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

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National foreword

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The UK participation in its preparation was entrusted by Technical Committee RAE/1, Railway applications, to Panel RAE/1/-7, Railway applications - Lighting.

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

'Normative': A (mandatory) requirement defined as an expression in the content of a document conveying criteria to be fulfilled if compliance with the document is to be claimed and from which no deviation is permitted [CEN/CENELEC Internal Regulations, Part 3: Rules for the Structure and Drafting of European Standards (PNE-Rules)].

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This European Standard was approved by CEN on 16 December 2011.

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Contents

Foreword

This document (EN 13272:2012) 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of an identical text or by endorsement, at the latest by August 2012, and conflicting national standards shall be withdrawn at the latest by August 2012.

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.

This document supersedes EN 13272:2001.

This document 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 document.

The main changes with respect to the previous edition are: technical requirements have been brought in line with the applicable TSIs; and requirements permitting new lighting technologies.

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, Turkey and the United Kingdom.

1 Scope

This European Standard contains performance requirements and recommendations for electrical lighting systems in the interiors of public transport railway rolling stock under all operating and emergency conditions. This European Standard does not address lighting installed in instruments or controls.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CEN/TS 45545 (all parts), *Railway applications — Fire protection on railway vehicles*

EN 50121 (all parts), *Railway applications — Electromagnetic compatibility*

EN 50153, *Railway applications — Rolling Stock — Protective provisions relating to electrical hazards*

CIE S 008/E:2001/8995-1:2002(E) *Lighting of Work Places — Part 1: Indoor [incl. Technical Corrigendum ISO 8995:2002/Cor.1 2005(E)*]

CIE Publication No 17.4, *International Lighting Vocabulary*

3 Terms and definitions

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

3.1 General

3.1.1
passenger area
all areas designed for passenger use

3.1.2
service area
all areas which are intended to be occupied by service personnel only

3.1.3
seating area
passenger area intended for seated persons, including wheelchair spaces

3.1.4
open gangway
wide gangway designed to be occupied by travelling passengers

Note 1 to entry: This excludes the gangways that are only to be used to pass from one vehicle to another.

3.1.5
vehicle access step

first fixed part of the floor threshold inside the vehicle

3.1.6
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)

Note 1 to entry: Adapted from EN 12665.

3.1.7
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)

Unit: lumen (lm)

Note 1 to entry: It is the light power emitted by a source.

Note 2 to entry: Adapted from EN 12665.

3.1.8
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 to entry: Illuminance was previously known as the illumination level or value.

Note 2 to entry: The orientation of the surface may be defined, e.g. horizontal, vertical.

3.1.9
average illuminance (E_{av})
illuminance averaged over the specified surface

Unit: lux (lx)

Note 1 to entry: Adapted from EN 12665.

Note 2 to entry: 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.

3.1.10
illuminance uniformity
ratio of the least favourable illuminance to the average illuminance within the specified measurement surface

Note 1 to entry: The least favourable illuminance may be either the minimum or maximum illuminance over all the measurement points.

3.1.11
correlated colour temperature (of a light source) (T_{cp})
temperature of a Planckian radiator whose perceived colour most closely resembles that of the given stimulus at the same brightness and under specified viewing conditions

Unit: Kelvin (K)

Note 1 to entry: Adapted from EN 12665.

3.1.12
colour rendering
effect of an illuminant on the reflective colour of objects by comparison with their reflective colour under a reference light source

Note 1 to entry: Adapted from IEC 60050-845-02-59.

3.1.13
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

Note 1 to entry: Adapted from IEC 60050-845-09-59.

3.1.14
unified glare rating
CIE discomfort glare measure

3.1.15
contractor(s)
organization(s) responsible for

— the design, manufacture or supply of the lighting system, and

— the purchase, installation or use of the lighting system

3.2 Types of lighting

3.2.1
general lighting
lighting of an interior provided for normal operation

3.2.2
stand-by lighting
lighting condition below the level of general lighting provided 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 a design feature for passenger comfort and energy conservation

4 Requirements for lighting in passenger areas

4.1 General lighting

4.1.1 General

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 a range of visual tasks to be performed.

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

— illuminance;

— uniformity;

— limitation of glare;

— colour temperature and colour rendering.

General lighting must achieve the values set out in Table 1 or Table 2.

NOTE Where agreed by contractors, it is possible for the general lighting system to adapt to the ambient lighting, provided that the contribution from the general lighting system plus that from the ambient lighting achieves the values set out in Table 1 or Table 2.

For high speed trains and conventional trains:

— general lighting shall be provided in normal operation without interruption;

— in the event of loss of the main power supply, general lighting shall be provided for a period of not less than 10 minutes.

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 and uniformity

Different requirements are made concerning the general lighting for rolling stock in public transport systems according to the service and/or location. Two classes of vehicles are defined: (a) high speed and conventional trains and (b) other trains.

a) For high speed and conventional trains, which travel on either or both of the high speed and conventional trans-European rail systems, the minimum value of the average illuminance and uniformity requirements shall be in accordance with Table 1.

b) For other trains, the minimum value of the average illuminance and uniformity requirements shall be in accordance with Table 2.

Table 1 — Minimum values of average illuminance and target uniformity for high speed and conventional trains

Location	Illuminance [a] E_{av} in lx	Uniformity
Seating areas where no additional reading lights are provided [b]	≥ 150	0,7 to 1,3
Seating area with reading lights which are switched off [b, c]	≥ 100	0,7 to 1,3
Reading zone, where reading lights are provided	≥ 150	0,7 to 1,3
Side corridors and aisles, at floor level	≥ 50	0,5 to 2,5
Side corridors and aisles, at 0,8 m above floor level	≥ 75	0,5 to 2,5
Vestibules	≥ 75	0,8 to 1,2
Vehicle access steps [d]	≥ 75	not applicable
Toilets, washrooms	≥ 150	not applicable
Steps and stairs	≥ 75	0,8 to 1,2
Standing areas, multifunctional areas, open gangways	≥ 75	0,5 to 2,5
Gangways	≥ 5	not applicable
Tables	≥ 150	0,7 to 1,3

[a] The values for illuminance are minimum values and may be increased by agreement between contractors.

[b] Where the average illuminance is greater than 220 lux, the uniformity range 0,7 to 1,5 shall apply.

[C] In the case of seating areas in dining cars, the uniformity requirements shall not apply and alternative illuminance levels may be agreed between contractors.

[d] Measured across the central 80 % of the width of the vehicle access step by a light placed within or immediately adjacent to it, according to Annex B (normative).

Table 2 — Minimum values of average illuminance and target uniformity for other trains

Location	Illuminance [a] E_{av} in lx	Uniformity
Seating areas	≥ 150	0,8 to 1,2
Standing areas, open gangways	≥ 50	0,5 to 2,5
Aisles at floor level	≥ 50	0,5 to 2,5
Aisles at 0, 8 m above floor level	≥ 75	0,5 to 2,5
Vestibules [b]	≥ 75	0,8 to 1,2
Vehicle access steps [c]	≥ 75	not applicable
a The values for illuminance are minimum values and may be increased by agreement between contractors. b With additional but switched-off threshold / step lighting. c Measured across 80 % of the width of the vehicle access step by a light placed within or immediately adjacent to it, according to Annex B (normative).		

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

4.1.3 Glare limitation

The lighting system shall be designed to minimize glare and to avoid glare from night time reflections in windows. The glare rating for the lighting system, when calculated using the Unified Glare Rating (UGR) tabular method set out in CIE S 008 / ISO 8995, shall be not greater than 22.

4.1.4 Correlated colour temperature

The correlated colour temperature of the lamps used for general lighting shall be between 2 800 K and 7 000 K.

NOTE For reasons of visual comfort, colour temperatures above 5 000 K are not advisable.

4.1.5 Colour rendering

The ability of a light source to render colours of surfaces accurately is important for safety and comfort. The Colour Rendering Index R_a of the light sources as defined in CIE 17.4, shall be ≥ 80 or colour rendering group 1B.

4.1.6 Illuminance in vehicles for night service

In vehicles that are intended predominantly for night service, the lighting shall be arranged to meet particular requirements concerning minimum illuminance.

- In passenger seating areas, the emergency lighting illuminance requirements of 4.3.3 shall apply.
- In sleeping compartments, individual subdued sleeping lighting should be provided. Where provided, general light switches shall be internally lit.

4.1.7 Reduced lighting

For energy conservation or for passenger comfort on main line trains, a proportion of the general lighting may be switched off in passenger seating areas. Where provided, the requirements for reduced lighting shall be as follows:

The minimum lighting requirement shall be the emergency lighting illuminance requirements of 4.3.3. In passenger access areas (e.g. vestibules, stairways, corridors) the illuminance and uniformity shall be in accordance with Table 1. Where provided for passenger use, general light switches shall be internally lit.

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.

4.2 Stand-by lighting

Standby lighting is not mandatory. However, where provided, the contractor shall specify the duration of standby lighting. Unless otherwise specified by the contractor, standby lighting illuminance shall be a minimum of 30 % of the general lighting illuminance.

4.3 Emergency lighting

4.3.1 General

Emergency lighting shall be provided to operate in the event of the switching off or failure of general or standby lighting. Luminaires of the general lighting system may be used for the emergency lighting system.

The emergency lighting shall be designed to enable continued occupation or safe egress from the vehicle, including the exit route. The emergency lighting shall be designed to illuminate the exit signs and the associated equipment.

The emergency lighting system shall provide the light necessary to enable passengers to move inside vehicles and leave vehicles and in particular to recognize the presence of obstacles.

Where required by the contractor, the emergency lighting system shall continue to operate after being subjected to two successive shock pulses in accordance with Annex C, when mounted in a manner representative of its installation in a vehicle. Reduced visibility due to airborne particles, caused by smoke or dust, should be taken into account.

The emergency lighting shall be arranged to ensure that it will be switched on automatically and cannot be made ineffective by passengers.

4.3.2 Power supply

The luminaires of the emergency lighting system shall be powered from the power supply (e.g. energy storage system) by an independent system. This shall ensure that the emergency lighting system remains operational in the event of failure of the dedicated lighting circuit.

The power supply shall be designed so that in the event of a fire, a minimum of 50 % of the emergency lighting in the vehicles not affected by fire shall be maintained for a period of time to be agreed by contractors.

4.3.3 Illuminance

The minimum value of the average emergency illuminance shall be 5 lx at floor level along the centre line of the escape route.

The minimum value at the exit threshold shall be 40 lx (when body side door is open).

Safety signs may be made of photoluminescent material conforming to the requirements of DIN 67510 or an equivalent publically available standard. Where photoluminescent signs are used, the minimum value of illuminance over the surface of the exit signage shall be 50 lx under general lighting.

NOTE This ensures the correct functioning of photoluminescent materials.

All values shall be measured in accordance with 6.2 and 6.3.

4.3.4 Uniformity of illuminance

The uniformity ratio of the emergency lighting, measured along the centre line of the escape route in accordance with 6.2 and 6.3 shall be between 0,15 and 5,0.

4.3.5 Glare limitation

In order to minimize glare effects, the luminance of the emergency luminaires shall not exceed 400 cd/m^2 in the usually visible surface (between 0° and 60° below the horizontal plane of the luminaire).

4.3.6 Starting performance

The minimum starting performance of the emergency lighting is such that 50 % of the fully specified illuminance shall be achieved within 5 s, and the fully specified illuminance within 15 s.

4.3.7 Operating time

The operating time of the emergency lighting shall be ensured for

— rail vehicles of high speed trains: at least 3 h;

— rail vehicles of conventional trains: at least 1,5 h;

— rail vehicles of other trains: at least 1 h

after the vehicle power supply, e.g. the battery charging system, has failed.

NOTE The specified times apply to a fully charged energy storage system under conditions agreed between contractors.

4.3.8 Location of emergency lighting

As a minimum, emergency luminaires shall be located in the following areas:

— in each self-contained area, e.g. passenger compartments, toilets, driver’s cab, kitchen, etc.;

— adjacent to doors and door steps, particularly at those which are used for emergency exit;

— adjacent to the gangway between vehicles, where applicable;

— in areas of likely obstructions, e.g. luggage in side corridors, vestibules, etc.;

— in the vicinity of interruptions or changes of direction in aisles or side corridors;

— at any change of the floor level.

NOTE The emergency luminaires in vestibule areas should be located to take account of exit arrangements and the route between vehicles.

4.3.9 Correlated colour temperature

The correlated colour temperature of the lamps used for emergency lighting shall be between 2 800 K and 7 000 K.

4.3.10 Colour rendering

The ability of a light source to render colours of surfaces accurately is important for safety. The Colour Rendering Index R_a as defined in CIE 17.4 shall be ≥ 80 or colour rendering group 1B.

4.3.11 Maintenance

The functionality of the emergency light source shall be readily testable. Where an independent energy storage system is provided, its status shall be readily testable.

5 Lighting in service areas

5.1 General lighting

5.1.1 General

In addition to the requirements of 4.1.1 the lighting shall be designed to provide good lighting performance in order to achieve a high degree of safety and comfort for the work intended.

5.1.2 Illuminance

For safety reasons, the minimum value of the average illuminance in the whole service area shall not be less than 50 lx. The required values are given in Table 3.

Table 3 — Minimum values of average illuminance and target uniformity for service areas

Location	Illuminance [a] E_{av} in lx	Uniformity
Cab, excluding drivers desk	≥ 50	0,5 to 2,5
Driver's desk, general [b]	≥ 75	0,7 to 1,3
Driver's desk, reading zone [b, c]	≥ 150	0,7 to 1,3
Machinery compartment	≥ 50 (adjustable)	0,5 to 2,5
Kitchen, table top	≥ 300	0,7 to 1,3
Kitchen, floor	≥ 100	0,5 to 2,5
Personnel's compartment, working desk	≥ 300	0,7 to 1,3

[a] The values for illuminance are minimum values and may be increased by agreement between contractors.

[b] If a working area within the driver's cab is provided e. g. for an assistant, its illuminance should not be less than 300 lx.

[c] The area of the reading zone at the driver's desk is subject to an agreement between contractors

5.1.3 Glare limitation

In addition to 4.1.3, the following requirements shall be fulfilled:

— in the driver's cab, reflection in the windscreen caused by the lighting system shall be reduced to a minimum at all normal viewing angles for the driver in the seated position;

— special attention shall be paid to avoid the effects of glare on in-cab CCTV monitors, where installed.

NOTE Particularly for driver's cabins in tramcars, the reflections caused by the lighting in the passenger compartment should be taken into consideration.

5.1.4 Correlated colour temperature

Unless otherwise agreed between contractors, for specific areas, e.g. the kitchen area, the required values of 4.1.4 and 4.1.5 shall be met.

5.1.5 Controls for cab lighting

Cab general lighting shall be provided on driver's command in all normal operational modes of the rolling stock (including "switched off").

5.2 Stand-by lighting

For stand-by lighting, the requirements of 4.2 are applicable.

5.3 Emergency lighting

5.3.1 General

The emergency lighting shall be designed to enable continued occupation or safe egress from the vehicle. Luminaires of the general lighting system may be used for the emergency lighting system.

The emergency lighting system provides the minimum of light necessary to enable personnel to move around and to work inside the vehicle and to leave the vehicle and in particular to recognize the presence of obstacles. A reduced visibility due to airborne particles, e.g. caused by smoke or dust, should be taken into account.

5.3.2 Power supply

The luminaires of the emergency lighting system shall be supplied from the energy storage system by at least one dedicated circuit. If the vehicle is not provided with its own energy storage system, the emergency lighting system or luminaires shall be equipped with its own power source.

NOTE For driver's cabs and machinery compartments, it is recommended to use the same lighting system for emergency lighting as for the general lighting. These lighting systems may be switched on and off individually.

5.3.3 Illuminance

The minimum value of the average emergency illuminance shall be 5 lx at floor level along the centre line of the escape route. This includes the gangway between vehicles.

The minimum value at the exit threshold shall be 40 lx (when body side door is open).

All values shall be measured in accordance with 6.2 and 6.3 except for driver's cabs and machinery compartments, where the full illuminance shall be ensured.

5.3.4 Uniformity of illuminance

The uniformity of the emergency lighting, measured along the centre line of the escape route in accordance with 6.2 and 6.3, shall be between 0,2 and 10.

5.3.5 Glare limitation

In order to minimize glare effects the luminance of the emergency luminaires shall not exceed 400 $cd.m^{-2}$ in the usually visible area (down to 60° below the horizontal plane of the luminaire).

5.3.6 Starting performance

The minimum starting performance of the emergency lighting is such that 50 % of the fully specified illuminance shall be achieved within 5 s, and the fully specified illuminance within 15 s.

5.3.7 Operating time

The operating time of the emergency lighting shall be ensured for:

— rail vehicles of high speed trains: at least 3 h;

— rail vehicles of conventional trains: at least 1,5 h;

— rail vehicles of other trains: at least 1 h

after the vehicle power supply, e.g. the battery charging system, has failed.

NOTE The specified times apply to a fully charged energy storage system under conditions agreed between contractors.

5.3.8 Location of emergency lighting

As a minimum, emergency luminaires shall be located in the following areas:

— in any self-contained area;

— adjacent to doors and door steps;

— in the vicinity of interruptions or changes of direction of aisles and corridors;

— at any change of the floor level.

5.3.9 Maintenance

The emergency lighting shall be checkable at any time. Its functional performance shall be checked regularly.

6 Measuring equipment, conditions and measuring points

6.1 General

Unless otherwise agreed between contractors, these measurements shall be performed during the type test of the vehicle.

6.2 Measuring equipment

In order to prove that the requirements of this European Standard are fulfilled, the illuminance level shall be measured by means of an illuminance meter (lux meter). This instrument shall fulfil the following requirements:

The measurement uncertainty shall be no greater than ± 10 %. The instrument's detector shall be corrected to take account of the effects of light falling on it at oblique angles (cosine correction) and shall also be colour-corrected. If the receptor is not colour-corrected, the appropriate correction factor (usually provided by the supplier) shall be applied, with consideration to the spectral characteristics of the light source.

6.3 Conditions for illuminance measurement

The conditions for measurement of illuminance shall be as follows:

a) specified power supply for the vehicle available for the application measured, the vehicle energy storage system should be in a fully charged condition;

b) average air temperature of the room to be measured shall be 20 °C ± 5 K;

c) if fluorescent lamps are being tested they shall undergo a burn-in time of 150 h before being tested;

d) after a minimum service time of 20 min of the lighting equipment (after switching on);

e) influence of the surrounding artificial or natural light shall be < 5 % of the required illuminance.

NOTE 1 This surrounding light shall be measured with the train lights switched off.

f) the measurements shall be performed in a vehicle which is clean and fully equipped but unoccupied.

NOTE 2 If luminaires can be obscured totally or partly by clothes or luggage, then measurements taking into account those circumstances should be agreed between contractors.

6.4 Locations for illuminance measurement

The illuminance shall be measured at the following prescribed locations:

— aisles or corridors: on a horizontal level, at the half width of the aisle at minimum 5 measuring points in identical distances (distances not greater than 2 m) at floor level and at a height of 0,8 m;

— seating areas: on a horizontal level, at a height of 0,8 m above floor level and 0,6 m in front of the back rest, at the centre line between the lateral margins of the seat being measured;

— dining compartment: according to the general lighting for seating areas;

— reading zones in seating areas: the illuminance shall be measured with the general lighting switched off and only the reading lights in service. In the case where the general lighting may not be switched off, it is permissible to measure the lighting in the reading zone by subtracting the measured value for the general lighting. The measurements shall be made on a horizontal level of 0,8 m above floor level at the centre point and four evenly spread out points of a circle with a radius of 0,2 m around the centre point. The centre point is located 0,6 m in front of the back rest and at the centre line between the lateral margins of the seat being measured;

— reading zones at the driver's desk: the illuminance shall be measured directly at the surface of the driver's desk in an area and at measuring points agreed between contractors;

— vestibules: on a horizontal level, at the centre of any door step at the door step level and in the middle of the vestibule area at floor level and at a height of 0,8 m;

— gangways: along the centre line of the gangway in the middle and on both ends at floor level, with a minimum of 3 measurement points;

— stairs / steps: on a horizontal level at the centre of any step at its level;

— toilets / washing areas: at the front margin of the wash-basin at a height of 1,5 m above floor level, the vertical illuminance level in the direction of the wash-basin and the horizontal illuminance level;

— special compartments: according to their purpose.

6.5 Measurement of illuminance and glare

If measurement of illuminance and glare is required, it shall be performed according to the methods given in Clause 5.7 and Annexes C and D of CIE S 008/E:2001 / 8995-1:2002.

7 Further requirements on the design of lighting systems

7.1 General

The number of luminaires required for a lighting system in rolling stock shall be calculated to fulfil the requirements stated in Clauses 4 and 5.

Ageing and degradation of the system shall be allowed for in the design by multiplying the rated illuminances as determined by calculation with a factor, which, unless otherwise specified, shall be 1,25. This value is equivalent with the light loss factor 0,8.

These factors take into account the decreasing of the illuminance of the system as a result of ageing and degradation of the lamps, the luminaires and the reflection degree of the surfaces. Hence, the illuminance shall be subject to regular inspection.

Maintenance of the system is required if the light loss factor drops below 0,8.

The electrical supply system shall be protected from fire in accordance with CEN/TS 45545.

The requirements of protection against electrical hazards shall be fulfilled in accordance with EN 50153.

Where surfaces of luminaires can be touched unintentionally, their surface temperature shall not exceed 50 °C.

When selecting luminaires for the purpose of this European Standard, the durability and danger of injuries caused by sharp edges and corners or by broken glass shall be considered.

7.2 Maintenance

When the lamps are replaced, lamps of the same performance (colour temperature, colour rendering, luminous efficiency) shall be used.

NOTE Attention is drawn to national regulations for the protection of the environment concerning the disposal of used lighting equipment, e.g. lamps, energy storage systems.

7.3 Electromagnetic compatibility (EMC)

The requirements concerning EMC for railway applications are given in the EN 50121 series.

In the cases where EN 55015 (industrial standard) contradicts some clauses of EN 50121, the application of this European Standard shall be subject to an agreement between contractors.

Annex A
(normative)

Contractual statements

A.1 Information and requirements to be agreed and documented

A.1.1 General

The following information shall be fully documented. Both the definitive requirements specified throughout this European Standard and the following documented items shall be satisfied before a claim of compliance with the Standard can be made and verified.

A.1.2 Information to be supplied by the purchaser

The following information to be supplied by the purchaser shall be fully documented:

— for stand-by lighting, whether requirements other than those given in this European Standard will apply (see 4.2);

— whether the illuminance tests are to be performed at a time other than during type tests (see 6.1).

A.1.3 Items for agreement

The following items to be agreed between the contractors, which are specified in the clauses referred to, shall be fully documented:

— illuminance values in particular areas (see Tables 1, 2 and 3);

— any special requirements for stand-by lighting (see 4.2);

— conditions of use of energy storage system for emergency lighting (see 4.3.7 and 5.3.7);

— area of reading zone at the driver’s desk (see 5.1.2);

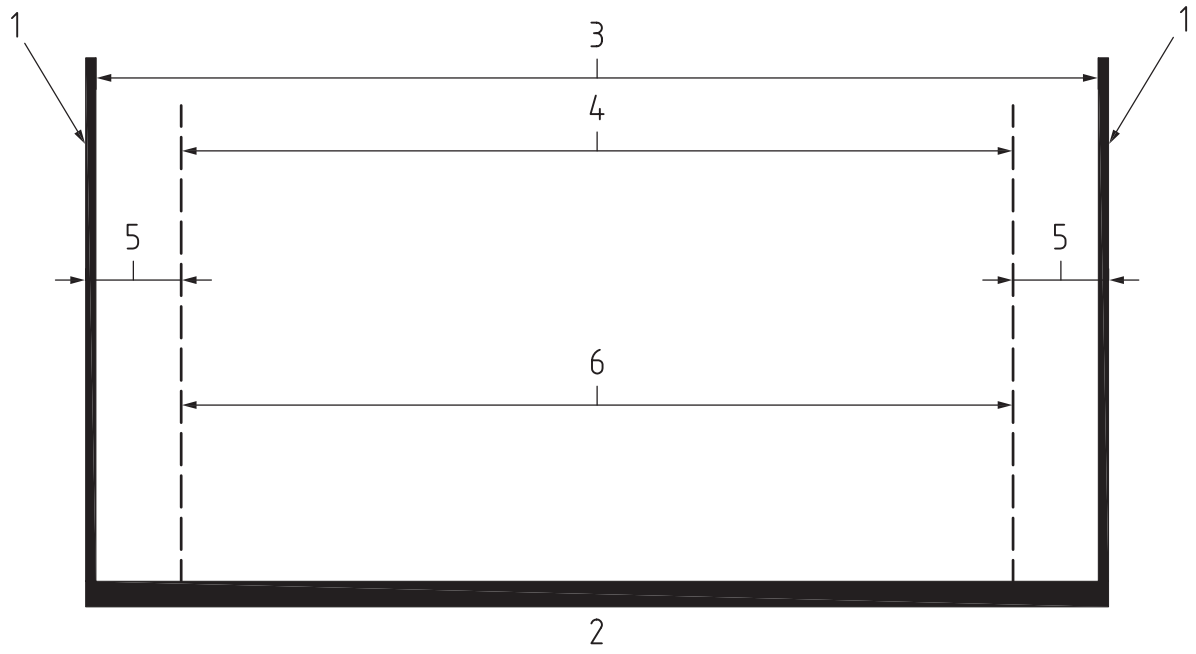
— when the illuminance measurements are to be performed, if not during type test (see 6.1);

— application of EN 50121 and EN 55015 (see 7.3).

Annex B
(normative)

Definition of the door and access step width requirement for illuminance measurements

The door width requirement for illuminance measurement is defined in the following diagram:



Key

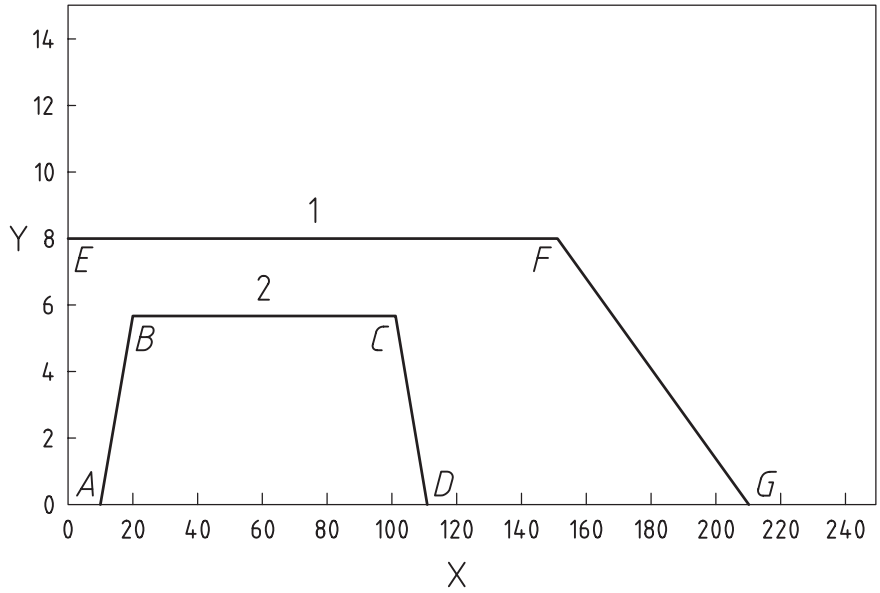
1 = door post
2 = step
3 = 100 % door width
4 = 80 % door width
5 = 0-20 % door width
6 = > 75 lux

Figure B.1 — Definition of the door width and access step requirement for illuminance measurements

Annex C
(informative)

Test pulse characteristics

The co-ordinates of points A to G on the graph below are shown in Table C.1



Key

X = time (ms)
Y = acceleration (g)
1 = upper limit
2 = lower limit

Figure C.1 — Test pulse characteristics

Table C.1 — Test pulse co-ordinates

	Time (ms)	Acceleration (g)
A	10	0,00
B	20	5,67
C	100	5,67
D	110	0,00
E	0	8,00
F	150	8,00
G	210	000

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the Directive 2008/57/EC[1].

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in table ZA.1 for HS Rolling Stock, in Table ZA.2 for CR Locomotives and Passenger Rolling Stock , in Table ZA.3 for the CR/HS issues relating to 'Persons with reduced mobility' and in Table ZA.4 for Safety in railway tunnels, confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 – Correspondence between this European Standard, the HS RST TSI published in OJEU dated March 26th 2008 and Directive 2008/57/EC

Clause/ subclauses of this European Standard	Chapter/§/annexes of the TSI	Corresponding text, articles/§/annexes of the Directive 2008/57/EC	Comments
Clause 4.1 General lighting; Table 1 - Minimum values of average illuminance and target uniformity for high speed and conventional trains Clause 4.3 Emergency lighting (general) Clause 5.3 Emergency lighting (in service areas) Clause 6 Measuring equip-ment, conditions and measuring points 6.3 Conditions for illuminance measurement, 6.4 Locations for illuminance measurement, 6.5 Measurement of illumi-nance and glare	4.2 Functional and technical specification of the sub-system 4.2.7.12 Emergency lighting system	Annex III, Essential requirements 1 General Requirements 1.1 Safety: 1.1.1 2 Requirements specific to each subsystem 2.4 Rolling stock 2.4.1 Safety: 2.4.1.8, 2.4.1.9 2.4.2 Reliability and availability	

[1] This Directive 2008/57/EC adopted on 17th June 2008 is a recast of the previous Directives 96/48/EC 'Interoperability of the trans-European high-speed rail system' and 2001/16/EC 'Interoperability of the trans-European conventional rail system' and revisions thereof by 2004/50/EC 'Corrigendum to Directive 2004/50/EC of the European Parliament and of the Council of 29 April 2004 amending Council Directive 96/48/EC on the interoperability of the trans-European high-speed rail system and Directive 2001/16/EC of the European Parliament and of the Council on the interoperability of the trans-European conventional rail system'

Table ZA.2 – Correspondence between this European Standard, the CR LOC&PAS TSI (final draft; 08/57–ST05, version EN04, 26.05.2010) and Directive 2008/57/EC

Clause/ subclauses of this European Standard	Chapter/§/annexes of the TSI	Corresponding text, articles/§/annexes of the Directive 2008/57/EC	Comments
Clause 5 Lighting in service areas 5.1.2 Illuminance Table 3 Minimum values of average illuminance and target uniformity for service areas 5.1.5 Controls for cab lighting 5.3 Emergency lighting (in service areas) Clause 6 Measuring equipment, conditions and measuring points 6.3 Conditions for illuminance measurement, 6.4 Locations for illuminance measurement, 6.5 Measurement of illuminance and glare	Chapter 4.2 Functional and technical specification of the sub-system 4.2.9.1 Driver's cab 4.2.9.1.8 Internal lighting	Annex III, Essential requirements 1 General Requirements 1.1 Safety: 1.1.1 2 Requirements specific to each subsystem 2.4 Rolling stock 2.4.1 Safety 2.4.2 Reliability and availability 2.6.3 Technical compatibility	

Table ZA.3 – Correspondence between this European Standard, the HS/CR PRM TSI published in OJEU dated March 7th 2008 and Directive 2008/57/EC

Clause/ subclauses of this European Standard	Chapter/§/annexes of the TSI	Corresponding text, articles/§/annexes of the Directive 2008/57/EC	Comments
Clause 4.1 General lighting; Table 1 - Minimum values of average illuminance and target uniformity for high speed and conventional trains Clause 4.3 Emergency lighting (general) Clause 5.3 Emergency lighting (in service areas) Clause 6 Measuring equipment, conditions and measuring points 6.3 Conditions for illuminance measuring, 6.4 Locations for illuminance measuring, 6.5 Measurement of illuminance and glare	Chapter 4.2 Characterisation of the sub-system rolling stock 4.2.2.5 Lighting	Annex III, Essential requirements 1 General Requirements 1.1 Safety: 1.1.1 2 Requirements specific to each subsystem 2.4 Rolling stock 2.4.1 Safety: 2.4.1.8, 2.4.1.9 2.4.2 Reliability and availability	

Table ZA.4 – Correspondence between this European Standard, the HS/CR SRT TSI published in OJEU dated March 7th 2008 and Directive 2008/57/EC

Clause/ subclauses of this European Standard	Chapter/§/annexes of the TSI	Corresponding text, articles/§/annexes of the Directive 2008/57/EC	Comments
Clause 4.3 Emergency lighting (general) Clause 5.3 Emergency lighting (in service areas)	Chapter 4.2 Functional and technical specifications of the subsystems 4.2.5. Subsystem rolling stock 4.2.5.9 Emergency lighting system in the train Note: The SRT TSI refers to HS RST TSI, 4.2.7.12, this reference being valid also for CR Passenger Rolling Stock.	Annex III, Essential requirements 1 General Requirements 1.1 Safety: 1.1.1 2 Requirements specific to each subsystem 2.4 Rolling stock 2.4.1 Safety: 2.4.1.8, 2.4.1.9 2.4.2 Reliability and availability	

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 12665, *Lighting applications — Basic terms and criteria for specifying lighting requirements*

[2] EN 55015, *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment*

[3] IEC 60050-845:1987, *International Electrotechnical Vocabulary Chapter 845: Lighting (identical to CIE Publication No. 17.4)*

[4] UIC 555 VE 2), *Electric lighting in passenger rolling stock*

[5] UIC 651 VE, *Layout of driver's cabs in locomotives, railcars, multiple unit trains and driving trailers*

[6] DIN 67510, *Photoluminescent pigments and products*

2) to be purchased from UIC, Direction Générale, 16, rue Jean Rey, F-75015 Paris.

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