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Standards

Irish Standard  
I.S. EN 16116-1:2013

# Railway applications - Design requirements for steps, handrails and associated access for staff - Part 1: Passenger vehicles, luggage vans and locomotives

## I.S. EN 16116-1:2013

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## Railway applications - Design requirements for steps, handrails and associated access for staff - Part 1: Passenger vehicles, luggage vans and locomotives

Applications ferroviaires - Exigences pour la conception des  
marchepieds, poignées et accès destinés au personnel -  
Partie 1: Véhicules voyageurs, fourgons à bagages et  
locomotives

Bahnanwendungen - Konstruktionsanforderungen an Tritte,  
Handgriffe und zugehörige Zugänge für das Personal - Teil  
1: Personenfahrzeuge, Gepäckwagen und Lokomotiven

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## Foreword

This document (EN 16116-1:2013) 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of an identical text or by endorsement, at the latest by March 2014, and conflicting national standards shall be withdrawn at the latest by March 2014.

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 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 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

This European standard is part of the series EN 16116, *Railway applications — Design requirements for steps, handrails and associated access for staff*, which consists of the following parts:

- *Part 1: Passenger vehicles, luggage vans and locomotives;*
- *Part 2: Freight wagons.*

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, Former Yugoslav Republic of Macedonia, 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.

## **Introduction**

Locomotives, luggage vans and passenger rolling stock are designed so that staff are not exposed to undue risk during coupling and access to the vehicle or to special equipment. It is therefore essential to define common requirements for rolling stock.

## 1 Scope

This European Standard specifies the minimum ergonomic and structural integrity requirements for steps and handrails used by railway staff to access passenger vehicles, luggage vans, locomotives and power units of rolling stock. It also applies to passenger-rated car carriers.

This European Standard defines the required spaces necessary for handling of screw couplings with side buffers, shunter handrails and shunter's stand. For staff access, it defines footsteps, handrails and their dimensions and free spaces. To fulfil the requirements for loads which are applied by the staff, it defines dimensions and requirements for materials or design loads.

It also defines the general requirements of steps and handrail for access to external equipment, for example windscreens, wipers or external lights.

This European Standard does not cover on track machines (mobile railway infrastructure construction and maintenance equipment) and tram-trains.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 131 (all parts), *Ladders*

EN 10025-2:2004, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

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

EN 15085 (all parts), *Railway applications — Welding of railway vehicles and components*

EN 15273 (all parts), *Railway applications — Gauges*

EN 16116-2, *Railway applications — Design requirements for steps, handrails and associated staff access — Part 2: Freight wagons*

## 3 Terms and definitions

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

### 3.1

#### **clearance**

defined free space which is needed to ensure space for the correct functioning of, and safety when handling, devices

### 3.2

#### **step**

footstep with defined properties solely for staff use

### 3.3

#### **shunter**

shunting staff who couple and uncouple vehicles and direct movements

## EN 16116-1:2013 (E)

- 3.4**  
**shunter's step**  
specific step used for the shunter's stand
- 3.5**  
**handrail**  
handrail with defined properties solely for staff use
- 3.6**  
**shunter handrail**  
specific handrail fitted at headstock under each buffer
- 3.7**  
**shunter's stand**  
shunter's step in combination with handrail for the specific use of shunting staff to allow travel outside the vehicle during shunting
- 3.8**  
**reserved spaces**  
defined free space which is needed to ensure safe working conditions for the shunting staff during coupling and uncoupling of screw couplings
- 3.9**  
**safe working position**  
position for the shunter allowing sight for directing driving during shunting operations

Note 1 to entry: These positions may be:

- a shunter's stand,
- a platform,
- a step with a corresponding handrail,
- the driver's cab or
- vestibule of a passenger car with sight in the direction of travel.

## 4 General requirements for steps and handrails

Steps and handrails shall withstand the loads applied by staff.

For confidence in the safety of steps and handrails an appropriate stiffness should be provided. The corresponding stiffness criteria (permissible elastic deformation under load) for steps and handrails are optional and should be defined in the specification.

The following requirements shall be demonstrated by analyses or tests:

- steps used as a safe working position for the shunter shall be able to withstand separately acting forces of 2 kN vertically and 1,5 kN laterally or longitudinally, applied by staff at any point without causing permanent deformation to it or its fixings,
- other steps shall be capable of withstanding separately acting forces of 1,5 kN vertically and 1,5 kN laterally or longitudinally, applied by staff at any point without causing permanent deformation to it or its fixings,



- handrails shall be capable of withstanding a force applied by staff of 1,5 kN at any point in any direction without causing permanent deformation to it or its fixings.

When demonstrated by tests it is recommended that the component is preloaded to stabilise any residual stresses induced during manufacture and the maximum force is applied at least twice. The results of the final tests shall not show permanent deformations.

Handrails shall not have any sharp edges; where handrails have a rectangular section the corners shall be rounded. Unless otherwise specified in this standard, the cross sectional dimensions shall be:

- for round shape between 20 mm and 35 mm or
- for oval shape: minimum dimension of 12 mm thickness and 35 mm width and maximum dimension of 40 mm.

Unless otherwise specified in this standard, the handrails should have a minimum clearance of 100 mm that may be reduced to a minimum of 40 mm if necessary.

Steps and handrails used by staff shall be secured as follows:

- with positive locking or
- with bolts of adequate length and appropriate self-locking or
- with high-strength lock ring-bolts or
- welded into place in accordance with EN 15085.

All steps shall be made with a non slip surface and shall not have sharp edges causing obstacles for the shoes of the staff.

Steps or platforms used as a safe working position for the shunter, walkways and access steps to the platform and drivers cab at shunting powered units which could be covered with ice because they are not sheltered from weather conditions shall be made of metal gratings and fulfil the following criteria:

- 1) Resistance to friction:  
The average value of the coefficient of friction measured in 3 directions (lengthwise, widthwise and diagonally) shall reach the following minimum values:
  - a) in dry and wet (water) condition: 0,65
  - b) in oiled condition: 0,30

Coefficient of friction values shall be ascertained by means of a 100 mm × 100 mm movable plate, on which a rubber pad with 80 shore hardness shall be glued; this plate shall be loaded with a weight of 75 kg. For the measurements carried out with water and oil, the grating shall be fully immersed.

- 2) Grating structure:  
To ensure that the gratings are sufficiently well-adapted to winter conditions, a ratio of at least 50 % of "void" area to total area shall be observed. Only apertures that can be penetrated by a ball-shaped object with a diameter of 10 mm and have a minimum area of 400 mm<sup>2</sup> shall be taken into account to determine this ratio.

NOTE The "void" area is the free space afforded by the grating apertures in the vertical direction.

Examples which fulfil the above criteria are given in Annex A.

Other steps which are not sheltered from weather conditions should be sufficiently well-adapted to conditions in relation with their use.

All dimensions given in this standard with respect to top of rail shall be derived for vehicles in working order standing on a horizontal track.

## 5 Requirements for handling screw couplings with side buffers

### 5.1 General

Vehicles which have to be coupled to trains of variable consist by screw couplings shall provide:

- safe working positions for the shunter at each vehicle end fitted with screw couplings,
- a shunter handrail under each buffer and
- reserved spaces for safe operation by the shunter.

A safe working position shall be accessible from both sides of the vehicle from 200 mm below top of rail.

If defined in the specification, a safe working position for the shunter may be omitted on the vehicle (e.g. dining cars or sleeping cars with side end doors only on one vehicle end or according to national regulations). In this case other operational solutions shall allow shunting of such vehicles and this shall be defined in the specification.

On passenger coaches and luggage vans fitted with side end doors, where there are no outside handholds or steps for passengers, when the door is closed, special handrails and steps for shunters may be omitted. In this case, the inner handrails and the inner door steps shall serve as a working position for the shunter when the door is open. The shunter shall have the possibility to open the doors from outside or inside and sliding doors shall not cause danger to the shunter during the shunting process.

Powered units that are exclusively or mainly intended for shunting purposes shall be provided at least at one end with a transverse platform accessible from both sides.

For the different types of vehicles, the following Table 1 provides the requirements for the working position and reserved spaces for the shunter and the corresponding clauses of this standard for the detailed descriptions. To avoid the risk of train surfing, the safe working position based on steps and corresponding handrails, which are accessible when the doors are closed, is not allowed for passenger coaches.

Table 1 — Requirements for safe working position of the shunter

Type of vehicle		Safe working position for shunter	Corresponding clauses for		
			steps	hand-rails	reserved spaces
Passenger coaches	With side end doors	Side end doors or position inside vehicle with sight for directing driving	5.1	5.1	6.2.1
	Without side end doors	Position inside vehicle with sight for directing driving	5.1	5.1	6.2
	Car carriers	Lower deck	8.1	8.1	6.2.1
Cab ends of driving trailers		Drivers cab and/or step with a corresponding handrail or shunter's stand <sup>a</sup>	5.2, 5.3.1	5.4.2	6.2
Powered units	Intended for shunting purposes	Transverse platform	5.5	5.5	6.2.1
		Steps at each of the four corners	5.3.2	5.4.3	6.2
	Not intended for shunting purposes	Drivers cab and/or step with a corresponding handrail or shunter's stand <sup>a</sup>	5.2, 5.3.1	5.4.2	6.2

<sup>a</sup> For power units not intended for shunting purposes and cab ends of driving trailers, steps with a corresponding handrail or a shunter's stand are not necessary but may be required by the specification.

Vehicles which have to be coupled by screw couplings shall be equipped with two shunter handrails as described in 5.4.1.

## 5.2 Shunter's stand

If a shunter's stand is required the shunter's step shall be designed according to 5.3.1 in combination with the corresponding handrails according to 5.4.2.

The position and dimensions required for the shunter's step and the corresponding handrails are those of the general case in EN 16116-2.

If applicable the rear edge of the shunter's step should lie in the buffer vertical fixing plane.

The minimum distance of the step end to the contact plane of the fully compressed buffers shall be 150 mm.

## 5.3 Steps

### 5.3.1 Shunter's step

The shunter's step may be made according to EN 16116-2.

For this step design, securing by welding is not permissible.

This step design fulfils the requirements given in Clause 4.

Other designs for the shunter's step are permissible if they fulfil the requirements given in Clause 4.

### 5.3.2 Steps at corners of shunting powered units

These steps apply to shunting powered units that are exclusively or mainly intended for shunting purposes.

At each of the four corners of the underframe a step enabling at least one member of the staff to stand shall be provided. This step can be either the lower rung of the steps for gaining access to the transverse platform or a recess embodying a step.

The lowest rung of the step shall be located at the lowest height above rail level compatible with the gauge limit, not higher than 600 mm but preferably be lower than 560 mm. The positioning of this rung shall ensure the required space above steps as defined in 6.2.2, Figure 3. The unobstructed surface of this rung shall be at least 500 mm long in the running direction and at least 300 mm deep transversely.

The vertical spacing of the rungs shall not exceed 325 mm.

## 5.4 Handrails

### 5.4.1 Shunter handrail

One shunter handrail shall be located at each headstock under each buffer. These shall be at least 260 mm long and be situated at a lateral distance of between 500 mm and 750 mm for either side of the vehicle centre line.

The minimum clearance between the handrails and any part of the vehicle should be preferably 100 mm but shall be at least 50 mm. The minimum dimensions and the positions for the shunter handrail are defined in Figure 1.

The shunter handrail shall be made of round bar steel with a diameter of min. 20 mm to max. 35 mm and the material strength shall be as a minimum that of EN 10025-2, grade S235. Such a design fulfils the load requirements of Clause 4 without further assessment.

Other materials or designs for the shunter handrail are permissible if they fulfil the strength and dimension requirements given in Clause 4.

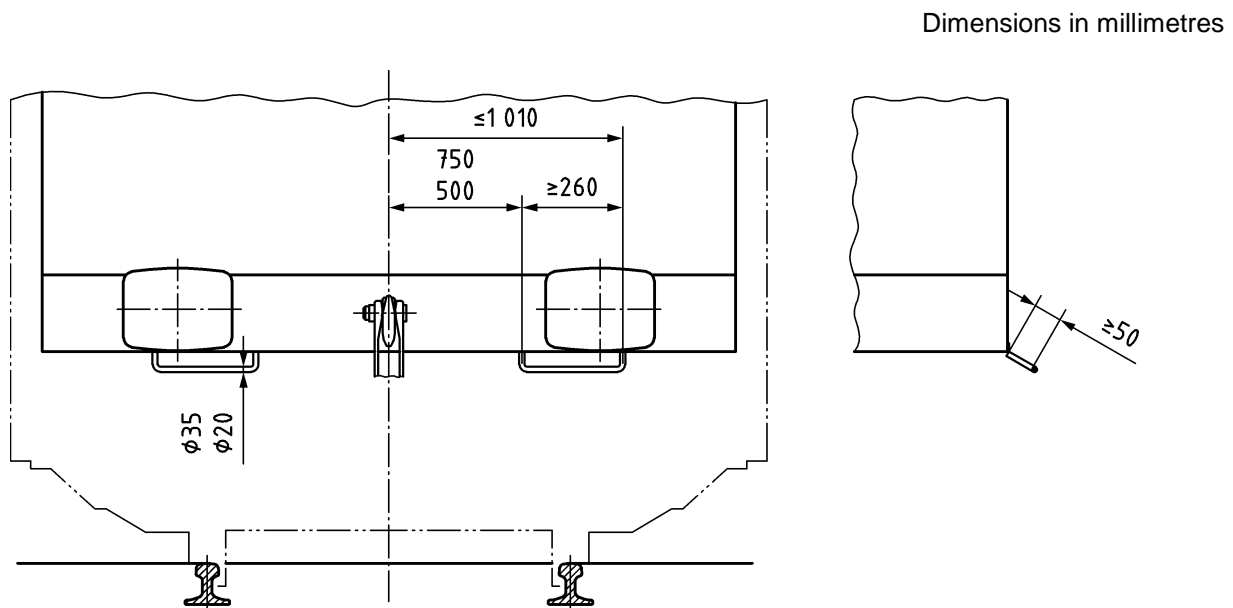


Figure 1 — Positions of shunter handrails

#### 5.4.2 Handrails corresponding to shunter's stand

The handrails corresponding to the shunter's stand are those of the general case in EN 16116-2.

These handrails shall be made of round bar steel with a minimum diameter of 20 mm or of steel tube with a minimum external diameter of 30 mm and a minimum wall thickness of 2 mm. The material strength shall be as a minimum that of EN 10025-2, grade S235. Such a design fulfils the load requirements of Clause 4.

Other materials for these handrails are permissible if they fulfil the strength requirements given in Clause 4.

#### 5.4.3 Handrails for steps at corners of shunting powered units

All steps as described in 5.3.2 shall be provided with handrails at both sides. They shall reach down to at least 1 200 mm above rail level and shall continue to a distance of at least 1 200 mm above the highest rung of the step.

These handrails shall have an external diameter of 25 mm to 35 mm.

The clearance around these handrails shall be at least 60 mm.

### 5.5 Transverse platform for shunting powered units

Access steps to the transverse platform shall be according to 5.3.2. The width of free space of the platform at guard rail level shall not be less than 500 mm, and at bottom level not be less than 400 mm.

The outside of the transverse platform shall be provided, over the whole frontal width of the powered unit, with a guard rail at least 1 100 mm high, designed with a view to safeguarding staff against falling on to the track. If the guard consists of a handrail and intermediate horizontal bars, the height of the lowest horizontal bar above the floor shall not exceed 350 mm and vertical distances between horizontal bars shall not exceed 500 mm. If the guard includes a bottom rail and an intermediate horizontal bar, the latter should be located equidistant between the bottom rail and the guard rail.

The surface of the platform shall be slip resistant according to Clause 4.

## 6 Reserved spaces

### 6.1 General

To ensure safe working conditions for the shunting staff it is necessary to define free spaces which are needed during coupling and uncoupling of screw couplings and for enabling temporary travel outside the vehicle for staff during shunting.

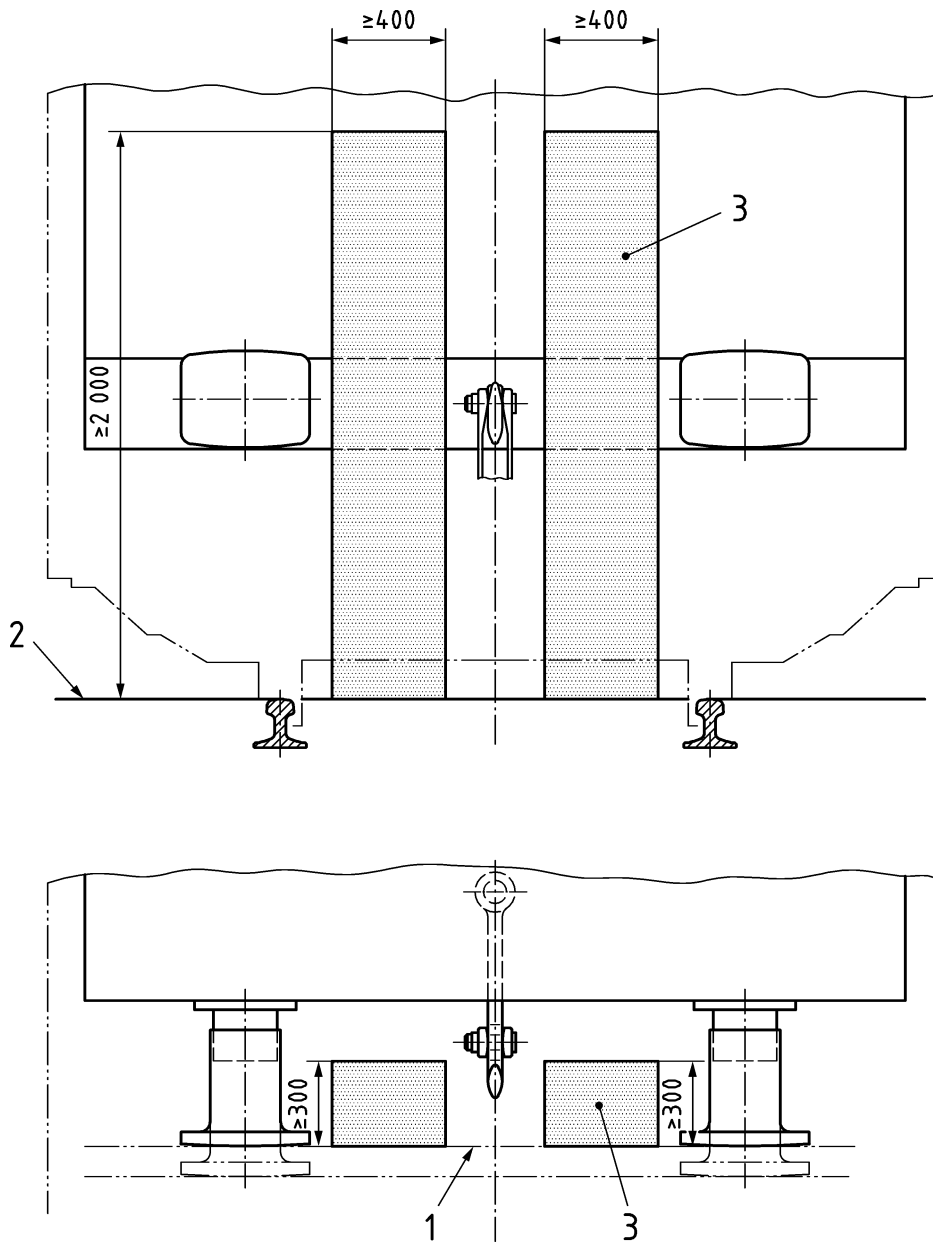
There are reserved/required free spaces to ensure safe and health for the shunting staff and required clearances for easy operation and coupling of screw couplings.

### 6.2 Space for shunting staff operation

#### 6.2.1 Space for shunter during coupling (Berne Rectangle)

Vehicles shall be designed so that staff are not exposed to undue risk during coupling and uncoupling. If screw couplers and side buffers are used, the required spaces shown in Figure 2 shall be free of fixed parts. For the assessment of this requirement the coupling gear components shall be lateral centrally positioned. Flexible connecting cables and flexible hoses as well as elastic deformable parts of gangways may be inside this space. There shall be no devices under the buffers that hinder the access to the space.

Dimensions in millimetres



**Key**

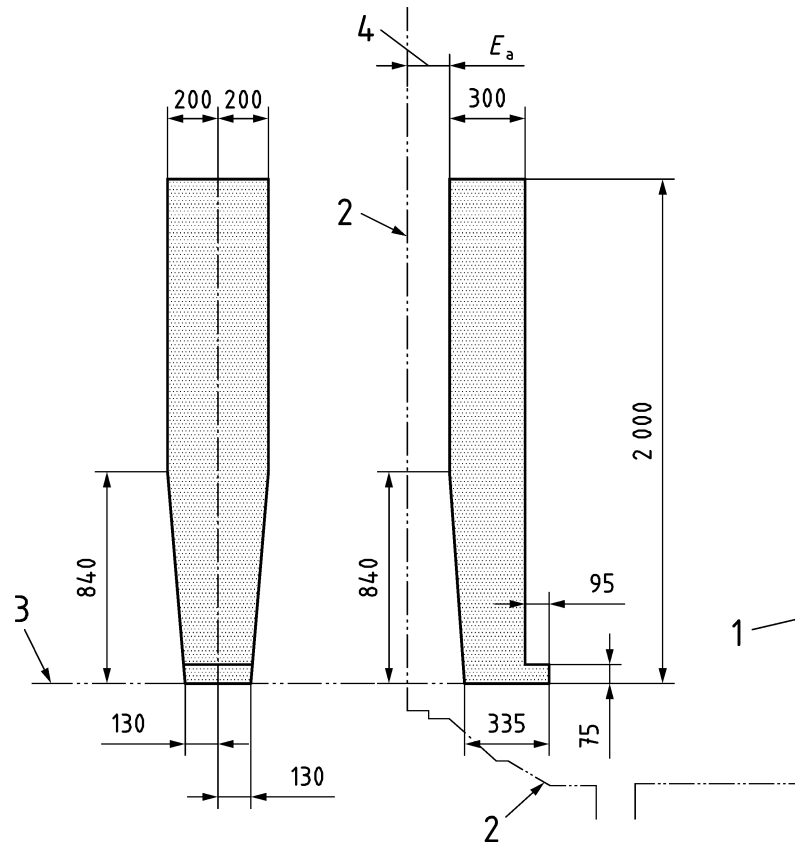
- 1 contact plane of fully compressed buffers
- 2 top of rail
- 3 space for shunter (Berne rectangle)

**Figure 2 — Required space for shunter during coupling and uncoupling**

**6.2.2 Space for the shunter during temporary travel**

Above the shunter's step the reserved space is defined in EN 16116-2. The free space specified in Figure 3 shall be maintained above the steps at the corners of shunting powered units used for temporary travel as described in 5.3.2.

Dimensions in millimetres



### Key

- 1 centre line of vehicle
- 2 kinematic gauge
- 3 step level
- 4 transverse reduction in relation to the kinematic gauge according to EN 15273-2 ( $E_a$ )

**Figure 3 — Required space above the steps at the corners of shunting powered units**

### 6.2.3 Clearance for draw hook

The clearance above the draw hook shall be of sufficient size to allow hooking of the D-shackle.

## 7 External access to vehicles with a driver's cab

### 7.1 General

The driver's cab shall be accessible directly or via any means from both sides of the train from 200 mm below top of rail.

The means for staff to access and egress from the cab, such as footsteps, handrails or opening handles, shall conform to this European Standard (see Figure 4).

The following requirements are applicable for external access, exclusively used by staff. For those cases, where staff have to use passenger entrance doors for cab access, relevant additional requirements to those defined for passenger doors in EN 14752 are given.

Rolling stock with external walkways as access to driver's cabs shall be equipped with a guard rail at least 1 100 mm high, a bottom rail and intermediate horizontal elements of arbitrary shape with a vertical opening of no more than 500 mm each. The walkway shall have a width at guard rail level of at least 500 mm.

The surface of the walkways shall be slip resistant according to Clause 4.

## **7.2 Steps**

The access steps shall be in the same vertical-plane or in a plane with a angle of pitch less than 90° (except where not possible due to different mounting conditions, for example, where some steps are bogie mounted and some are body mounted). The access steps shall be located one above the other and are equidistant from one another. The vertical distance between the steps is recommended to be between 250 mm and 350 mm but shall not exceed 450 mm. The bottom step shall be as low as permitted by the gauge and should not be higher than 600 mm above top of rail. A value higher than 600 mm shall be treated as an exception.

The steps shall be of the same width which shall be 300 mm as a minimum. The depth of the step shall be at least 80 mm. There shall be a free space over the step. The depth of this space shall be 150 mm as a minimum. The minimum height of the space over the step shall be 150 mm for shunting powered units, and should be 150 mm but shall not be less than 120 mm for other vehicle types. The height may decrease to 80 mm at a depth of 150 mm.

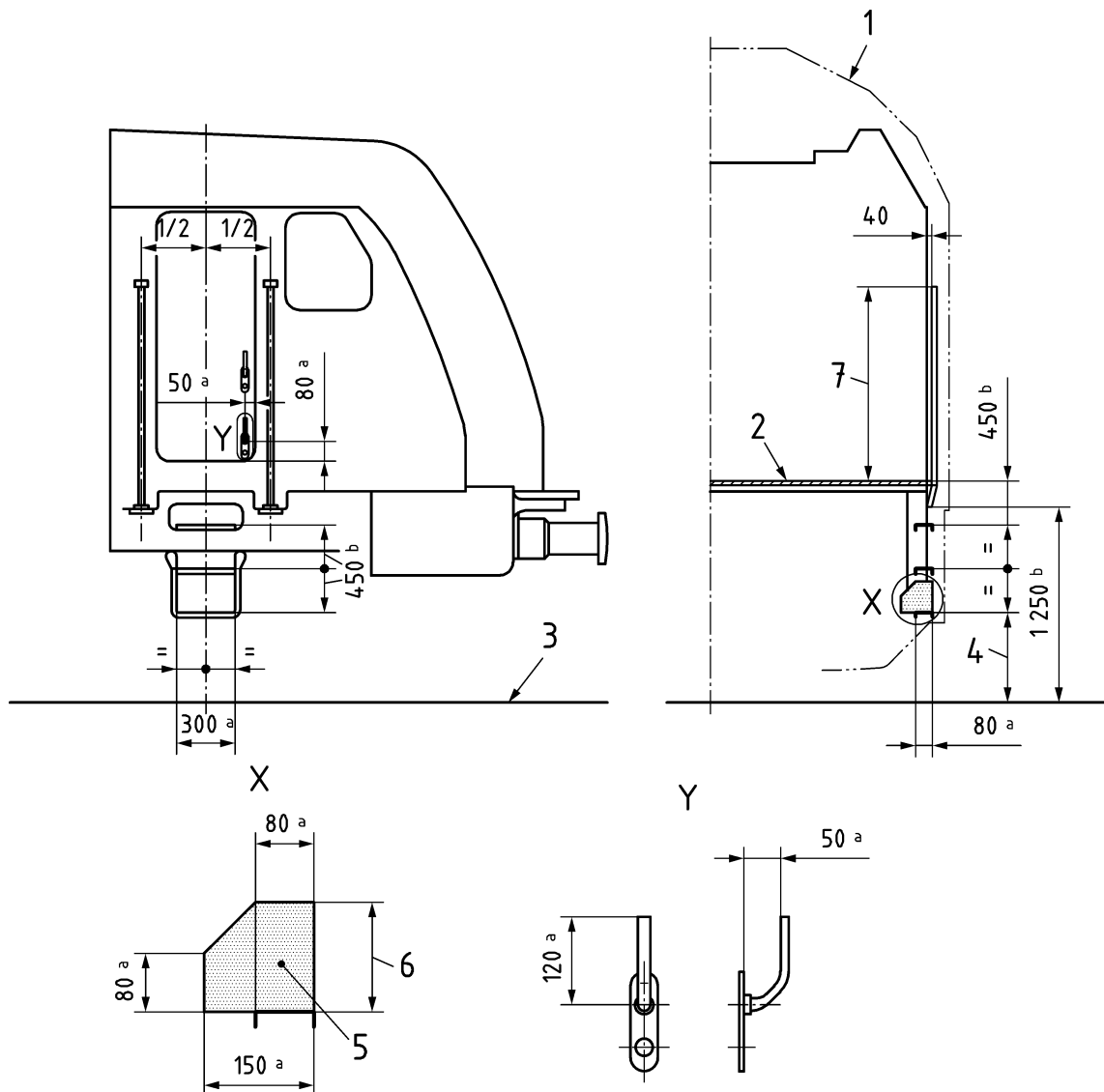
Figure 4 shows the dimensions for the steps.

The level of the access door does not have to comply with the requirements above.

The floor or any sealing frame at the access door need not be considered as a step but the height of the floor level above the adjacent step shall not be more than 450 mm and it is recommended that this height is equidistant to the other steps.



Dimensions in millimetres

**Key**

- 1 gauge as per EN 15273
- 2 compartment floor
- 3 top of rail
- 4 as small as the gauge allows
- 5 free space over the step
- 6 minimum 150 mm for shunting powered units, minimum 120 mm for other vehicle types
- 7 minimum 1 200 mm for shunting powered units, minimum 1 000 mm for other vehicle types
- a minimum value
- b maximum value

**Figure 4 — External access to driver's cab****7.3 Handrails and door handles**

A handrail shall be provided in all cases on each side of external doors and footsteps directly leading to drivers' cabs. The handrails shall be mounted solely at each end. The distance from the lower extremity of the handrail to top of rail should not be higher than 1 100 mm, but shall not exceed 1 250 mm. The distance from the top end of the handrail to the driver's cab floor level shall be 1 200 mm for shunting powered units and

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