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Railway applications - Driver's cab - Part 1: Visibility, layout, access

Bahnanwendungen - Führerraum - Teil 1: Sichtbedingungen, Gestaltung, Zugang

Applications ferroviaires - Cabines d'opérateur - Partie 1: Visibilité, layout, accès

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Railway applications - Driver's cab - Part 1: Visibility, layout, access

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (prEN 16186-1:2010) has been prepared by Technical Committee CEN/TC 256 “Railway Applications”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

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.

Introduction

This European Standard addresses operational requirements for train driving, shunting and related preparatory work as far as mechanical driver’s cab interfaces are concerned. It provides current cab design principles and considers latest available research findings provided by the European Research project EUDD+[1)].

The structure of this standard is based on the functional breakdown structure for railway vehicles as laid down in FprEN 15380-4. This approach was chosen because it enables defining functional requirements without necessarily setting requirements on the function carrier, which is advantageous in the case of different technical solutions addressing the same functional requirement, and because it facilitates the management of requirements for the partners in the railway sector.

Requirements that are specific for a dedicated technical product are provided as system requirements following a system breakdown structure for the cab derived from the Commission Decision 2009/965/EC[2)].

Each requirement is tagged by a REQ number as a unique identifier and sometimes by a keyword.

The function groups according to FprEN 15380-4 form Clause 4 and its sub-clauses of this standard. Since not all functions are addressed by requirements in the scope of this standard, the clause numbers do not fully represent the FBS structure. Therefore, the FBS number is given in brackets in the clause title.

1 Scope

This standard applies to conventional and high speed interoperable rolling stock with driver’s cab. As far as OTMs are concerned, the standard applies only for driving configuration and not for working mode.

1) see Bibliography [1]

2) see Bibliography [2]

This standard defines:

— anthropometric measurements of the driver (referred as mandatory in the TSI[3)]);

— general design rules for layout and access to the cab (for conformity assessment);

— front visibility conditions, including positions of line-side signals to be considered (referred to as mandatory in the TSI);

— assessment methods for TSI requirements on layout of the cab and accessibility of equipment and controls.

Due to railway systems constraints the level of comfort provided to the persons within the defined anthropometric range may vary for the extremes in height. Persons outside the anthropometric range may face some discomfort.

NOTE Persons outside the anthropometric range are covered by the operators' safety management systems.

The standard applies to driver desks installed on the left, on the right, or in a central position in the driver's cab. Due to cab space and resulting desk integration constraints, desk design can vary between left, right or central position.

2 Normative references

The following referenced documents are indispensable for the application 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 894 (all parts), *Safety of machinery — Ergonomics requirements for the design of displays and control actuators*

EN 1005 (all parts), *Safety of machinery — Human physical performance*

EN 12663-1, *Railway applications — Structural requirements of railway vehicle bodies — Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)*

prEN 13272:2010, *Railway applications — Electrical lighting for rolling stock in public transport systems*

EN 14752:2005, *Railway applications — Bodyside entrance systems*

EN 15152, *Railway applications — Front windscreens for train cabs*

EN 15227, *Railway applications — Crashworthiness requirements for railway vehicle bodies*

FprEN 15892, *Railway applications — Noise Emission — Measurement of noise inside driver's cabs*

prEN 16116-1:2010, *Railway Applications — Design requirements of steps and handrails on passenger vehicles and locomotives*

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

EN ISO 2813, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20°, 60° und 85°*

3) see Bibliography [4] and [5]

EN ISO 10263-2, *Earth-moving machinery — Operator enclosure environment — Part 2: Air filter element test method*

EN ISO 22727, *Graphical symbols — Creation and design of public information symbols — Requirements*

ISO 7001, *Graphical symbols — Public information symbols*

ISO 9186 (all parts), *Graphical symbols — Test methods*

3 Terms and definitions, and abbreviations

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

3.1
can
is possible

[EN 50129:2003]

3.2
configuration of train, unit and cab
set of functions available in a defined state of train, unit or cab

NOTE Train systems can have different configurations depending on the environment and/or operational service. Different functions are available in each configuration. Configurations are: Shut down, Switched on, Stand-by, In service, Driving, Energy saving, Self protection, Degraded.

3.3
control
element that is operable by the driver as a man machine interface for triggering a desired function

3.4
direct brake
local brake on locomotives, where the brake force is directly commanded by the driver, e.g. by means of TCMS

NOTE The brake force will be controlled from 0 kN to the maximum brake force designed.

3.5
display image
visible image with a defined content that is shown on a display unit

3.6
display system
consists of the display units (max. 4 per main desk) and the internal and external interfaces to TCMS

3.7
driver
person tasked with operating a vehicle or a train by operating controls in a driver's cab or on a radio remote control unit

NOTE For the driver, the relevant requirements of TSI OPE[4)], 4.6, 4.7 and Annex H apply.

4) see Bibliography [6] and [7]

3.8
driver display unit
hardware to display the defined display images with circumferential keys for driver interaction and selection of functions offered by these keys (hard and soft keys)

3.9
driver's cab
compartment of a vehicle which is equipped with controls and instruments for the driver in order to control traction unit(s) in the train

3.10
dynamic brake
brake force generated on traction units

3.11
electronic timetable display unit
tbd

3.12
engine room for traction units
area or compartment or cabinet where drive units (electric or diesel) and/or auxiliary units are situated or the equivalent for driving coaches (e.g. cubicle for ETCS on-board equipment and air-cocks)

3.13
gloss factor
tbd

3.14
immediate
as soon as possible, i.e. maximum duration $t \leq 1$ s, if not specifically or otherwise defined

3.15
luminance coefficient
luminance coefficient = reflective coefficient $\times$ 100

3.16
may
is permissible

[EN 50129:2003]

3.17
running
($v > 0$) detection in case of increasing speed from $v >$ (1...3) km/h

3.18
parking brake
brake used to prevent parked rolling stock moving under the specified conditions taking into account the place, wind, gradient and rolling stock loading state until intentionally released

3.19
redundancy images
display image with merged content out of two regular display images, that shall be displayed on the remaining display unit (e.g. in case of failure of one display unit)

3.20
redundancy mode
tbd

3.21
REQ
requirement identified by a unique number

3.22
shall
is mandatory

[EN 50129:2003]

3.23
should
is recommended

[EN 50129:2003]

3.24
standstill
(v = 0) detection in case of decreasing speed from $v < (3 - \Delta v)$ km/h with $0 < \Delta v < 2{,}5$ km/h

3.25
technical and diagnostics display unit
tbd

3.26
train radio display unit
tbd

For the purposes of this document, the following abbreviations are used.

ASC	Automatic Speed Control
ATC	Automatic Train Control
ATP	Automatic Train Protection
BP	Brake Pipe
CCD	Control Command Display
CR	Conventional Rail
CCS	Control Command and Signalling
DAC	Driver Activity Control
DMU	Diesel Multiple Unit
EIRENE	European Integrated Railway Radio Enhanced Network (GSM-R specification)
EMU	Electric Multiple Unit
ETCS	European Train Control System
ETD	Electronic Timetable Display
FBS	Functional Breakdown Structure
GSM-R	Global System for Mobile communications – Rail
HVAC	Heating Ventilation Air Conditioning
HS	High Speed
LOC/PAS	Locomotives and Passenger coaches
MMI	Man Machine Interface
MP	Main air reservoir Pipe

OPE	Operation
OTM	On-Track Machine
PIS	Passenger Information System
RST	Rolling Stock
TCMS	Train Control and Monitoring System
TDD	Technical and Diagnostic Display
TRD	Train Radio Display
TSI	Technical Specification for Interoperability

4 Functional requirements

4.1 Carry and protect passengers, train crew and load (FBS 1)

4.1.1 Arrange interior space (FBS 1.1)

REQ5388 Interior layout

The interior layout of the cab shall respect the anthropometric measurements of the driver as set out in this standard (see Annex A).

REQ5999

The following requirement applies only to cabs without front centre access. The longitudinal distance between the inside face of the front windscreen on a height above floor level of 1 800 mm and the nearest object located behind the driver's seat, shall be a minimum of 1 200 mm measured in an area within a distance of 200 mm to 800 mm from either side of the windscreen centre line. On the height of the eye point of the seated tall driver this longitudinal distance shall be at least 1 500 mm.

REQ5392

The freedom of movement of staff inside the cab shall not be inhibited by obstructions or by awkward projections. This objective is demonstrated by the requirements of this clause.

REQ5395

Objective: The internal fittings of drivers' cabs shall be so designed that staff cannot be hurt by sharp edges, protruding objects etc.

REQ5396

All protruding edges in the cab shall have a radius of at least 2 mm.

REQ5397

The distance from the driver's eye to the windscreen in seated position shall be a minimum of 500 mm and a maximum of 1 500 mm. It is recommended to minimize the distance to the front window.

REQ4570 Interior layout of seat and driving positions

The interior layout shall allow both seated and standing driving positions on locomotives and driving coaches intended to be used in a train formation with a locomotive.

4.1.1.1 Provide floor and flooring (FBS 1.1.1)

REQ5400

Objective: Floor surfaces shall be designed to minimise slipping and tripping hazards.

REQ5408

On a level track, the floor shall be horizontal with a tolerance of 2°.

REQ3982 Interior cab layout

Height changes are not permitted on the cab floor; they are permitted between the cab and adjacent compartments or exterior doors.

REQ6082

Steps shall be marked according to EN 14752:2005, 5.6.2.1.

REQ5998

Height changes between interior floors up to 60 mm shall be managed with a ramp. Height changes between 60 mm and 120 mm should be avoided. Height changes of more than 120 mm shall be managed with steps which shall have a height in the range of 120 mm and 250 mm and a minimum depth of 270 mm.

4.1.1.2 Provide roof and roofing (FBS 1.1.2)

REQ5410

Headroom of 2 000 mm shall be provided at all points accessible in the standing position. A height of 1 850 mm is permitted for the cab floor lateral area at the side walls that shall not be more than 30 % of the whole cab floor area. For train sets with a windscreen inclined by less than 35° from the horizontal or with maximum design speed > 190 km/h, a lower value may apply also in front of the backrest of the driver seat. This value shall not be less than 1 700 mm at the front edge of the driver's desk.

REQ5412

The roof shall be watertight.

4.1.1.3 Provide lining and panelling (FBS 1.1.4)

REQ5416

All surfaces or equipment which are in frequent or permanent contact with the driver shall be manufactured from low thermal conductivity materials to avoid hot or cold sensation. Open point: list of low thermal conductivity materials or assessment criteria.

4.1.1.4 Provide acoustic and thermal insulation (FBS 1.1.5)

REQ5417

The prescribed noise levels shall be assessed according to FprEN 15892.

REQ5420

Driving cabs shall have acoustic characteristics that ensure exploding detonators, if provided, can be heard inside the cab at the vehicle's maximum speed and shall be readily distinguishable from background noise. This is deemed to be fulfilled by a detonator creating noise between 125 db(A) and 162 db(A) at 1 m distance.

REQ5403

The driver's cab, and particularly the floor, shall be provided with thermal insulation.

REQ5409

The driver's cab, and particularly the roof, shall be provided with thermal insulation.

4.1.1.5 Provide luggage and storage space (FBS 1.1.6)

REQ3987 Storage facilities for train staff

There shall be adequate storage facilities for clothing and equipment that has to travel with the staff inside or close to driver's cabs and where a train is equipped with a separate service compartment.

REQ5421

Objective: Suitable storage for personal equipment needed to undertake driving duties shall be located in the cab. The design shall take into account any risk of injury to the cab occupants.

REQ5422

In each cab the following shall be provided:

a) Two hooks for clothing or a niche with a clothes beam providing a minimum space for clothes of 350 mm × 300 mm × 1 500 mm;

b) a free space (e.g. on the cab floor) shall be available for storing a suitcase or bag with a size of 300 mm × 400 mm × 400 mm.

REQ5423

If a niche is provided for storage, a clearance of at least 40 mm shall be provided.

REQ5424

Where additional cupboard space is required, it shall have the following minimum dimensions: 400 mm × 250 mm × 250 mm.

REQ5498

A possibility to hang a jacket may be integrated in the rear of the seat.

4.1.1.6 Carry and secure accompanying object (FBS 1.1.7)

REQ5425 Onboard tools

Where emergency equipment is provided in or near the drivers cab, it shall be positioned so that it is readily accessible and staff can visually check that it is there and properly functional without having to remove it from its stowage location.

REQ5427

A ladder or other portable devices of equivalent function shall be provided in or close to the driver's cab for cabs without exterior doors and without permanent means of escape.

REQ5428

Fixed equipment and portable equipment for permanent storage in the cab shall be attached compliant with the requirements of EN 12663-1.

4.1.2 Carry and enclose the load (FBS 1.2)

4.1.2.1 Fasten equipment and load (FBS 1.2.1)

REQ5432

A loose type seat is permitted if

— a storage is provided when it is not in use or;

— if it is prevented from unintentional movement by resistance of the floor/seat interface of 0,3 g.

4.1.3 Protect against fire (FBS 1.4)

4.1.3.1 Manage and provide fire extinguishment (FBS 1.4.4)

REQ5866

Based on CEN/TS 45545, there shall be no interface for the driver to interfere with a fire extinguishing system, but there may be information given to the driver.

REQ5436

Fire extinguishers shall be positioned so that they are readily accessible, can be visually checked without having to remove them from their stowage location and do not present a hazard to the free movement of personnel within the cab.

4.2 Provide appropriate conditions to passenger, train crew and load (FBS 2)

4.2.1 General

REQ5439

At each stage of the design of a new cab, consideration shall be given to the tasks to be carried out efficiently and safely by the driver, in accordance with the principles of this standard.

REQ5440

For providing access for the whole hand in normal operation, at least 40 mm clearance should be provided.

REQ4590 Driver desk

The driver's desk and its operating equipment and controls shall be arranged to enable, in the most commonly used driving position, the driver to keep a normal posture, without hampering his freedom of movement, taking into account the anthropometric measurements of the driver as set out in Annex A of this standard.

4.2.2 Provide safe and comfortable sitting, lying and standing positions (FBS 2.1)

4.2.2.1 General

REQ5389 Interior layout of seat and driving positions

The following requirement applies only to locomotives and driving coaches intended to be used in a train formation with a locomotive. For facilitating the standing position, the clearance between any desk and seat part shall be enabled to be at least 190 mm and should preferably be 250 mm. Assessment may be done by a half cylinder the plane of which is located at the centre of the seat cushion front edge (see Figure C.2).

REQ5442

For the driver, reaching the standing position from the seated position shall be possible without any rotation of the seat.

REQ6084

Headrest and electric connection of the driver's seat are optional.

4.2.2.2 Provide seating possibilities (FBS 2.1.2)

4.2.2.2.1 General

REQ6087

The driver's seat shall be facing forwards. For OTMs and shunting locomotives, deviations may apply.

REQ4585 Driver's seat design

The driver's seat shall be designed in such a way that it allows all normal driving functions to be undertaken in a seated position, taking into account the anthropometric measurements of the driver as set out in the Annex A of this standard. It shall allow for correct posture of the driver from the physiological point of view.

REQ4584 Driver's seat count

The cab shall be equipped with at least one driver's seat and additionally with a forward facing seat not considered as a driving position for possible accompanying crew. For the additional seat, visibility requirements need not apply.

REQ5458

If, as an option, the duties of the second person are equivalent to the driver, the corresponding seat shall meet the requirements of the driver's seat contained in this standard.

REQ5463

The seat shall be easily removable for the purpose of replacement.

REQ5433

For fixed seats, EN 12663-1 shall apply.

4.2.2.2.2 Emergency egress from seat

REQ5447

Objective: The driver's seat shall not prevent emergency egress from the driving cab. This requirement is supported by Figure C.2.

REQ5481 Driver's seat clearance zone

The driver's seat clearance zone shall be according to Figure C.2.

REQ4587 Driver's seat position

The seat shall not constitute an obstacle for the driver to escape in case of emergency.

REQ5480

In any position of the seat, safe escape shall be allowed by the seat design, e.g. by its shape, or any unrestricted rotation or movement of the seat and/or the arm rest. "Unrestricted" means that no device is required for escape from the seat, e.g. unlocking.