BS EN 16116-2:2013

BSI Standards Publication

Railway applications — Design requirements for steps, handrails and associated access for staff

Part 2: Freight wagons

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National foreword

This British Standard is the UK implementation of EN 16116-2:2013.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Foreword

This document (EN 16116-2:2013) 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of an identical text or by endorsement, at the latest by March 2014, and conflicting national standards shall be withdrawn at the latest by March 2014.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.

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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.*

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Introduction

To achieve an undisturbed, reliable and safe operation of freight trains it is essential to define common requirements for safe access and egress for rolling stock of interoperable trains with respect to e.g. structural requirements, operating characteristics, way of operation, maintenance as well as their handling.

Coupling of freight wagons by means of screw couplings is usually done by personnel.

The design of freight wagons needs to be suitable to meet these functions without exposing staff to undue risk.

Freight wagons require sufficient space for their coupling and uncoupling by staff without any rigid features impeding accessibility to the screw coupler. Also there is a need for provision of suitable footsteps and handrails for personnel, to allow temporary travel outside the vehicle during shunting as well as to access the vehicle.

If wagons according to TSI-FW are equipped with steps and handholds, these needs apply to all designs of vehicle.

To achieve an undisturbed, reliable and safe operation it is therefore essential to harmonise the functional requirements and characteristic dimensions and assess and permanently ensure their suitability for interoperable traffic.

1 Scope

This European Standard specifies the minimum requirements for ergonomic and structural integrity of steps and handrails used together to give staff access to freight wagons. It does not cover ladders, top platforms and top gangways.

It defines in particular the required spaces necessary for handling of screw couplings with side buffers, for shunter handrails, for shunter's stand, for steps and handrails.

This European Standard also defines their dimensions, positions, limits for durability and functionality.

It also defines the general requirements for the access to tail lights for freight wagons.

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

EN 12561-7, *Railway applications — Tank wagons — Part 7: Platforms and ladders*

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

EN 15273-2, *Railway applications — Gauges — Part 2: Rolling stock gauge*

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 couples and uncouples vehicles or directs movements

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 wagon 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

4 Steps and handrails

4.1 General requirements

If not otherwise defined in this standard, steps and handrails used by staff shall be secured as follows:

— with bolts of adequate length and self-locking nuts, or

— with bolts of adequate length and cottered hexagon castlenuts, or

— with high-strength lock ring-bolts.

The mechanical strength of the material used for all kind of handrails and steps, where the properties according to 4.2.2 are not required, shall be as a minimum that of EN 10025-2, grade S235JR.

4.2 Steps

4.2.1 General

Steps shall be made with non-slip surface.

This should be a metal grating, see Figure 1, Pos. 1 or Pos. 2.

For all other solutions the following characteristics shall be fulfilled:

— **Resistance to friction**
The average value of the friction coefficient measured in three directions (lengthwise, breadthwise and diagonally) shall reach the following minimum values:

a) in dry condition = 0,65

b) in wet condition (water) = 0,65

c) in oiled condition = 0,30

Friction coefficient 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.

— **Mechanical strength**
Metal gratings shall withstand, without residual deformation, a horizontal compression force of at least 4 kN, exerted parallel and at right angles to the edge of the step board, and of at least 8 kN exerted diagonally in relation to the edge of the step board. Elastic deformations shall not exceed 10 mm.

— **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 with a minimum area of 400 mm^2 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.

4.2.2 Shunter's step

The material for the steps support shall be S355J2C + N in accordance with EN 10025-2.

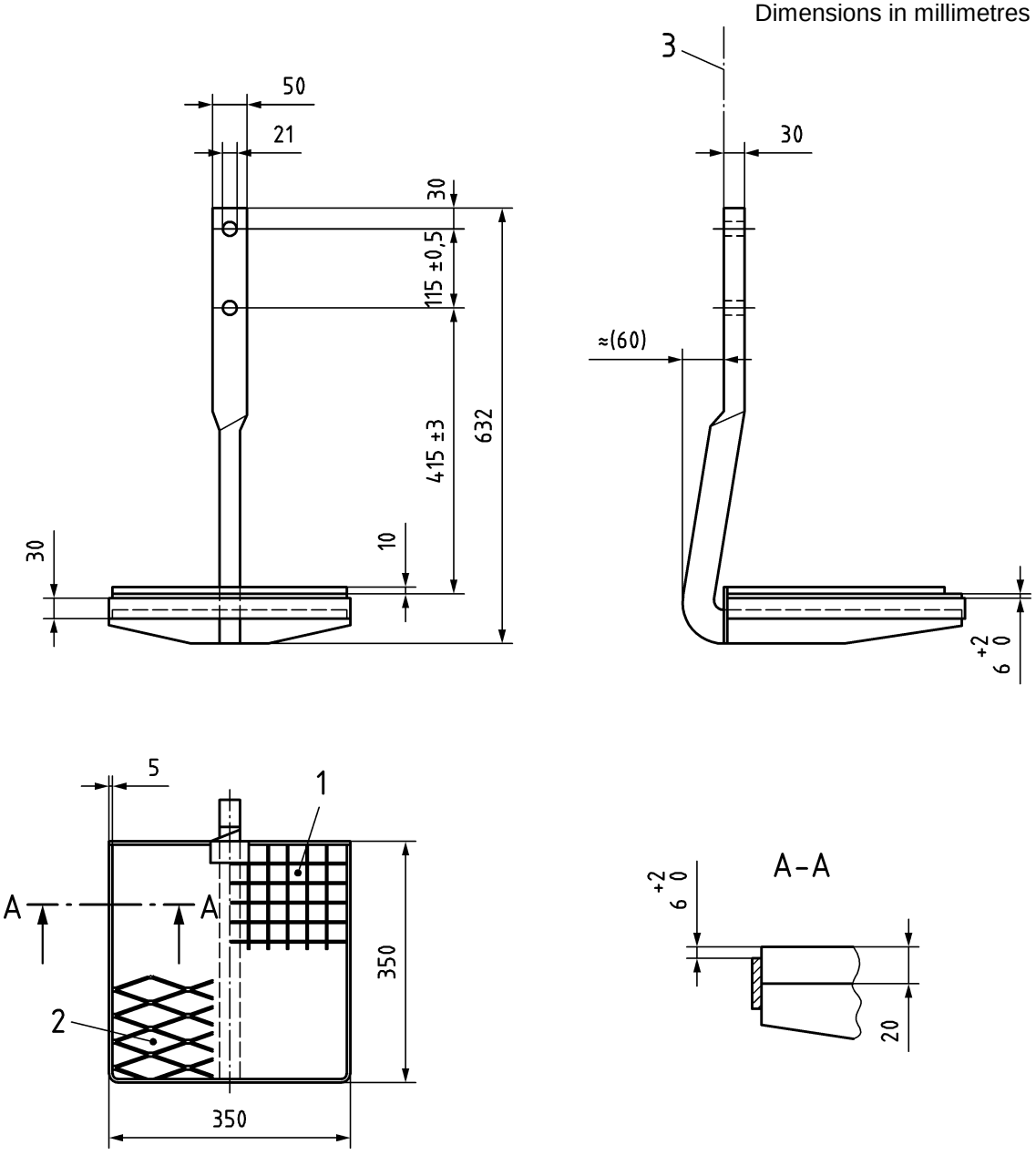
Cold forming for steps support is not allowed.

The shunter's step is shown in Figure 1. The grating according to Figure 1 is mandatory.

For specific operation the size of the step of the shunter’s stand can be reduced to 270 mm x 225 mm.

The surface protection (e.g. hot-galvanised) should provide an adequate service life.

Dimensions in millimetres

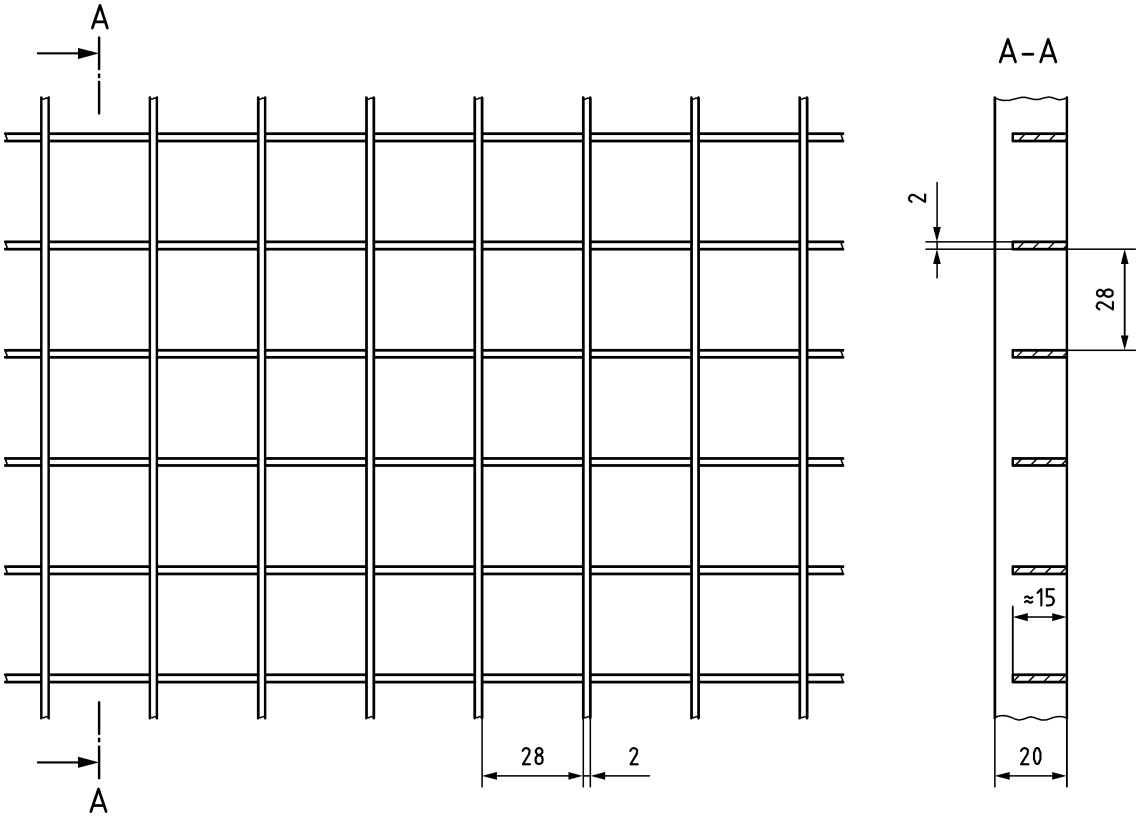


Key

1 grating from welded metal (Figure 2a)
2 grating from expanded metal (Figure 2b)
3 buffer fixing plane

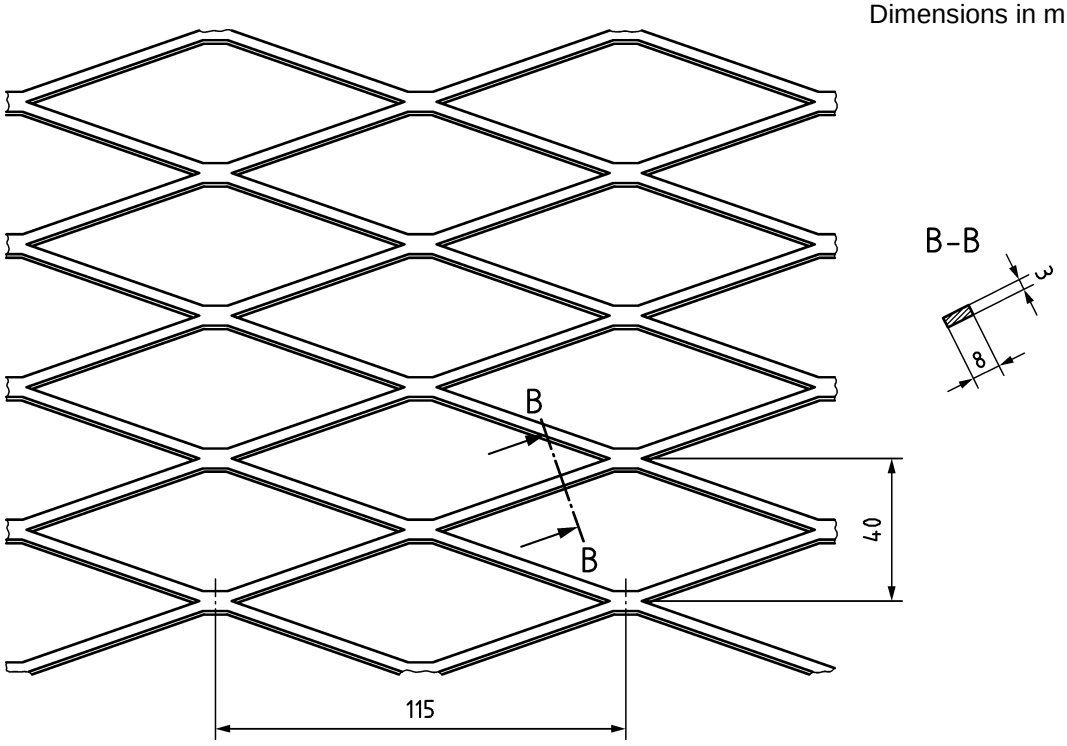
Figure 1 — Shunter's step

Dimensions in millimetres



a) Example for grating from welded metal

Dimensions in millimetres



b) Example for grating from expanded metal

Figure 2 — Examples for grating

4.2.3 Other steps

The other steps may be welded into place in accordance with EN 15085.

The minimum dimensions (length × width) of the surface shall be:

— crossing steps and steps for checking the load 175 mm × 175 mm;
When stirrup shaped steps are used for crossing steps at the wagon side they shall be 425 mm × 50 mm

— steps for platform or gangway 430 mm × 160 mm;

— steps for staff access to the wagon floor from both sides 500 mm × 110 mm;
When stirrup shaped steps are used they shall be 500 mm × 50 mm

— stirrup shaped steps and steps with a width < 160 mm, the friction resistance has to be in accordance with 4.2.1 and the clearance behind the steps including the width of the step shall be in accordance with EN 12561-7.

The minimum distance in vertical direction at steps for platforms and gangways (example in B.1) shall be:

— If there are more than one step, the vertical distance between the steps and platform shall not be less than 360 mm and not more than 400 mm. An equal distance of 365 mm should be preferred.

— The lateral recess between the second and the lowest step shall be 80 mm.

4.3 Handrails

4.3.1 General

If there are no deviating indications in the drawings, the handrails shall be made from round-bar steel with minimum diameter of 20 mm or pipe steel. The maximum diameter shall be 35 mm.

The handrails shall withstand the loads applied by the shunters accessing the steps or the space between the buffers.

When using round-bar steel and material specifications, fixing requirements and dimensions given in this standard it is proven that these loads are sustained. Otherwise it shall be demonstrated by analyses or tests that the handrail is capable of withstanding a force of 1,5 kN applied at any point over its length at any direction without causing permanent deformation in it. When demonstrated by tests, permanent deformations on first loading shall not be considered.

All measurements related to the positions of the handrails are referring to the centrelines of the handrails. Clearances are measured from the surfaces of the handrails.

The clearance between the handrails and any part of the wagon shall be at least 120 mm.

In order to comply with the kinematic gauge the position of the handrails can be adjusted in exceptional cases.

4.3.2 Shunter handrail

Wagons shall be equipped with two shunter handrails at each headstock under the buffers.

The clearance between the handrails and any part of the wagon can be reduced to 100 mm. The minimum dimensions and the positions for the shunter handrail are defined in Figure 3 and Figure 4.

Dimensions in millimetres

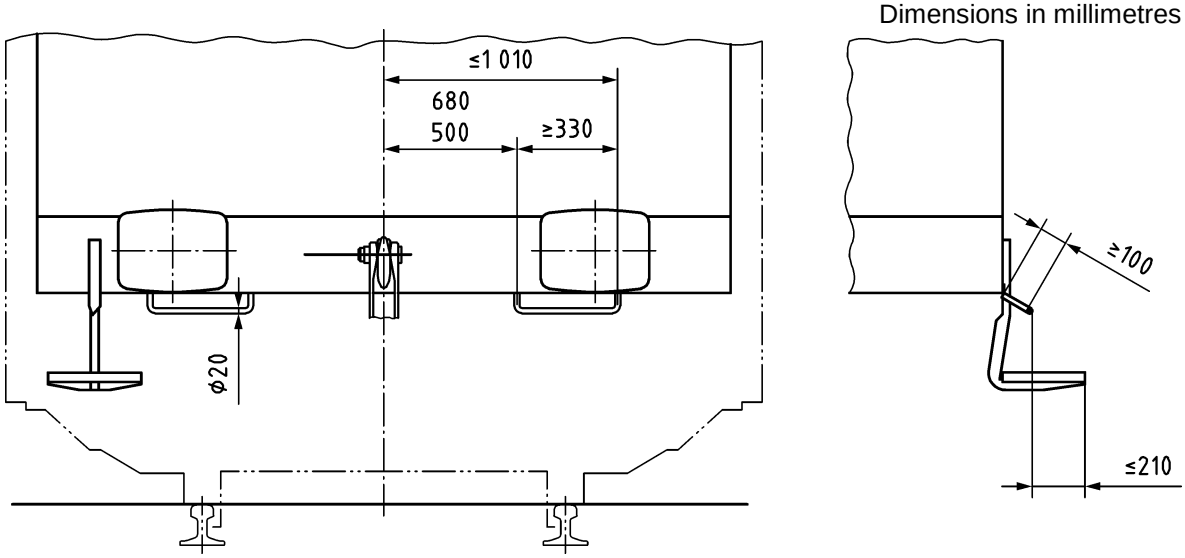
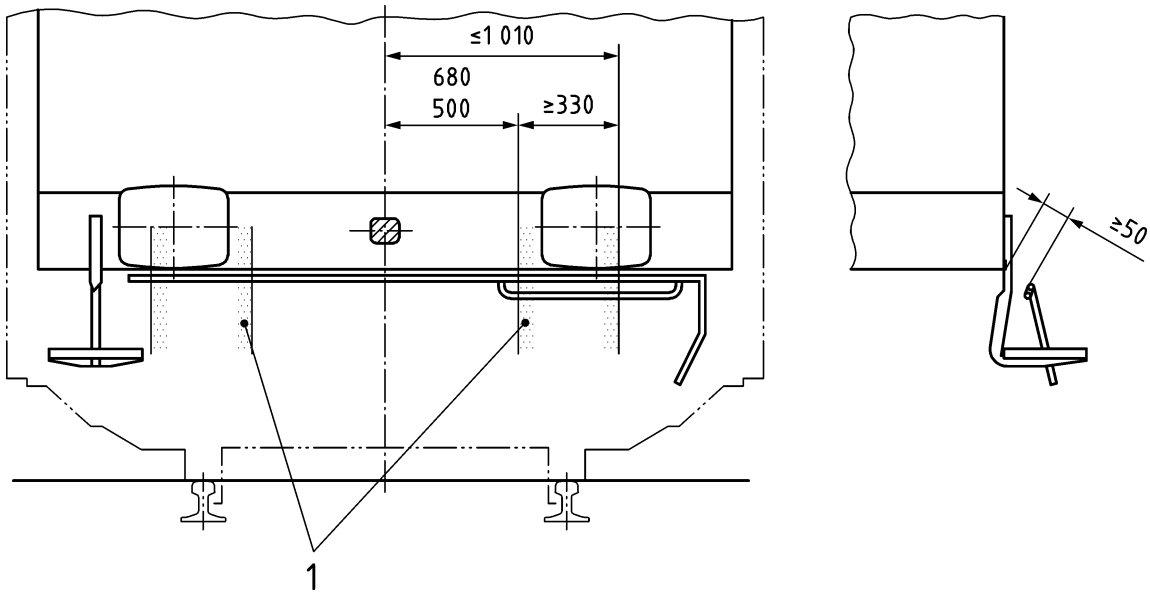


Figure 3 — Positions of shunter handrails

Dimensions in millimetres



Key

1 area which may be used by the shunter in the case of a wagon fitted with an automatic coupler

Figure 4 — Position of shunter handrail when using automatic coupler together with side buffers

4.3.3 Other handrails

Other handrails may be welded into place in accordance with EN 15085.

5 Shunter's stand

5.1 General

Each wagon end (headstock) shall be equipped with a left-end positioned shunter's stand, which is placed on the left side of the headstock when seen by an observer standing in the centre-line of the track facing the headstock.

Where a wagon end is equipped with a gangway according to Annex B, a shunter’s stand is not required.

Each shunter's stand includes a step defined in 4.2.2 and a minimum of one handrail.

This handrail shall be made from pipe steel with a diameter of (30 +5/0) mm, with a minimum wall thickness of 2 mm and a minimum clearance of 230 mm.

A second handrail shall be provided for safe access to the shunter’s stand. An example is given in Figure 5, Pos. 7. Such a handrail is not needed for the designs according to 5.2 and 5.3.

The rear edge of the shunter's step shall lie in the buffer vertical fixing plane.

The fixing of the shunter's stand (step and handrail) to the carbody shall be by means that permit removable mounting for maintenance purposes; welding is not acceptable.

The position and the dimensions required for the handrails and the position for the step are defined in Figure 5.

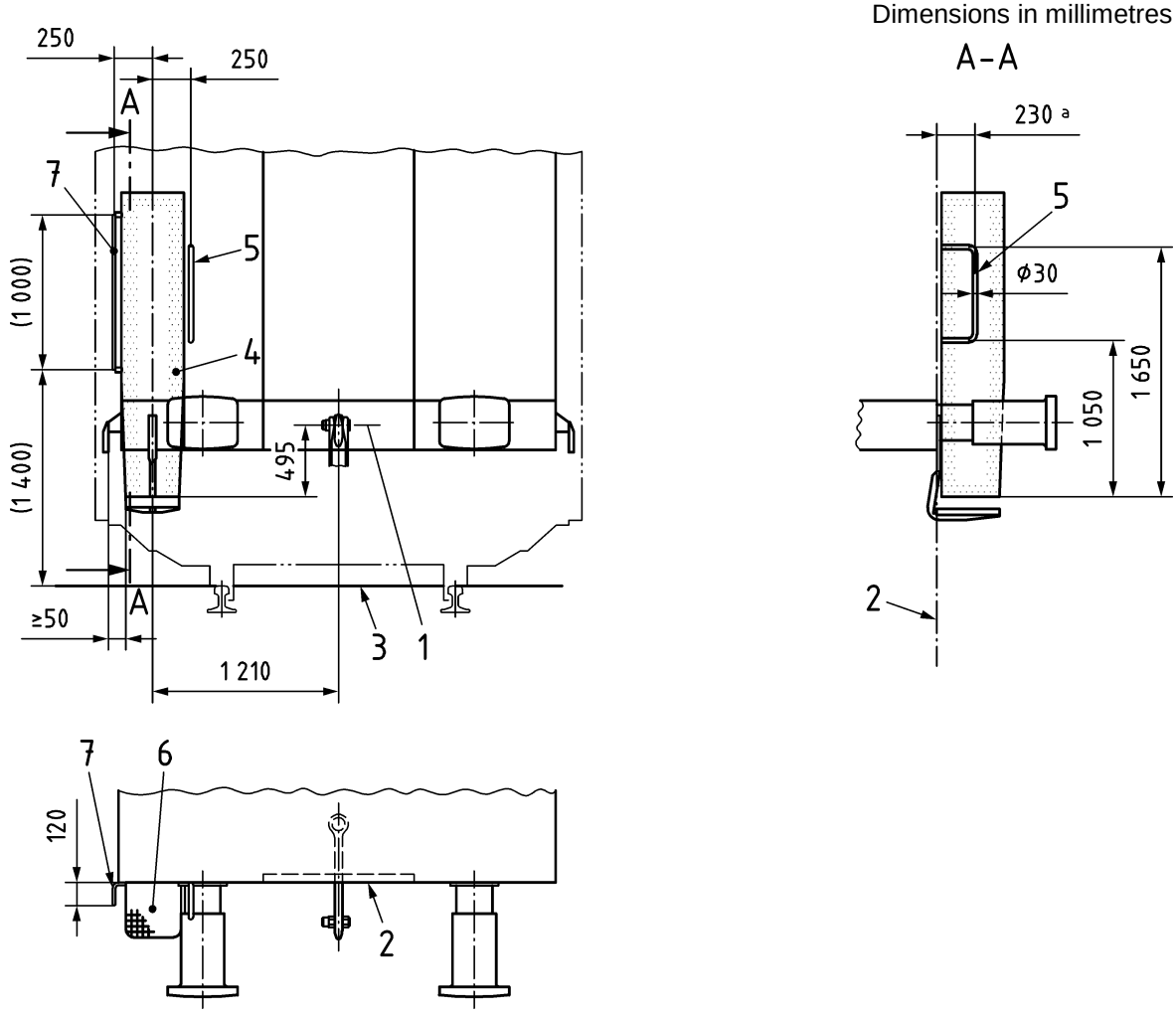
Exceptions to this are defined in Figure 6 and Figure 7.

NOTE Figures 5, 6 and 7 regarding handrails are dimensions from the symmetric axles of the handrails.

The fixing of the handrails depends on the individual design of the under frame or superstructure.

In exceptional cases (e.g. particular gauges), and in order to comply with the reserved space stated in 6.2.2, as long as the kinematic gauge is respected, the shunter’s stand can be adjusted in the horizontal direction. Only if this method is not successful, a vertical adjustment of the shunter's stand could be accepted, but no more than permitted by the kinematic gauge. The vertical position shall not be less than 480 mm instead of 495 mm (see Figure 6, Footnote 1) from coupling centre line.

Dimensions in millimetres



Key

1 coupling centre line
2 buffer fixing plane
3 top of rail
4 reserved spaces as per Figure 9
5 handrail
6 step
7 handrail corner upright

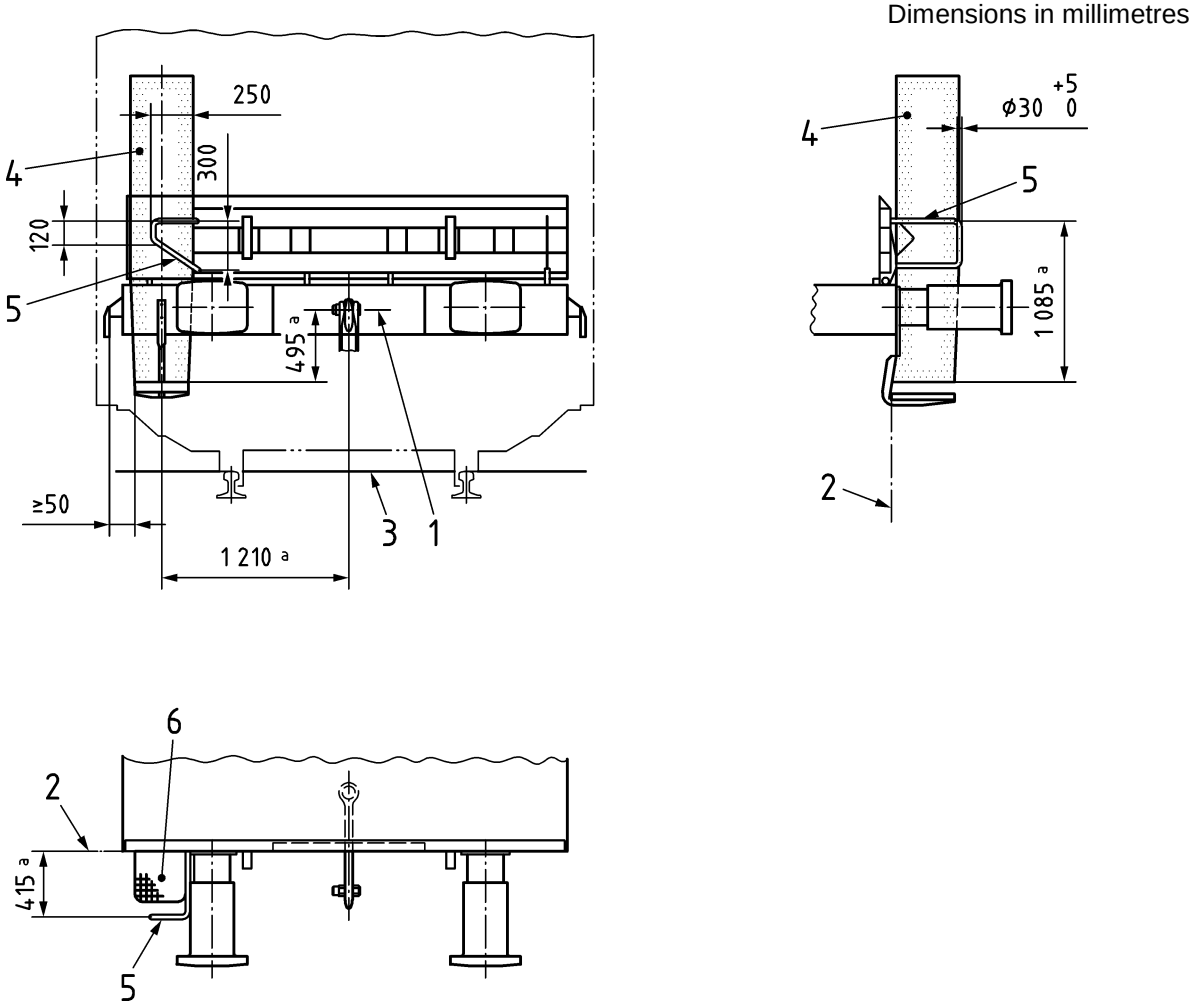
[a] If for wagon design reasons, component parts extend into the reserved space up to max. 80 mm (or 95 mm in relation to the buffer fixing plane), this dimension shall be increased according to the dimensions of the corresponding components.

Figure 5 — Shunter's stand

5.2 Shunter's stand at wagons with end wall boards

The positions for the handrails and the step for the shunter's stand are defined in Figure 6.

Dimensions in millimetres



Key

1 coupling centre line
2 buffer fixing plane
3 top of rail
4 reserved space as per Figure 9
5 handrail
6 step

[a] These measurements have to be adjusted in order to avoid interferences between buffer and handrail when the moveable end wall board is in the horizontal position.

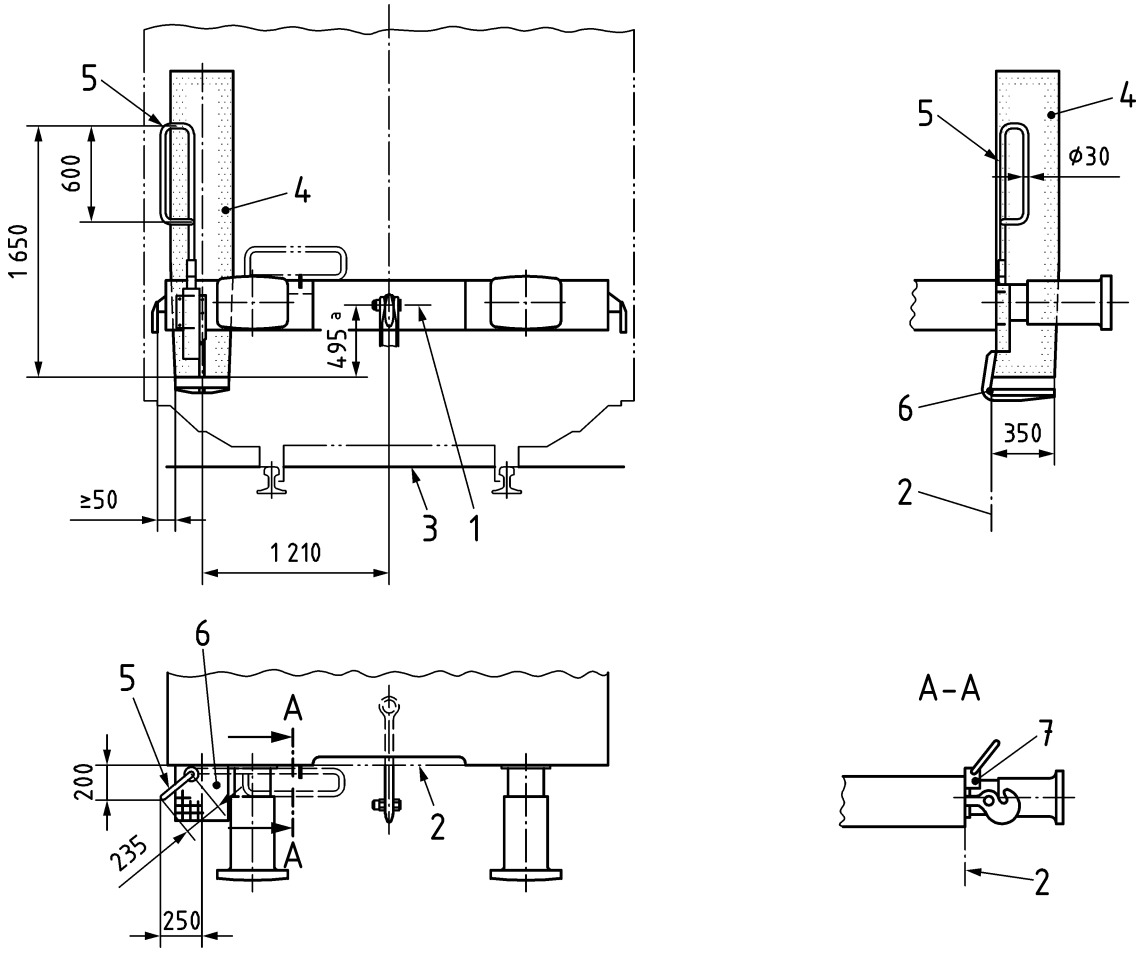
Figure 6 — Shunter's stand at wagons with end wall boards

5.3 Shunter's stand with tilting handrail

In the case when the common shunter's stand is not appropriate, e.g. at wagons without superstructure or at wagons where the loading area starts at a distance less than 800 mm from the buffer fixing plane, a shunter's stand with a tilting handrail, as described below, shall be provided.

The positions for the handrails and the step for the shunter's stand at wagons without superstructure are defined in Figure 7.

Dimensions in millimetres



Key

1 coupling centre line
2 buffer fixing plane
3 top of rail
4 reserved space as per Figure 9
5 handrail
6 step
7 rest position bracket

[a] If the centre line of a coupler is lower than 1 040 mm this distance has to be reduced so that the step remains at the same level as the common shunter's stand.

Figure 7 — Shunter's stand with tilting handrail

The requirements are:

— The handrail shall be tilted when a force exceeding 800 N applies at the top end and it shall be possible to revert it into the original position.

— It shall also be capable of being tipped in the lateral direction to the centreline of the wagon in a rest position.
Therefore it is required to have a locking device to avoid an unintentional tipping and it is recommended to have a support for placing the handrail in the horizontal rest position (see Figure 7).

— The handrail shall be fitted with a device to prevent rotation of the handrail around its vertical centre line (in vertical and horizontal position). This device shall not avoid tilting of the handrail as described above.

5.4 Shunter's stand for special case flat wagons with fixed handrails

For special cases, where the common shunter's stand is not appropriate, an example is shown at Annex B, Figure B.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, for taillight access and for temporary travel outside the vehicle for staff during shunting.

There are reserved/required free spaces to ensure health and safety of the shunting staff and required clearances for easy operation and access for tail light exchange and coupling of screw couplings.

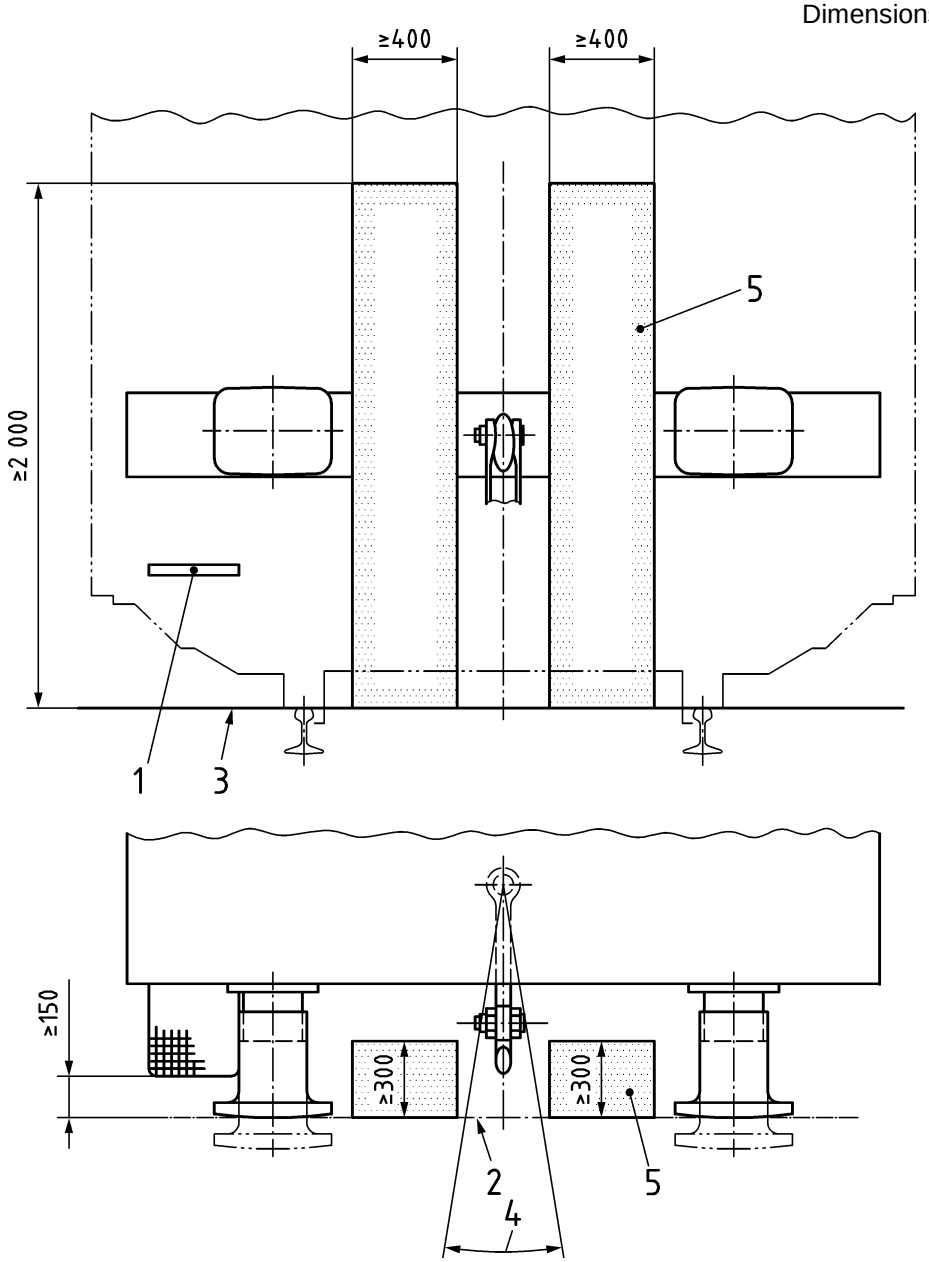
6.2 Space for shunting staff operation

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 8 shall be free of fixed parts.

Flexible connecting cables and flexible hoses may be inside this space. With exception of the shunter handrails (see 4.3.2) there shall be no devices under the buffers that hinder the access to the space.

Dimensions in millimetres



Key

1 end step (only left-end step is required) according to Figure 1
2 contact plane of fully compressed buffers
3 top of rail
4 lateral movement of coupling at coupled wagons (see Figure A.1)
5 space for shunter (Berne rectangle)

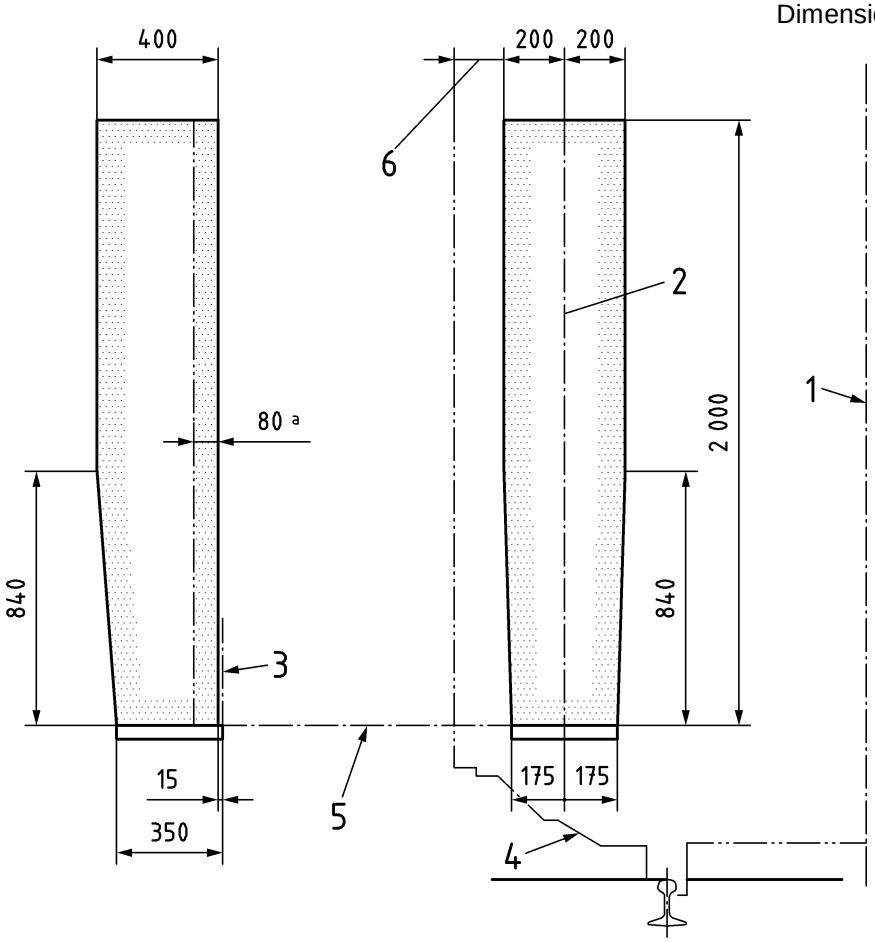
Figure 8 — Required space for shunter during coupling and uncoupling (screw couplings)

6.2.2 Space for the shunter during temporary travel

The reserved space above the shunter step, as defined in Figure 9 shall be maintained, with the exception of the handrail position specified in Figure 6 and Figure 7.

The free space specified in Figure 10 shall be maintained above all steps and the top access steps of the end platforms and crossing gangways.

Dimensions in millimetres



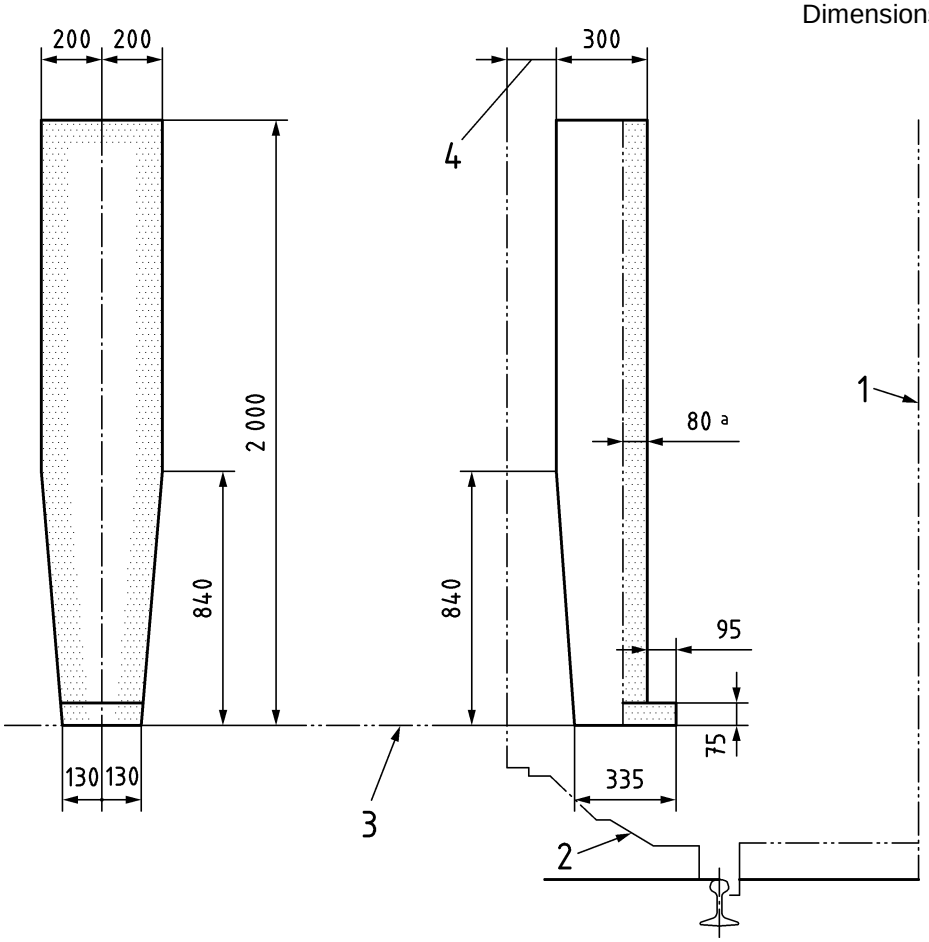
Key

1 centre line of wagon
2 centre line of left end step
3 buffer fixing plane
4 kinematic gauge
5 step level
6 transverse reduction in relation to the kinematic gauge according to EN 15273-2

[a] In the event of design problems, component parts such as the closing and locking devices of sliding walls may exceptionally infringe this space. These components shall nonetheless be placed parallel to the end wall and have no projecting parts liable to cause injury.

Figure 9 — Required space above left end step

Dimensions in millimetres



Key

1 centre line of wagon
2 kinematic gauge
3 step level
4 transverse reduction according to EN 15273-2

[a] In the event of design problems, component parts such as the closing and locking devices of sliding walls may exceptionally infringe this space. These components shall nonetheless be placed parallel to the end wall and have no projecting parts liable to cause injury.

Figure 10 — Required space above the top access step of the platforms and gangways

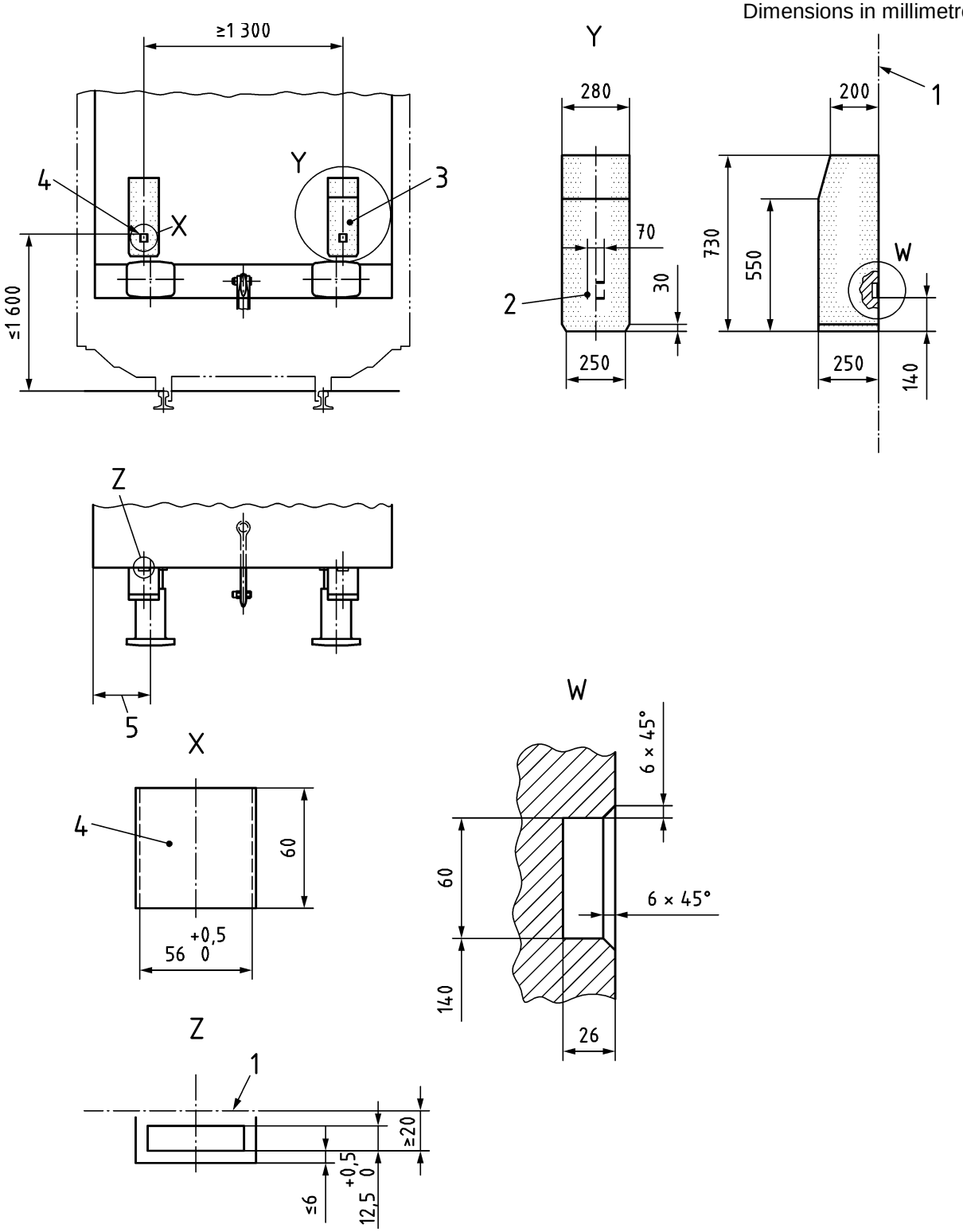
6.3 Clearances for tail light and draw hook

6.3.1 Position, space envelope and clearance for the tail light

The tail lamp brackets shall be located in such a position that the lamp, when fitted, is not obscured and is easily accessible. Where the end of a wagon carries a device for mounting a taillight, steps and handrails shall be provided where necessary to enable easy access.

The required clearance for tail light access is defined in Figure 11.

Dimensions in millimetres



Key

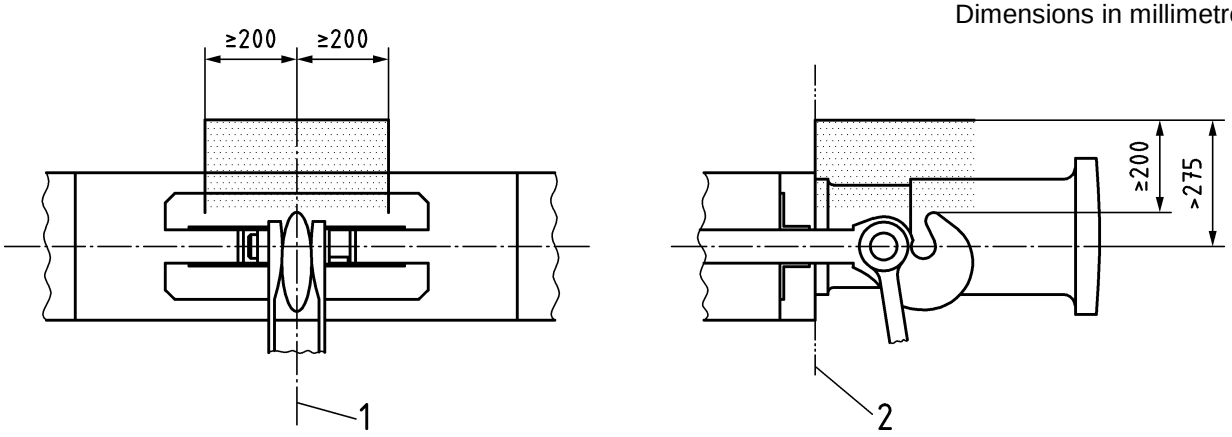
1 outside of wagon end wall or bracket fixing plane
2 clearance for tail light bracket
3 clearance for tail light
4 tail light bracket
5 preferred place for tail light position

Figure 11 — Required dimensions and clearance for tail light brackets and access

6.3.2 Clearance for draw hook

The required clearance at the draw hook for easy access is shown in Figure 12.

Dimensions in millimetres



Key

1 centre line of wagon
2 buffer fixing plane

Figure 12 — Required clearance above draw hook

Annex A
(normative)

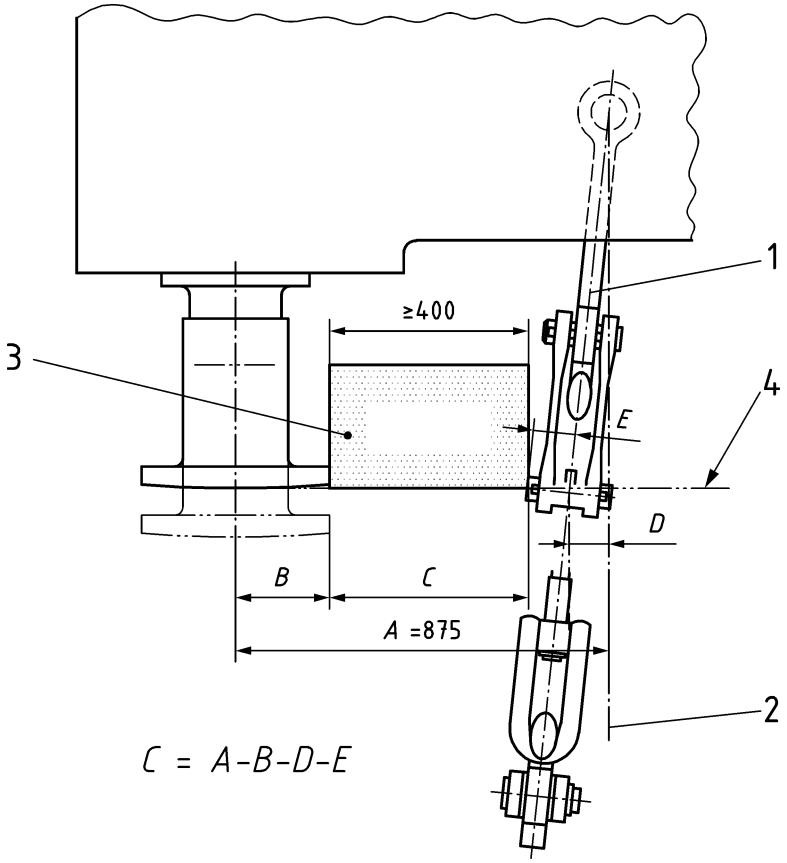
Calculation of space for shunter (Berne Rectangle) in curves when using screw couplings

The minimum required spaces, as defined in 6.2.1, shall be complied with on the following condition:

— position of the deflected screw coupling, coupled with a reference wagon (Type Res/Rs), in a curve with a radius of 150 m as calculated below;

— the width of “C” ≥ 400 mm.

Dimensions in millimetres



Key

1 centre line of coupling
2 centre line of wagon
3 space for shunter (see Figure 8)
4 contact plane of fully compressed buffers

A half-distance between buffers
B half-width of buffer-head plate
C width of space for shunter
D lateral deflection of coupling in a curve R 150 m
E semi-width of coupling in centre position

Figure A.1 — Space for shunter in curves (screw couplings)

$$D = \frac{2\left(an + n^2\right) - a\left(n-1\right) - n\left(n-2\right)}{600} - 0{,}04 \qquad \text{(A.1)}$$

where

D is the lateral deflection of coupling centre line in buffer-head plane when buffer is fully compressed, in mm;

a is the distance between axles or bogie centres on the wagon being examined, in m;

n is the distance between axle or bogie centre and buffer-head of wagon being examined, in m.

Annex B
(informative)

Gangways and other access solutions

B.1 General

The information provided in this annex gives typical historical solutions for these requirements. If these solutions are to be adopted, then the mandatory elements defined shall be respected.

B.2 Steps for gangways and platforms

The construction and position of the gangways shall be as specified like the example in Figure B.1.

To facilitate climbing onto the gangway, the following items shall be fitted on both sides of the wagon:

— two steps (160 × 430 mm) long. The lower step shall be set at a height of 425 mm below the horizontal plane running through the centreline of the automatic coupler;

— a vertical handrail, fitted to each corner upright;

— a vertical part of the railing shaped like a handrail.

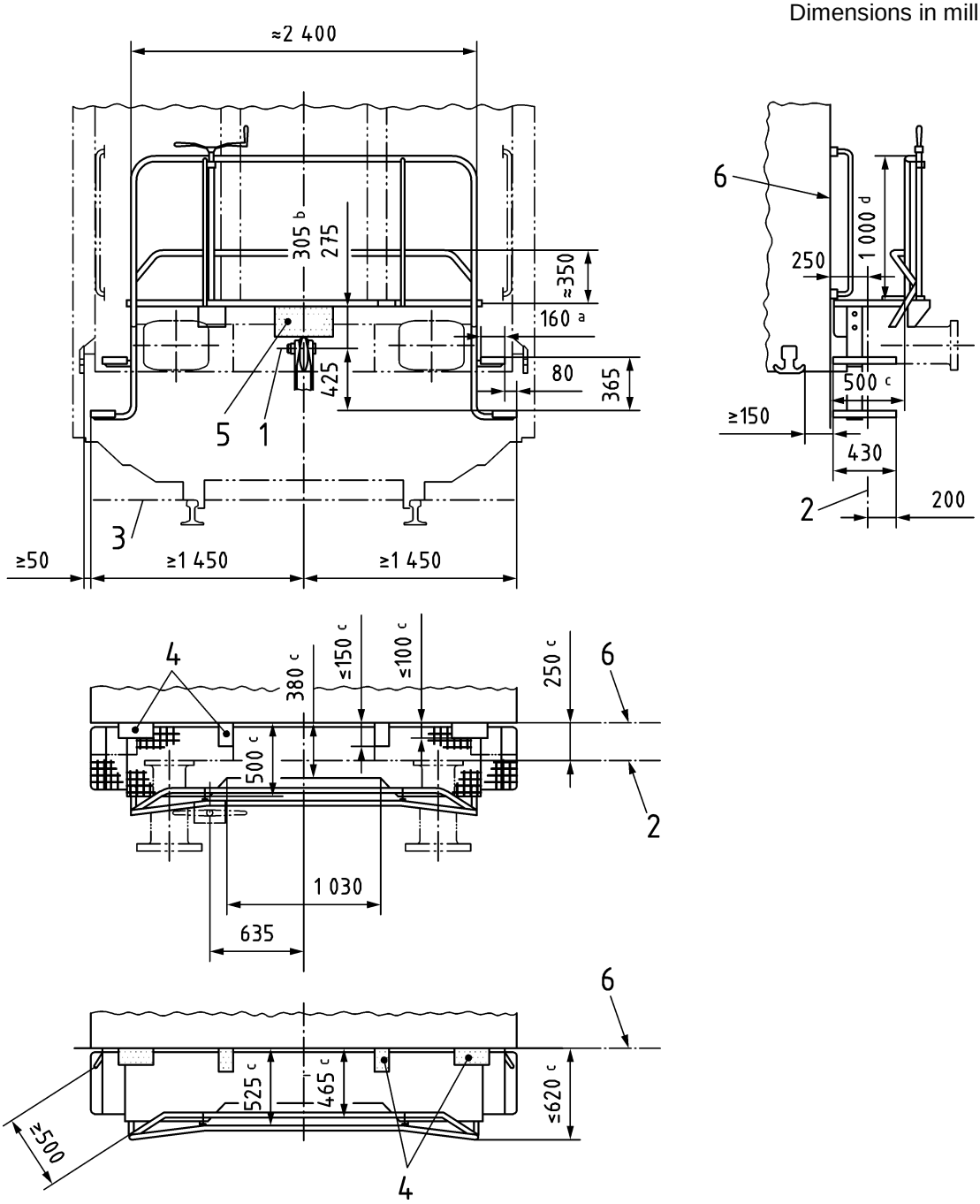
It shall be possible for the shunter/shunting locomotive driver to remain on the top steps while the vehicle is moving. To allow this, clearance shall be maintained over the top steps as specified in Figure 10.

The treads of the steps and the floor of the gangway shall be made of non-slip metal gratings as specified in 4.2.1.

The gangway shall be equipped with a gangway handrail providing a secure hand-hold for the shunter/shunting locomotive driver, even while the vehicle is moving. An intermediate rail at knee height shall be provided to prevent the shunter from falling off. The ends of these intermediate rails shall be fashioned in such a way as to form a guide to the steps.

For traffic to UK, as long as the kinematic gauge is respected, the lower steps can be adjusted in the horizontal direction. Only if this method is not successful, a vertical adjustment of the lower steps could be accepted, but no more than permitted by the kinematic gauge.

Dimensions in millimetres



Key

1 coupling centre line
2 buffer fixing plane
3 top of rail
4 space for exceptional infringement by components, closing and locking devices or superstructure
5 clearance for draw hook
6 reference plane

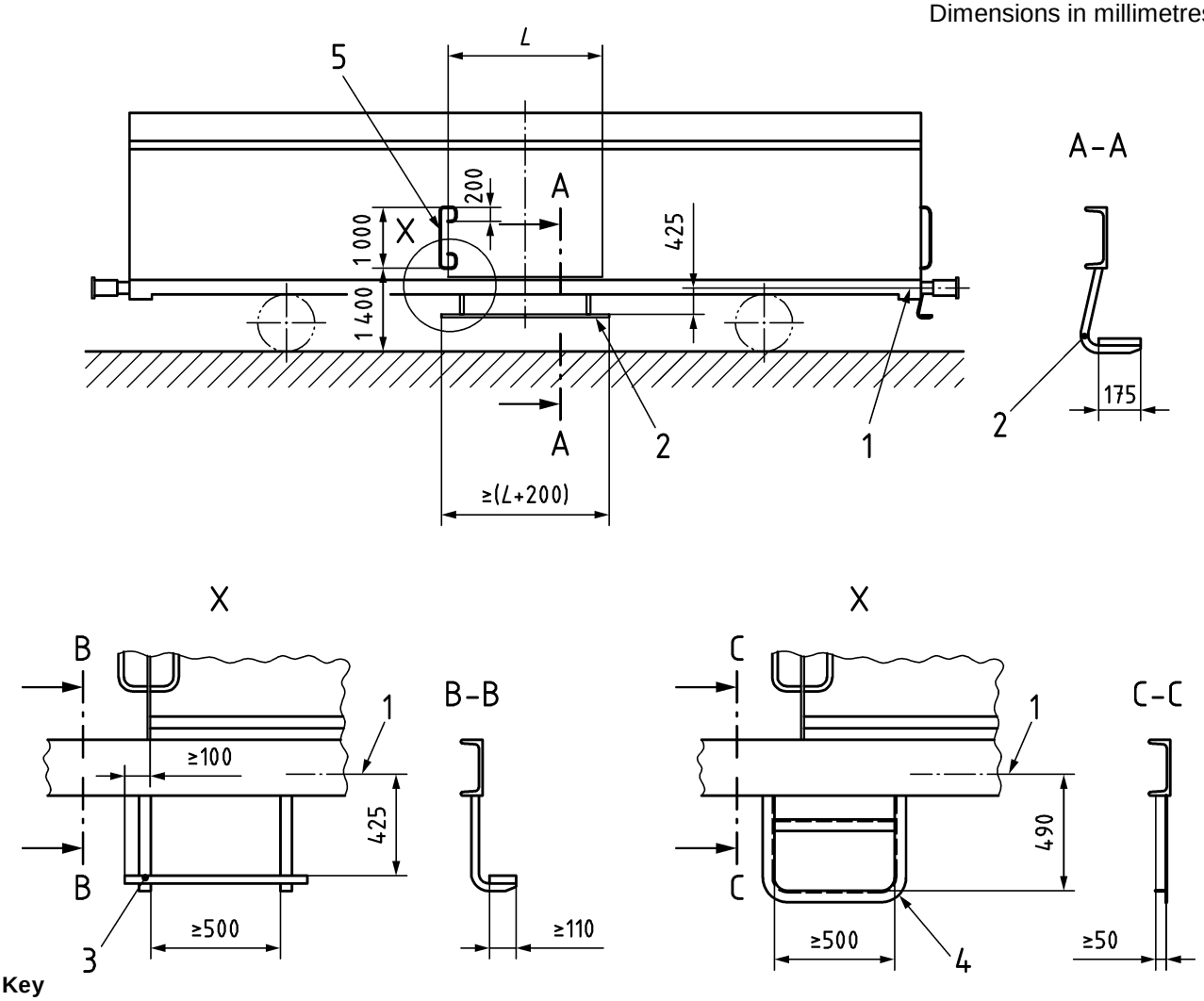
[a] step width
[b] min. dimension for clearance of draw hook - see 6.3.2
[c] distances from reference plane 6
[d] the height of the guard rail of 1 000 mm may be increased for operational reasons

Figure B.1 — Example for gangway

B.3 Steps for access to the wagon floor

The minimum vertical distance of the lower step to the centreline of the automatic coupling shall be 425 mm for platform and gangway, and 450 mm for all other steps.

Dimensions in millimetres



Key

1 coupling centre line
2 step arrangement 1
3 step arrangement 2
4 step arrangement 3 (stirrup-shaped step)
5 handrails at side wall and doors

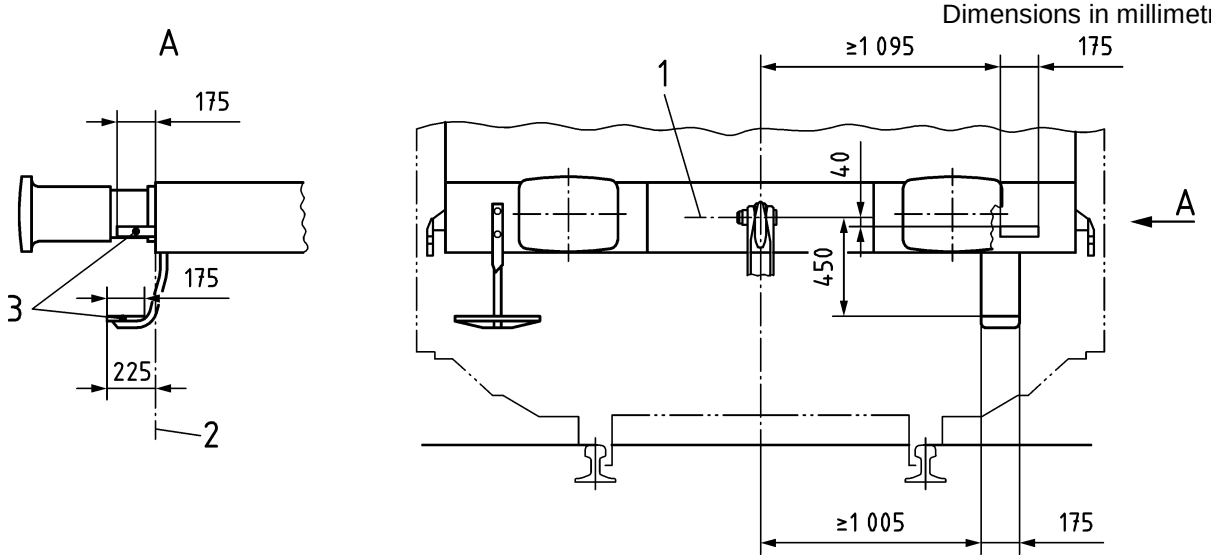
Figure B.2 — Examples for other steps

B.4 Steps at wagon end

If there are provisions for a crossing facility with steps at one end of the wagon, then this end shall, as specified in 5.1, be equipped not only with the left end step but also with:

a right-hand crossing step 175 mm long, 175 mm wide and set at a height of 450 mm below the horizontal plane through the centre line of the coupling. The rear edge of this step shall be 50 mm in front of the headstock plane.

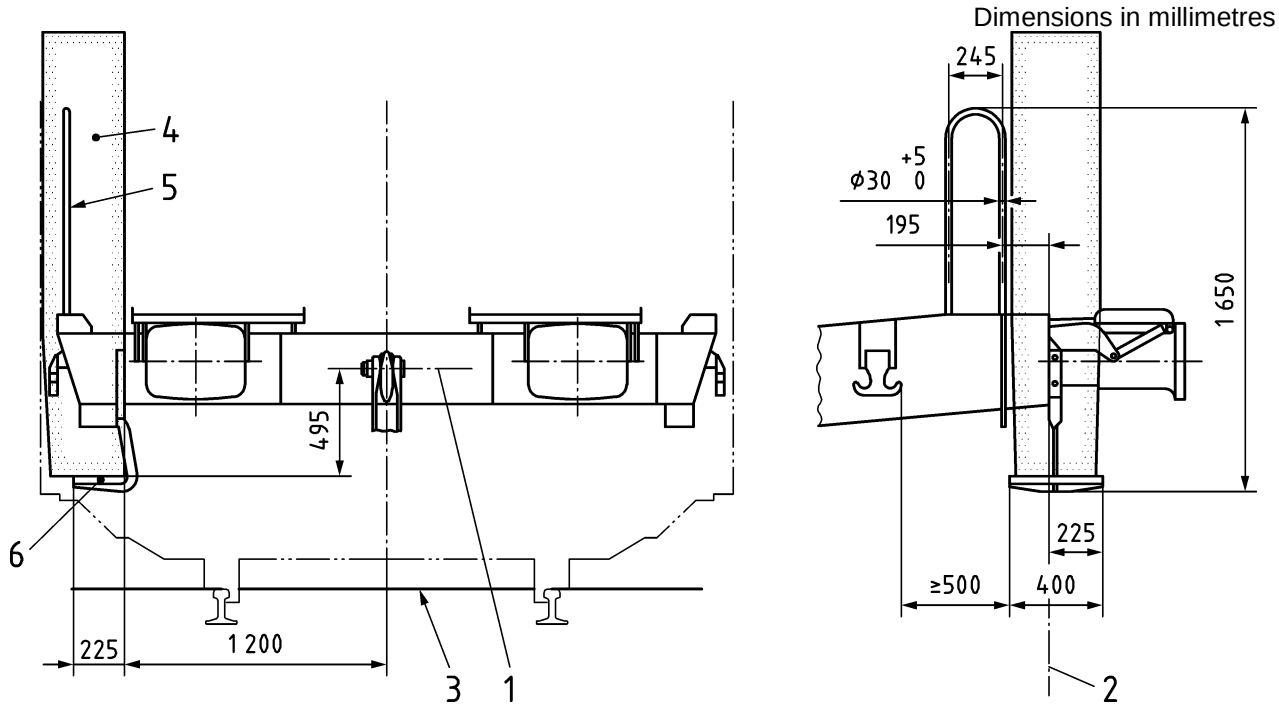
Dimensions in millimetres



Key

1 coupling centre line
2 buffer fixing plane
3 steps for crossing or for staff to climb to the wagon floor

Figure B.3 — Example for steps at wagon end



Key

1 coupling centre line
2 buffer fixing plane
3 top of rail
4 reserved spaces as per Figure 9
5 handrail
6 step

Figure B.4 — Example for shunter's stand at car carrier flat wagon

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/CENELEC/ETSI 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 CR Freight Wagons 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.

[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.1 – Correspondence between this European Standard, the CR TSI RST Freight Wagons dated July 2006, published in the OJEU on 8 December 2006 and its intermediate revision published in the OJEU on 12 April 2013 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
The whole standard is applicable	4.Characterisation of the subsystem 4.2. Functional and technical specifications of the subsystem 4.2.2. Structures and mechanical parts 4.2.2.1. Mechanical Interface §4.2.2.1.1. End coupling 4.2.6 System protection §4.2.6.3 Attachment devices for rear-end signal Annex C Additional optional conditions §C.1 Manual coupling system §C.2 UIC footsteps and handrails	Annex III, Essential requirements 1 General requirements 1.1 Safety 1.1.1, 1.1.3, 1.1.5 1.2 Reliability and availability 1.5. Technical compatibility	Clauses 4.2.6.3 of the TSI, Clauses C.1 and C.2 of the annex C of the TSI mandate ERA/TD/2012-04/INT version 1.0 of 04.06.2012. The requirements of this ERA/TD are in the following subclauses of the EN: • 6.3.1 • 6.2, 6.3.2 • 4.2, 4.3.5, 6.2.2

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

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