SLOVENSKI STANDARD
SIST EN 13032-1:2004

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Svetloba in razsvetljava – Merjenje in podajanje fotometričnih podatkov svetlobnih virov in svetilk – 1. del: Merjenje in format podatkov

Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 1: Measurement and file format

Licht und Beleuchtung - Messung und Darstellung photometrischer Daten von Lampen und Leuchten - Teil 1: Messung und Datenformat

Lumiere et éclairage - Mesure et présentation des données photométriques des lampes et des luminaires - Partie 1: Mesurage et format de données

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17.180.20	Barve in merjenje svetlobe	Colours and measurement of light
91.160.01	Razsvetljava na splošno	Lighting in general

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Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 1: Measurement and file format

Lumière et éclairage - Mesure et présentation des données photométriques des lampes et des luminaires - Partie 1: Mesurage et format de données

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This European Standard was approved by CEN on 16 January 2004.

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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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Contents

Foreword

This document (EN 13032-1:2004) 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of an identical text or by endorsement, at the latest by January 2005, and conflicting national standards shall be withdrawn at the latest by January 2005.

Acknowledgement is given to CIE for their help in the preparation of this standard.

The European Standard 13032 *Light and lighting - Measurements and presentation of photometric data of lamps and luminaires* is published in the following parts:

Part 1: Measurement and file format.

Part 2: Presentation of data for indoor and outdoor work places.

Part 3: Emergency lighting (in preparation).

Part 4: Sports lighting (in preparation).

Part 6: Tunnel lighting (in preparation).

The annexes A and E are informative. The annexes B, C and D are normative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

The provision of reliable and accurate photometric data is a basic requirement for any lighting engineer in order to design a good lighting scheme.

This European Standard aims to put on a common basis current European lighting practices so that a luminaire with its associated performance data, purchased in one country, can be directly compared and accurately employed in another country.

The standard is a guide to procedures referring where necessary to the relevant CIE, ISO and CEN publications.

The reliability of these data depends also on well defined qualifications about the management, the organisation and the metrological referability of the Laboratory and the skill of the staff.

1 Scope

This European Standard establishes general principles for the measurement of basic photometric data for lighting application purposes.

It establishes the measurement criteria needed for the standardisation of basic photometric data and details of the CEN file format for electronic data transfer.

This is part 1 of a multi part standard. Part 1 deals with the basic photometric measurement and file format. Other parts deal with lamps and luminiares data depending on the applications.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 12665:2002, *Light and lighting - Basic terms and criteria for specifying lighting requirements.*

ISO 9660, *Information processing – Volume and file structure of CD-ROM for information interchange.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 12665 together with the following apply.

3.1
light source
lamp or luminaire

3.2
photometric centre
point in a luminaire or lamp from which the photometric distance law operates most closely in the direction of maximum intensity

NOTE It is the origin of the coordinate system used for the measuring of luminous intensity distribution and should be specified.

3.3
limiting photometric distance
minimum distance for deriving the luminous intensity from the measured illuminance

3.4
relative measurement
measurement obtained as a ratio of two quantities of the same type expressed in arbitary units. Photometric measurement in SI units relative to specified bare lamp flux

[CIE 121:1996, definition 2.3.2]

3.5
luminaire data per 1 000 lm (of lamp flux)
photometric data of luminaire relative to a total theoretical luminous flux of 1 000 lm from all the lamps of the luminaire, when these are operated outside the luminiare under reference conditions but with the same ballast(s)

3.6
luminous intensity distribution (of a luminaire)
distribution of luminous intensity with direction. The luminous intensity distribution may be represented by numerical tables or by graphics and is usually expressed in units of candelas per 1 000 lm of lamp flux

4 Co-ordinate system

4.1 General[1)]

The determination of the intensity distribution involves the use of a co-ordinate system in order to define the direction in which the intensity measurements are made; the system used is a spherical co-ordinate system with the centre coincident with the photometric centre of the luminaire.

From a general point of view the co-ordinate system consists in a group of planes with a single axis of intersection: the polar axis. In this system a direction in space is characterised by two angles:

a)- the angle between the plane taken as a conventional origin and the half plane containing the considered direction;

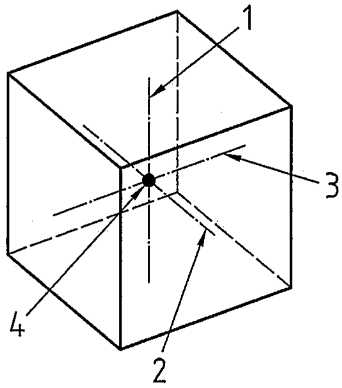
b) - the angle between the polar axis and the considered direction or the complement of this angle.

The orientation of this system with respect to the first axis and the second axis (see Figure 1) of the luminaire is chosen with particular regard to the type of luminaire, to the type of lamp, to the mounting attitude of the luminaire and its application, in order to perform more accurate measurements or to simplify the consequent lighting calculations.

The identification of the first axis and the second axis shall be defined by the manufacturer or the photometric laboratory according to this standard. The third axis is the axis containing the photometric centre and perpendicular to the two first axes. For information on the location of the photometric centre see clause 5.8.

NOTE Usually the first axis of a luminaire is perpendicular to the light emitting area of the luminaire. As the light emitting area is not always clearly defined and could be curved, the relationship between this axis and a mechanical feature of the luminaire should be declared (e.g., the design attitude for road luminaires or the front glass for floodlights and for ceiling mounted luminaires the surface upon which the luminaire is mounted).

1) See CIE 121, 3.3.



Key
1 First axis
2 Second axis
3 Third axis
4 Photometric centre

Figure 1 — Photometric centre and photometric axes of the luminaire

4.2 System of measuring planes

4.2.1 General

In general the luminous intensity distribution of a luminaire is measured in a number of planes. From the variety of possible measuring planes three systems of planes have been historically used and were identified by the CIE as A-, B- and C-planes. The same terminology is adopted in this standard, but A-planes system is disregarded.

The C-planes system is to be considered as the recommended standard system.

The B-planes system may also be used, in particular for the photometry of luminaires such as floodlights.

Any two of these planes with an angular difference of 180° will form a plane in the mathematical sense.

4.2.2 B-planes[2)]

The totality of B-planes (see Figure 2) is the group of planes for which the line of intersection (polar axis) goes through the photometric centre and is parallel to the second axis of the luminaire.

B-planes are marked with angles B_X with $-180° \leq B_X \leq +180°$. Within a plane directions are given by the angle β with $-90° \leq \beta \leq +90°$. The system of B-planes is coupled rigidly to the light source and follows its tilt if the luminaire is tilted.

The photometric centre of the luminaire lies in the centre of the co-ordinate system.

The first axis of the luminaire lies in plane B_0, is perpendicular to the polar axis through the photometric centre and points in the direction $\beta = 0°$.

The second axis of the luminaire is coincident with the polar axis.

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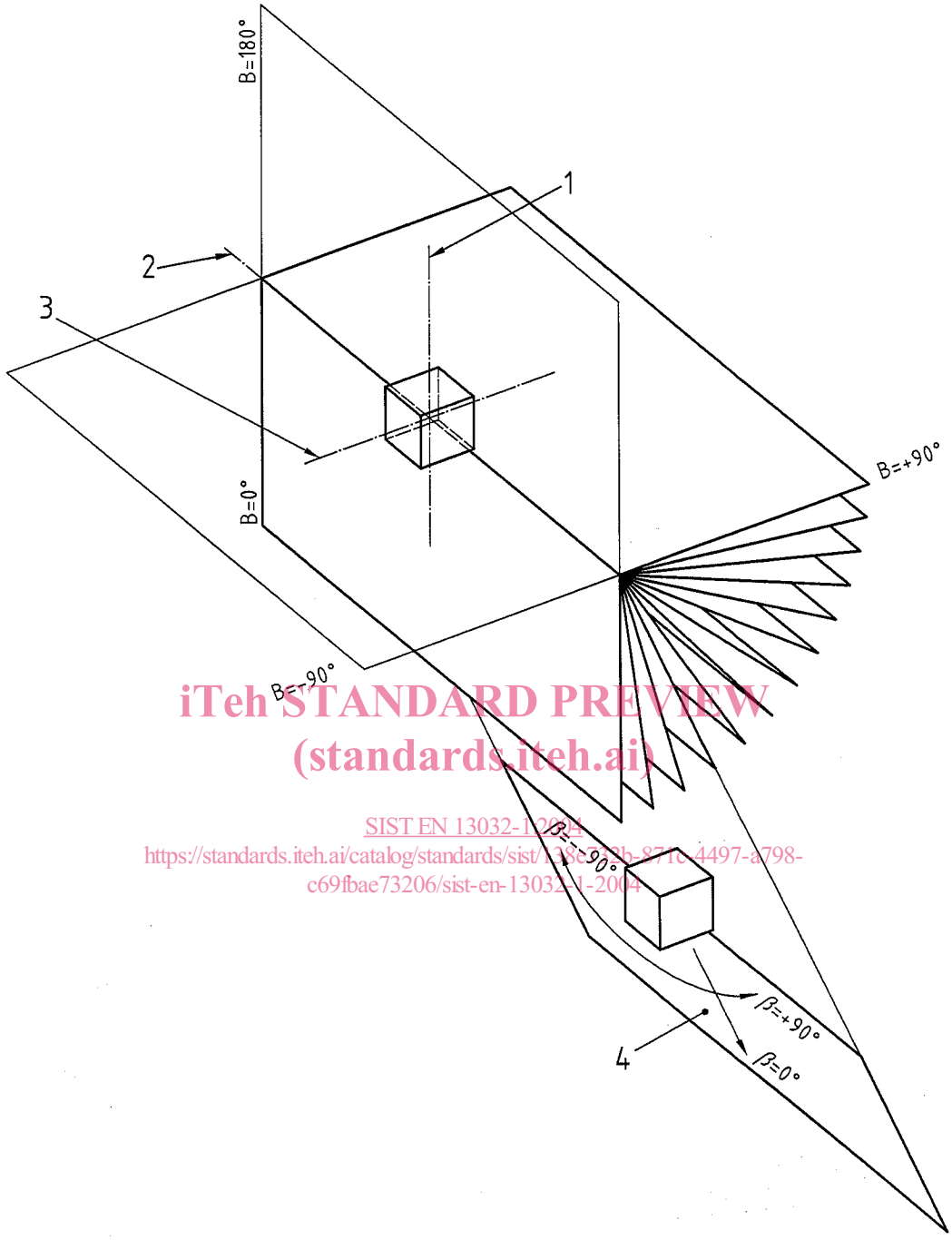
2) See CIE 121, 3.4.2.



Key
1 First axis
2 Second axis, polar axis
3 Third axis
4 Page = B-Plane

Figure 2 — Luminaire orientation for B-planes

Conventions related to the choice of axes linked to the luminaire:

1) The first axis of the luminaire is the axis through the photometric centre and perpendicular to the plane which is representative for the main light emitting area.

2) For floodlights the second axis of the luminaire generally is parallel to the spigot or tilting axis of the luminaires. If orientation of the lamp requires a different orientation of the second axis, it shall be stated by the lamp manufacturer or the photometric laboratory.

3) For luminaires other than floodlights containing linear single or double ended lamps, the axis of the lamp or the geometric axis of multiple lamps, is chosen as the third axis of the luminaire, perpendicular to the two first ones. Thus the transverse plane to the lamps of the luminaire, which is generally the most extensive light emitting plane, lies in the B_0 plane (for luminaires with a symmetry in this transverse plane in B_0 /B_{180} plane).

4) For other luminaires with the lamp axis coincident with the first axis of the luminaire, for other luminaires with multiple lamps or for other luminaires where no lamp axes can be defined, the luminaire shall be orientated that:

   a) the maximum intensity I_{max} of the light distribution is within the B_0 plane or if I_{max} is located at $\beta = 0°$ or if there are more than one location of I_{max};

   b) the B_0 /B_{180} plane is the symmetry plane of the luminous intensity distribution with the highest degree of symmetry.

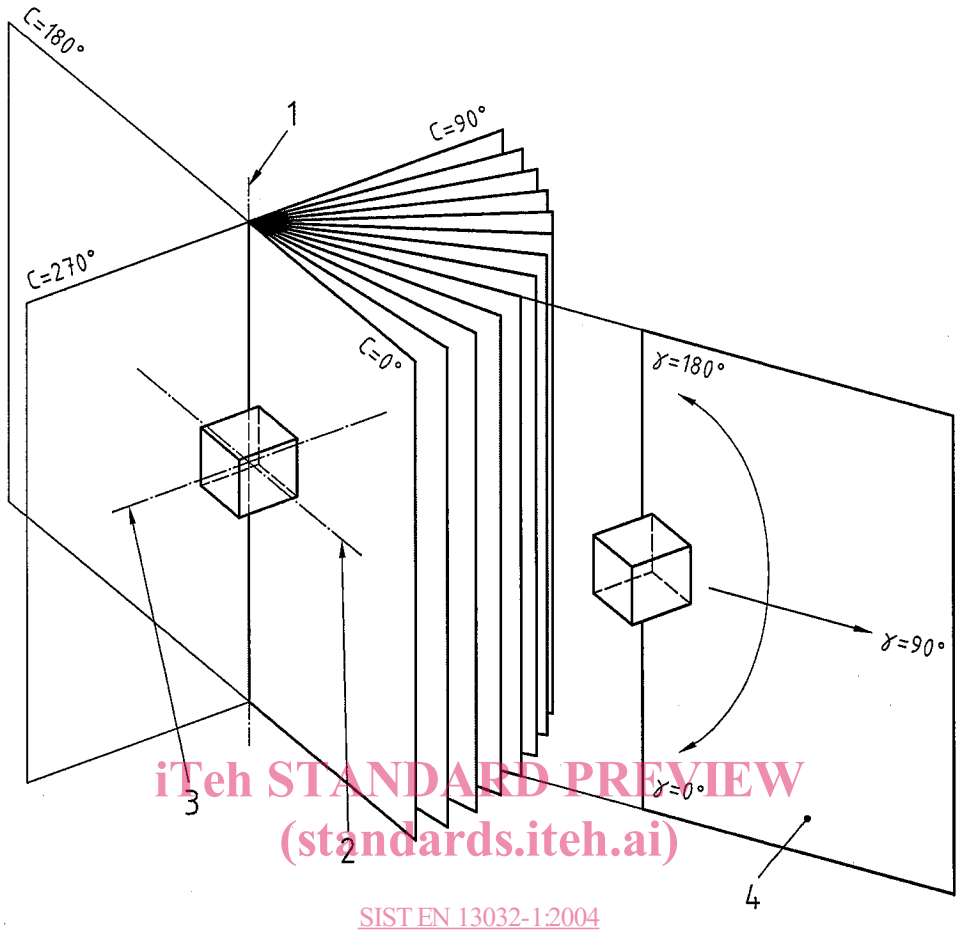
If the convention 1) or 2) is applicable or if different conventions are used, the choice of luminaires axes shall be stated by the manufacturer or the photometric laboratory, so as to clearly identify the luminaire alignment in the co-ordinate system, both for photometric measurements and for lighting calculations.

4.2.3 C-planes[3)]

The totality of C-planes (see Figure 3) is the group of planes for which the line of intersection (polar axis) is the vertical line through the photometric centre. The polar axis does not necessarily coincide with the first axis of the luminaire, if the luminaire is tilted during measurements.

C-planes are marked with angles C_X with $0° \leq C_X < 360°$. Within a plane directions are given by the angle γ with $0° \leq \gamma \leq 180°$. The direction $\gamma = 0°$ is oriented to the nadir.

3) See CIE 121, 3.4.3.

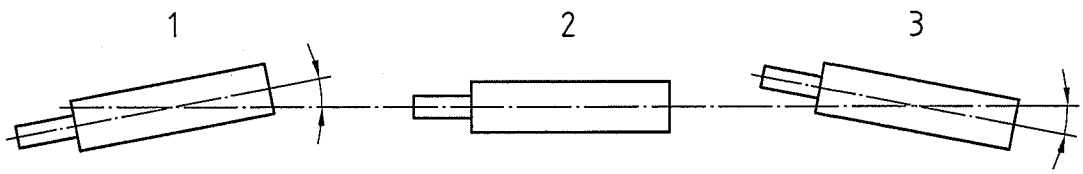


Key
1 First axis, polar axis
2 Second axis
3 Third axis
4 Page = C-plane

Figure 3 — Luminaire orientation for C-planes

The system of C-planes is oriented rigidly in space and does not follow a tilt of the luminaire.

If the luminaire is tilted during measurement (the polar axis is not coincident with the first axis of the luminaire), the angle of tilt should be declared (see Figure 4).



Key
1 Positive tilt angle
2 Zero tilt angle
3 negative tilt angle

Figure 4 — Definition of tilt angle

Conventions related to the choice of axes linked to the luminaire:

1) The first axis of the luminaire is the axis through the photometric centre and perpendicular to the plane which is representative of the main light emitting area.

2) For luminaires containing linear single or double ended lamps, the axis of the lamp or the geometric axis of multiple lamps, is chosen as the third axis of the luminaire, perpendicular to the two first ones. It means that the transverse plane to the lamps of the luminaire, which is generally the most extensive light emitting plane, lies in the $C=_0$ plane (for luminaires with a symmetry in this transverse plane in C_0 /C_{180} plane).

3) For luminaires with the lamp axis coincident with the first axis of the luminaire, for luminaires with multiple lamps or for luminaires where no lamp axes can be defined, the luminaire shall be orientated that:

   a) the maximum intensity I_{max} of the light distribution is within the C_0 plane or if I_{max} is located at $\gamma = 0°$ or if there are more than one location of I_{max};

   b) the C_0 /C_{180} plane is the symmetry plane of the luminous intensity distribution with the highest degree of symmetry.

If the latest convention 1) or 2) is applicable or if different conventions are used, the choice of luminaires axes shall be stated by the manufacturer or the photometric laboratory, as to clearly identify the luminaire alignment in the co-ordinate system, as well for photometric measurements as for lighting calculations.

NOTE For road lighting calculations, the usual convention is that the C_0 /C_{180} intensity planes lie parallel to the road. This is normally the case for most transversely mounted luminaires, but not for luminaires with linear lamp(s) where the lamp axis is parallel to the road axis.

4.2.4 Relationships between the plane systems[4)]

The value of the light intensity measured in a certain direction is independent of the way the direction is presented. Generally the values of each of the two angles are different for any direction in the aforementioned plane systems. The angular values of one plane system can be converted into the corresponding angular values of another plane system if the relationships given in the following Table 1 are used. The relationships are only valid if the tilt angle of the luminaire in the C-plane system is zero and as far as the second axis of the luminaire respects the conventions for luminaire orientations in the two co-ordinate systems.

Table 1 — Conversion equations for plane systems

Orientation Planes		For Conversion of Angles	
Given	Wanted	For Planes	For Angles
B, ß C, γ	C, γ B, ß	$\tan C = \sin B / \tan \beta$ $\tan B = \sin C \times \tan \gamma$	$\cos \gamma = \cos B \times \cos \beta$ $\sin \beta = \sin C \times \sin \gamma$

NOTE In some countries, the defined B-planes system has also been named A-planes system. To avoid confusion with the co-ordinate systems originally defined by CIE, A-plane name for this system is not recommended.

4) See CIE 121, 3.4.4.

5 Laboratory requirements for tests

5.1 General[5)]

The object of the tests is to measure the characteristics of the luminaire by means of appropriate equipment and procedures under the following test conditions which are comparable between laboratories and which relate as closely as practicable to the typical conditions of service for which the luminaire is designed.

5.2 Test conditions

5.2.1 Test room

Measuring location: A luminaire shall be measured in surroundings so arranged that the photometer head receives only light from the luminaire direct or with intended reflection. Stray light shall be minimised according to the requirements in annex A.

5.2.2 Test voltage[6)]

The test voltage at the supply terminals shall be the rated lamp voltage or the rated circuit voltage appropriate to the lamp control gear in use, if any.

The voltage shall be controlled in accordance with Table 2.

5.2.3 Ambient temperature[7)]

The mean ambient temperature, T_m, shall equal (25 ± 1) °C throughout the test of the light source, except where larger tolereances are indicated in table 2.

If the temperature for which the nominal luminous flux of a fluorescent lamp is published is other than 25 °C, a correction factor, supplied by the lamp manufacturer, shall be applied by the laboratory.

The ambient temperature shall be measured at a horizontal distance not exceeding 1,5 m to the surface of the light source with the lamps switched on.

Photometric measurements not made in accordance with the mean ambient test temperature shall have correction factors applied to the individual readings.

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5) See CIE 121, 4.1 and 4.3.

6) See CIE 121, 4.2.5.

7) See CIE 121, 4.3.1.