



SLOVENSKI STANDARD

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Železniške naprave – Električna razsvetljava v železniških vozilih za javne prevozne sisteme

Railway applications - Electrical lighting for rolling stock in public transport systems

Bahnanwendungen - Elektrische Beleuchtung in Schienenfahrzeugen des öffentlichen Verkehrs

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Applications ferroviaires - Eclairage électrique pour matériel roulant des systèmes de transport public

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EUROPEAN STANDARD
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Railway applications - Electrical lighting for rolling stock in public transport systems

Applications ferroviaires - Eclairage électrique pour matériel roulant des systèmes de transport public

Bahnanwendungen - Elektrische Beleuchtung in Schienenfahrzeugen des öffentlichen Verkehrs

This European Standard was approved by CEN on 2 September 2001.

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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 Management Centre has the same status as the official versions.

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 256 "Railway applications", 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of an identical text or by endorsement, at the latest by April 2002, and conflicting national standards shall be withdrawn at the latest by April 2002.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this standard.

Annex A is 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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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EN 13272:2001 (E)**1 Scope**

This European Standard specifies the design criteria of electrical lighting illumination levels in the interiors of public transport railway rolling stock for all operating conditions.

For the design of the lighting system it is necessary to take into account the tasks that are to be performed in the given area, as well as meeting safety requirements.

In addition to providing task-related illumination levels, the design of the lighting should, wherever possible, provide a comfortable and pleasing visual environment.

The specification of minimum lighting levels is necessary to ensure that tasks requiring a particular attention can be safely performed.

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).

- prEN 45545-1 *Railway applications - Fire protection on railway vehicles - Part 1: General.*
- prEN 45545-2¹ *Railway applications - Fire protection on railway vehicles - Part 2: Requirements for fire behaviour of materials and components.*
- prEN 45545-3 *Railway applications - Fire protection on railway vehicles - Part 3: Fire resistance requirements for fire barriers and partitions.*
- prEN 45545-4¹ *Railway applications - Fire protection of railway vehicles - Part 4: Fire safety requirements for railway rolling stock design.*
- prEN 45545-5 *Railway applications - Fire protection of railway vehicles - Part 5: Fire safety requirements for electrical equipment including buses and magnetic levitation vehicles.*
- prEN 45545-6¹ *Fire protection of railway vehicles - Part 6: Additional fire safety measures.*
- prEN 45545-7¹ *Fire protection of railway vehicles - Part 7: Fire safety requirements for flammable liquid and gas installations.*
- EN 50121-1 *Railway applications - Electromagnetic compatibility - Part 1: General.*
- EN 50121-2 *Railway applications - Electromagnetic compatibility - Part 2: Emission of the whole railway system to the outside world.*
- EN 50121-3-1 *Railway applications - Electromagnetic compatibility - Part 3-1: Rolling stock; Train and complete vehicle.*
- EN 50121-3-2 *Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock – Apparatus.*
- EN 50121-4 *Railway applications - Electromagnetic compatibility - Part 4: Emission and immunity of the signalling and telecommunications apparatus.*

¹ in preparation.

EN 50121-5 *Railway applications - Electromagnetic compatibility - Part 5: Emission and immunity of fixed power supply installations and apparatus.*

EN 50153 *Railway applications - Rolling Stock - Protective provisions relating to electrical hazards.*

EN 55015 *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment.*

CIE Publication No. 29.2:1986 *Guide on interior lighting.*

IEC 60050-845:1987 *International Electrotechnical Vocabulary Chapter 845: Lighting* (identical with CIE Publication No. 17.4)

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply:

3.1 Characteristics

3.1.1

luminance (in a given direction at a given point of surface) (L)

luminous intensity of the light emitted in a given direction from an element of the surface, divided by the area of the element projected in the same direction

Unit: candela per square metre (cd/m^2)

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3.1.2

luminous flux (Φ)

quantity derived from radiant flux (radiant power) by evaluating the radiation according to the spectral sensitivity of the human eye (as defined by the CIE standard photometric observer). It is the light power emitted by a source or received by a surface

Unit: lumen (lm)

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3.1.3

illuminance (E)

ratio of the luminous flux incident on a surface to the area of the illuminated surface

Unit: lux (lx) = lm/m^2

NOTE 1 Illuminance was previously known as the illumination level or value.

NOTE 2 The orientation of the surface may be defined, e.g. horizontal, vertical.

3.1.4

average illuminance (E_{av})

illuminance averaged over the specified surface

Unit: lux (lx)

[EN 12665]

NOTE In practice this may be derived either from the total luminous flux falling on the surface divided by the total area of the surface, or alternatively from an arithmetic average of the illuminances at a representative number of points on the surface.

3.1.5

illuminance uniformity

ratio of the illuminance at the least favourable measuring point on the average illuminance

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illuminance at the least favourable measuring point
average illuminance

[EN 12665 mod.]

NOTE The least favourable points represent the lowest and the highest value of the considered measuring.

3.1.6**contrast**

subjective perception of the difference in appearance of two or more parts of a field seen simultaneously or successively (hence: colour contrast, brightness contrast, lightness contrast, simultaneous contrast, successive contrast) [845-02-47 mod.]

NOTE Contrast can also be expressed in a physical sense, e.g. luminance contrast.

3.1.7**glare**

discomfort or impairment of vision experienced when an expressively bright area or object(s) are within the visual field [845-02-52]

3.1.8**colour appearance**

chromaticity of an illuminant (light source)

3.1.9**colour temperature (of a light source) (T_c)**

temperature of a full radiator (black body/ Planckian radiator) which emits radiation of the same chromaticity as that of the light source being considered

Unit: Kelvin (K)

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3.1.10**colour rendering**

effect of an illuminant on the colour appearance of objects by conscious or subconscious comparison with their colour appearance under a reference light source [845-02-59]

3.1.11**light loss factor**

ratio of the average illuminance of the illuminated surface after a certain period of use of a lighting installation to the average illuminance obtained under the same conditions for the installation considered conventionally as new [845-09-59 mod.]

3.2 Types of lighting**3.2.1****general lighting**

basic illumination of an interior

3.2.2**stand-by lighting**

part of a lighting system provided to enable normal activities to be continued substantially unchanged for a specified time limit, taking supply interruptions into account

3.2.3**emergency lighting**

lighting provided for a specified minimum time limit when the general or the stand-by lighting fails

3.2.4**reduced lighting**

level of illumination as an optional feature for passenger comfort and energy conservation, but not to be used for vehicle design

NOTE Vehicle design is based on the values in Table 2.

3.3

passenger accommodation

all areas normally occupied by passengers

3.4

service area

all areas which service personnel are intended to occupy

NOTE This includes e.g. driver's cabs, machinery compartments, kitchen areas, personnel compartments.

3.5

seating area

area in a passenger accommodation intended for seated passengers only

3.6

purchaser

organisation which orders the lighting system and has the responsibility for direct negotiations with the manufacturer

3.7

manufacturer

organisation which has the technical responsibility for the supply of the lighting system

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4 Requirements for lighting in passenger rooms

4.1 General lighting

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4.1.1 General

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The quality of lighting influences visual performance, performance attitude, safety at work and general well-being.

The lighting for rolling stock in public transport systems shall enable the relevant visual tasks to be performed.

The requirements to be met by the lighting are based on the following criteria:

- illuminance;
- uniformity of illumination;
- limitation of glare;
- colour appearance and colour rendering.

A lighting system can only satisfy specified requirements if all criteria mentioned above have been taken into account. Depending on the type and level of the difficulty of the visual task, orientation of seating, or of the type of accommodation to be lit, priority may be given to one or more of these criteria.

4.1.2 Illuminance

Different requirements are made concerning the general lighting for rolling stock in public transport systems according to the service and/or location. Two classes are defined, vehicles for mass transit systems and for main line systems.

- a) In mass transit vehicles, the minimum value of the average illuminance shall be 150 lx in the seating areas and 75 lx in standing areas and vestibules (see Table 1).

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- b) For vehicles in main line trains, the minimum value of the average illuminance related to the quality level as well as to the expected activities and to the different locations is given in Table 2.

Table 1 - Minimum values of average illuminance and target uniformity for mass transit vehicles

Location	Illuminance ^b E_{av} in lx	Uniformity
Seating areas	≥ 150	0,8 to 1,2
Aisles, standing areas	≥ 75	0,5 to 2,5
Vestibules ^a	≥ 75	0,8 to 1,2
<p>^a With additional but switched-off threshold / step lighting.</p> <p>^b The values for illuminance are minimum values and may be increased by agreement between user and manufacturer.</p>		

Table 2 - Minimum values of average illuminance and target uniformity for main line and suburban trains

Location	Illuminance ^b E_{av} in lx	Uniformity
Seating areas with no additional reading lights	≥ 150	0,7 to 1,3
Seating area ^a	≥ 100	0,7 to 1,3
Reading zone	≥ 150	0,7 to 1,3
Side corridors	≥ 50	0,5 to 2,5
Vestibules, platforms	≥ 75	0,8 to 1,2
Toilets, washrooms	≥ 150	not applicable
Steps and stairs	≥ 75	0,8 to 1,2
Aisles, standing areas, multifunctional areas	≥ 75	0,5 to 2,5
Tables	≥ 150	0,7 to 1,3
<p>^a With additional but switched-off reading lights.</p> <p>^b The values for illuminance are minimum values and may be increased by agreement between user and manufacturer.</p>		

The values of illuminance given in this clause shall be achieved in the different locations in accordance with the measuring points in 6.4.

The uniformity in the seating areas of dining cars should be in accordance with the values given for seating areas. For reasons of interior design and well-being, the illuminance uniformity may deviate more than in other areas.

4.1.3 Glare limitation

The lighting system shall be designed to limit glare. Glare caused by night-time reflections in windows should be avoided.

Luminaires shall be designed to conform to glare safeguard, CIE publication 29.2, 5.7.2, quality class 'A', giving curves for normal illuminance validity:

- mass transit systems: 300 lx curve;
- main line systems: 1 000 lx curve.

4.1.4 Colour appearance

In order to obtain an appropriate colour appearance, the colour temperature of the lamps used for the general lighting should be between 3 000 K and 3 300 K. For reasons of interior design and well-being, the colour appearance may deviate more in some areas, e.g. dining cars.

4.1.5 Colour rendering

The ability of a light source to render colours of surfaces accurately is important for safety and comfort. The CIE General Colour Rendering Index R_a shall be ≥ 80 or colour rendering group 1B. For reasons of interior design and well-being, the colour rendering may be lower in some areas, e.g. dining cars.

NOTE The colour rendering index is indicated by the manufacturer of the lamps.

4.1.6 Illuminance in vehicles for night service

In vehicles which are intended predominantly for night service, the lighting shall be arranged to meet particular requirements concerning minimum illuminance. In saloon areas, at least 5 lx along centre line at floor level shall be achieved. In passenger access areas (e.g. vestibules, stairways, corridors) the illuminance shall not be less than 50 lx. Individual subdued sleeping lighting should be provided.

4.1.7 Reduced lighting

For energy conservation or for passenger comfort on mainline trains a proportion of the general lighting may be switched off in passenger saloon areas. In passenger access areas (e.g. vestibules, stairways, corridors) the illuminance shall be in accordance with Table 2.

4.1.8 Lighting control functions

For special tasks, e.g. vehicle cleaning and lamps testing, it is recommended that a dedicated switching device is provided at a place in the vehicle which is convenient to the service people.

NOTE For coaches of main line trains, the requirements of UIC 555 concerning the control of the lighting apply.

4.2 Stand-by lighting

The purpose of stand-by lighting is to maintain general lighting for a specified limited period of time in the situation where the power supply of the vehicle fails or is switched off. The time period is limited to conserve battery power (and to enable the capacity of the battery to be optimised). Unless otherwise agreed between user and manufacturer, stand-by lighting shall meet at least the following requirements:

- the general lighting level shall be maintained for at least 10 min after the power supply has failed;
- stand-by lighting shall be a minimum of 30% of the general lighting level.