SLOVENSKI STANDARD
SIST EN 13032-5:2019

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Svetloba in razsvetljava - Merjenje in podajanje fotometričnih podatkov sijalk in svetilk - 5. del: Predstavitev podatkov za svetilke za cestno razsvetljavo

Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 5: Presentation of data for luminaires used for road lighting

Licht und Beleuchtung - Messung und Darstellung photometrischer Daten von Lampen und Leuchten - Teil 5: Darstellung von Daten von Leuchten für den Einsatz in der Straßenbeleuchtung

Lumière et éclairage - Mesurage et présentation des données photométriques des lampes et des luminaires - Partie 5 : Présentation des données relatives aux luminaires utilisés pour l'éclairage public

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ICS:

93.080.40	Cestna razsvetljava in pripadajoča oprema	Street lighting and related equipment

SIST EN 13032-5:2019 **en,fr,de**

EUROPEAN STANDARD
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English Version

Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 5: Presentation of data for luminaires used for road lighting

Lumière et éclairage - Mesurage et présentation des données photométriques des lampes et des luminaires - Partie 5 : Présentation des données relatives aux luminaires utilisés pour l'éclairage public

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This European Standard was approved by CEN on 18 June 2018.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 13032-5:2018) has been prepared by Technical Committee CEN/TC 169 “Light and Lighting”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2019, and conflicting national standards shall be withdrawn at the latest by May 2019.

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This document has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of Commission Regulation (EC) No 245/2009, as amended by Regulation (EU) No 347/2010.

For relationship with Commission Regulation (EC) No 245/2009, as amended by Regulation (EU) No 347/2010, see informative Annex ZA, which is an integral part of this document.

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Introduction

The Eco-design Directive 2009/125/EC requires a reduction of energy consumption of fluorescent lamps without integrated ballast, for high intensity discharge lamps, for LED light sources, and for ballasts and luminaires able to operate such lamps and light sources.

Utilance is a measurement of the efficiency of the luminous intensity distribution of a luminaire to spread its luminous flux onto a specified surface provided other quality requirements of EN 13201 series are met.

There are many lighting solutions that can satisfy the road lighting criteria specified in EN 13201-2. To design these solutions, photometric data of the equipment is required.

The use and application of utilance can serve as a tool for the pre-selection of adequate luminaires to fulfil the lighting requirements of EN 13201-2.

The knowledge of the utilance road lighting is needed for the calculation of the installation luminous efficacy as described in EN 13201-5.

This document specifies the presentation of tables of utilances and utilization factors of luminaires used for road lighting.

Utilance is used in place of utilization factors because it can be applied to luminaires with replaceable or non-replaceable lamps/light sources.

1 Scope

This document defines the presentation of utilances or utilization factors respectively for luminaires used for road lighting.

2 Normative references

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

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

EN 13201-2, *Road lighting — Part 2: Performance requirements*

EN 13201-3, *Road lighting — Part 3: Calculation of performance*

EN 13201-5, *Road lighting — Part 5: Energy performance indicators*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12665 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
utilization factor (of an installation, for a reference area)
F_U
ratio of the luminous flux received by the reference area to the sum of the individual luminous fluxes of the lamps /light sources of the installation

3.2
utilance (of an installation, for a reference area)
U
ratio of the luminous flux received by the reference area to the sum of the individual total fluxes of the luminaires of the installation

3.3
utilization factor road lighting
$F_{U,rl}$
ratio of the luminous flux received by one or more parallel strips along the road to the sum of the individual total fluxes of the lamps / light sources of the installation

Note 1 to entry: “Along the road” is considered parallel to that of the kerb following in the same direction as any adjacent luminaires.

3.4
utilance road lighting
U_{rl}
ratio of the luminous flux received by one or more parallel strips along the road to the sum of the individual total fluxes of the luminaires of the installation

Note 1 to entry: "Along the road" is considered parallel to that of the kerb following in the same direction as any adjacent luminaires.

4 Utilances road lighting and utilization factor road lighting

4.1 General

In this standard the average illuminance on a reference area, a longitudinal strip of a road, representing, for example, the carriageway, a single lane, a cycle path, or a footpath, can be calculated as:

$$\bar{E} = U_{\mathrm{rl}} \cdot f_{\mathrm{M}} \cdot \Phi_{\mathrm{Lum}} \cdot W^{-1} \cdot S^{-1} \quad (1)$$

where

$\bar{E}$ is the maintained average illuminance in lx on the strip under consideration;

U_{rl} is the utilance road lighting:

f_{M} is the overall maintenance factor;

ϕ_{Lum} is the luminaire luminous flux in lm;

W is the width of reference area, in m;

S is the luminaire spacing in m.

NOTE If the luminaire luminous flux is not known it can be determined from the knowledge of the total luminous flux of the light sources in the luminaire and the light output ratio of the luminaire.

The utilance road lighting U_{rl} (see Figure 2) is given by the ratio of the luminous flux emitted by the luminaire within a specified solid angle to the total luminous flux emitted by the same luminaire, whereas the utilization factor road lighting $F_{\mathrm{u,rl}}$ is given by the ratio of the luminous flux emitted by the luminaire within a specified solid angle to the total luminous flux of the light source(s) in the same luminaire. The utilization factor road lighting can be expressed as utilance road lighting multiplied by the light output ratio:

$$F_{\mathrm{U,rl}} = U_{\mathrm{rl}} \cdot R_{\mathrm{LO}} \quad (2)$$

where

R_{LO} is the light output ratio (of a luminaire).

The utilance can be derived from the luminous intensity distribution of the luminaire (measured according to EN 13032-1 or EN 13032-4, including uncertainties) and should be provided in an appropriate format (see example in Table 1).

4.2 General assumptions

The tables are applicable for regular arrangements with constant overhang and mounting height on straight sections of roads.

The luminous intensity distribution of the luminaire is part of the basic data needed for installation performance calculations. This data should be given for luminaires used in road lighting in the format specified in EN 13201-3.

With the photometric centre of luminaire as origin and the reference area of the road between two lines parallel to its axis (which extends in principle from -∞ to +∞) a solid angle is defined. The position of the

two circumscribing lines is given by their transverse angle. It is common practice to choose one of these circumscriptions at a transverse distance equal to zero.

A reference area represents one or more carriageways, footpaths, cycle paths, emergency lanes and other road areas lying separately or adjacent to a carriageway, strips just outside or inside a carriageway (for the evaluation of the edge illuminance ratio), etc. (see Figure 1).

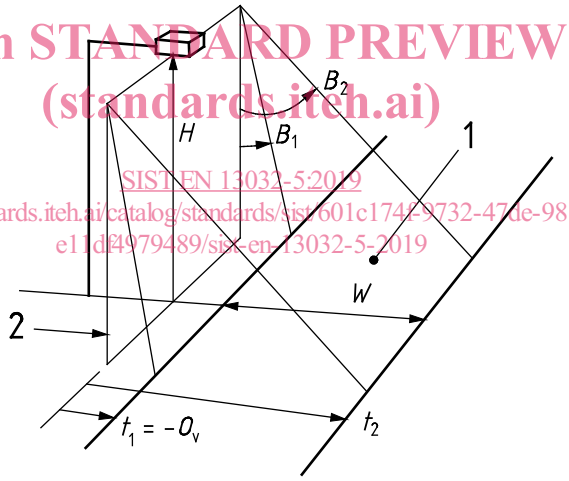
Each area is to be lit to the lighting requirements as defined in EN 13201-2.

Further, it is assumed that the areas are illuminated by a lighting installation with luminaires / lamps / light sources of the same type in one or more rows that are parallel to the above-mentioned lines that confine the areas.

The basic conventions made in the mathematical procedures are described in EN 13201-3:2015, 4.1 and 4.2.

4.3 Calculation of utilance by interpolation in an utilance table

The limiting lines of a reference area (strip) in relation to a row of luminaires are shown in Figure 1. The limiting lines are part of the inclined planes B_1 and B_2 which pass through both the limiting lines and the luminaire. The angles of inclination of the planes B_1 and B_2 are given by $\tan^{-1}(t_1 / H)$ and $\tan^{-1}(t_2 / H)$ respectively, where t_1 and t_2 are the transverse distances to the limiting lines and H is the luminaire mounting height (centre point of light above the reference area).



Key

O_V	overhang (position of the photometric centre of the luminaire) with respect to the reference area in m;
W	width of the reference area in m;
H	luminaire mounting height in m;
δ	angle of tilt of the luminaire for calculation; (in this example $\delta = 0^\circ$)
t_1, t_2	transverse distances to the limiting lines
B_1, B_2	angles of inclined limiting planes to vertical plane B = 0°
1	reference area
2	vertical plane $B = 0°$

Figure 1 — Basic position of reference area relative to a luminaire in a row of luminaires

Once the plane angles B_1 and B_2 have been calculated for a given installation geometry the resulting utilance can be calculated by interpolation between tabulated utilances given as function of angle B.

For $B_1 - \delta \geq 0$ and $B_2 - \delta > 0$;

$$U = U(B_2 - \delta) - U(B_1 - \delta); \quad (3)$$

For $B_1 - \delta < 0$ and $B_2 - \delta \geq 0$;

$$U = U(B_2 - \delta) + U(B_1 - \delta); \quad (4)$$

For $B_1 - \delta < 0$ and $B_2 - \delta \leq 0$;

$$U = U(B_1 - \delta) - U(B_2 - \delta); \quad (5)$$

where

$$B_1 = \tan^{-1}(-O_v / H) \text{ and } B_2 = \tan^{-1}[(W - O_v) / H] \quad (6)$$

O_v is the overhang (position of the photometric centre of the luminaire) with respect to the reference area in m;

W is the width of the reference area in m;

H is the luminaire mounting height in m;

δ is the angle of tilt of the luminaire for calculation; (in this example $\delta = 0°$)

$U(B_x)$ is the utilance as interpolated for the angle B_x.

NOTE The angle of tilt for calculation is the difference in angle between the tilt in application and the tilt during measurement of the luminaire (EN 13201–3).

For a plane angle B_x between two successive angles B_i and B_{i+1} for which the utilances $U(B_i)$ and $U(B_{i+1})$ are given in tabular form the general formula for linear interpolation can be used to calculate the resulting utilance $U(B_x)$:

$$U(B_x) = U(B_i) + \frac{B_x - B_i}{B_{i+1} - B_i} \times \left[U(B_{i+1}) - U(B_i)\right] \quad (7)$$

NOTE See CIE 132 for calculation of utilances.

4.4 Utilance road lighting table

For the determination of the resulting luminaire utilance between two plane angles B_{x1} and B_{x2} it is necessary to calculate the utilance road lighting by linear interpolation between the nearest values in the utilance road lighting data table. To provide for a sufficient accuracy the utilance road lighting should be given at angular interval ΔB not greater than 5° from −90° to +90° (see Table 1). In some cases, it could be required to extend the range, for example, from −180° to +180°. The angle of tilt, usually 0°, to be specified.

NOTE Luminaires with a concentrated flux distribution might require more angles at which the utilance data is presented.

Table 1 — Example of Utilance road lighting table for a luminaire used for road lighting

Angle B_i in (°), kerbside	**Utilance road lighting $U_{rl,i}$ (B) as function of angle B, kerbside**	**Angle B_i in (°), roadside**	**Utilance road lighting $U_{rl,i}(B)$ as function of angle B, roadside**
−90	$U(B = -90°)$	90	$U(B = 90°)$
−85	$U(B = -85°)$	85	$U(B = 85°)$
−80	$U(B = -80°)$	80	$U(B = 80°)$
−75	$U(B = -75°)$	75	$U(B = 75°)$
−70	$U(B = -70°)$	70	$U(B = 70°)$
−65	$U(B = -65°)$	65	$U(B = 65°)$
−60	$U(B = -60°)$	60	$U(B = 60°)$
−55	$U(B = -55°)$	55	$U(B = 55°)$
−50	$U(B = -50°)$	50	$U(B = 50°)$
−45	$U(B = -45°)$	45	$U(B = 45°)$
−40	$U(B = -40°)$	40	$U(B = 40°)$
−35	$U(B = -35°)$	35	$U(B = 35°)$
−30	$U(B = -30°)$	30	$U(B = 30°)$
−25	$U(B = -25°)$	25	$U(B = 25°)$
−20	$U(B = -20°)$	20	$U(B = 20°)$
−15	$U(B = -15°)$	15	$U(B = 15°)$
−10	$U(B = -10°)$	10	$U(B = 10°)$
−5	$U(B = -5°)$	5	$U(B = 5°)$
0	$U = 0$	0	$U = 0$