to entry:

$$E_{dm} = \int E_{e,\lambda}\, s_{dem,rel}(\lambda)\, d\lambda$$

where

$E_{e,\lambda}$ is the total *irradiance* (3.23) at a specified wavelength and $s_{dem,rel}(\lambda)$ is the spectral responsivity value of an material at a specified wavelength.

3.18
exhibit
item shown in the *exhibition* (3.19)

3.19
exhibition
designed display of *exhibit(s)* (3.18) and information

3.20
filter
any device that modifies or reduces a portion of the electromagnetic spectrum

Note 1 to entry: more information is included in Annex C of the present document.

3.21
illuminance
<at a point of a surface>
E
quotient of the *luminous flux* (3.32) $d\Phi$ incident on an element of the surface containing the point, to the area dA of that element (unit: lux, lx = lm·m^{-2})

Note 1 to entry: It represents the quantity of *light* (3.24) impinging on a surface.

[SOURCE: CIE S017:2020, modified: Note 1 to entry added]

3.22
infrared radiation
IR
optical radiation for which the wavelengths are longer than those for visible radiation

Note 1 to entry: For infrared radiation, the range between 780 nm and 1 mm is commonly subdivided into:

IR-A: 780 nm to 1400 nm, or 0,78 µm to 1,4 µm;

IR-B: 1,4 µm to 3,0 µm;

IR-C: 3 µm to 1 mm.

Note 2 to entry: A precise border between "visible" and "infrared" cannot be defined, because visual sensation at wavelengths greater than 780 nm is noted for very bright *sources* (3.43) at longer wavelengths.

Note 3 to entry: In some applications the infrared spectrum has also been divided into "near", "middle" and "far" infrared; however, the borders necessarily vary with the application.

[SOURCE: CIE S 017/2020, 17-21-004]

3.23
irradiance
E_e
radiometric quantity (3.37); the *radiant flux* (3.36) per unit area at a point on the surface (unit: watt per square metre, W m^{-2})

3.24
light
1. characteristic of all sensations and perceptions that is specific to vision

2. radiation that is considered from the point of view of its ability to excite the human visual system

Note 1 to entry: This term has 2 meanings that should be clearly distinguished. When necessary to avoid confusion between these 2 meanings the term "perceived light" may be used in the first sense.

Note 2 to entry: Light is normally, but not always, perceived as a result of the action of a light stimulus on the visual system.

Note 3 to entry: The term "light" is sometimes used for optical radiation extending outside the visible range, but this usage is not recommended.

3.25
light source
surface or *object* (3.34) emitting *light* (3.24)

Note 1 to entry: A light source can be self-emitting (primary light source) or non-self-emitting (secondary light source).

[SOURCE: CIE S017:2020]

3.26
lighting design
result of the *lighting designer* (3.27) proposal

3.27
lighting designer
professional with suitable education and relevant experience in *lighting design* (3.26), able to manage the aesthetic, behavioural and technical issues of the project

3.28
lighting management
all actions that contribute to the control and organisation of *light* (3.24)

3.29
lighting management protocol
language that allows different lighting devices to communicate

3.30
luminaire
apparatus which distributes, *filters* (3.20) or transforms the *light* (3.24) emitted from one or more *light sources* (3.25) and which includes, all the parts necessary for fixing and protecting the *light sources* (3.25) and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply

3.31
luminance
L
light (3.24) reflected or emitted by a surface in the direction of the observer's eyes (unit: candela/m^2 (cd/m^2))

Note 1 to entry: Based on EN 12665 and modified for specific use.

3.32
luminous flux
Φ
luminous power emitted by a *light source* (3.25), *photometric quantity* (3.35) derived from the *radiometric quantity* (3.37) *radiant flux* (3.36) (radiant power) by evaluating the radiation according to the spectral sensitivity of the human eye (as defined by the CIE standard photometric observer) (unit: lumen, lm)

Note 1 to entry: For the practical use of this document, in this definition, the values used for the spectral sensitivity of the CIE standard photometric observer are those of the spectral luminous efficiency function V(λ) (photopic vision).

Note 2 to entry: See CIE S 017/E:2011 or IEC-IEV, 1987, 845-01-22 for the definition of spectral luminous efficiency, 845-01-23 for the definition of the CIE standard photometric observer and 845-01-56 for the definition of luminous efficacy of radiation and ISO 23539:2005(E)/CIE S 010/E:2004.

Note 3 to entry: Based on EN 12665 and modified for specific use.

3.33
luminous intensity
I
density of *luminous flux* (3.32) with respect to solid angle in a specified direction (unit: candela, cd = lm sr^{-1}; sr = steradian)

Note 1 to entry: It is the *luminous flux* (3.32) on a small surface, divided by the solid angle that the surface subtends at the source (3.43) (CIE S 017/E:2011 or IEC-IEV, 1987, 845-01-31).

Note 2 to entry: The candela is the base SI photometric unit. For its definition, see CIE S 17/E:2011 or IEC-IEV, 1987, 845-01-050 or the BIPM SI Brochure.

Note 3 to entry: Based on EN 12665 and modified for specific use.

3.34
object
single manifestation of tangible *cultural heritage* (3.10)

Note 1 to entry: The term "*object*" (3.34) is used in this standard for *cultural heritage* (3.10), both immovable and movable. In specific professional contexts, other terms are used: e.g. "artefact", "cultural property", "item", "site", "building", "monument", "specimen", "structure", "cultural landscape", "document".

[SOURCE: EN 15898:2019, 3.13]

3.35
photometric quantity
quantity that is based on the perception of radiation by the human eye and is valid only for visible radiation

3.36
radiant flux
Φ_e
all radiation emitted in all directions from a *light source* (3.25) (unit: watt, W)

3.37
radiometric quantity
quantity that is physically related to the electromagnetic radiation

3.38
reflectance
ρ
ratio of the (luminous or radiant) flux reflected from a surface to the flux incident on it

Note 1 to entry: Based on EN 12665 and modified for specific use.

3.39
reflection
process by which radiation is returned by a surface or a medium, without change of frequency of its monochromatic components

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

[SOURCE: CIE S 017/E:2011 17-1065 – modified, note 2 to entry deleted]

3.40
relative damage potential
RDP
ratio of the *damage potential* (3.11) of a specific *light source* (3.25) and the *damage potential* (3.11) of the CIE standard illuminant A (2 856 K) (equivalent to the incandescent lamp); it is dimensionless

3.41
relative spectral responsivity
relative damage action spectrum **(syn.)**
$\boldsymbol{s(\lambda)_{dm,rel}}$
describes the wavelength dependence of the photochemical damage properties of a material, such as fading; it is dimensionless. The suffix $_{dm}$ stands for damaging

$$s(\lambda)_{dm,rel} = \alpha(\lambda) \cdot \frac{1}{\lambda} \cdot f(\lambda)$$

where

$\alpha(\lambda)$ is the spectral absorbance

$f(\lambda)$ is a function of wavelength determined by the receiving material

Note 1 to entry: For many non-pigmented materials and for *exhibits* (3.18) whose spectral absorption behaviour is not known or available $s(\lambda)_{dm,rel}$ can be approximated by the exponential function $e^{-b\ (\lambda[nm]/\ -300)}$ In this case the function is normalized at 300 nm so that $\mathbf{s(\lambda)_{dm,rel}} = 1$ for $\lambda = 300$ nm.

[SOURCE: based upon CIE 157:2004]

3.42
relative UV content
ratio of the amount of UV radiation that a surface receives to the amount of visible radiation (lumens) from the same *light source* (3.25) (units: µW/lm)

Note 1 to entry: there is no standardized method on how to measure and / or calculate it.