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Railway applications — Re-railing and recovery requirements for railway vehicles

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National foreword

This British Standard is the UK implementation of EN 16404:2016. It supersedes BS EN 16404:2014 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RAE/3/-/10, Railway applications - Vehicle lifting.

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

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Applications ferroviaires - Exigences relatives au réenraillement et au rétablissement de véhicules ferroviaires

Bahnanwendungen - Anforderungen für das Aufgleisen und Bergen von Schienenfahrzeugen

This European Standard was approved by CEN on 22 November 2015.

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European foreword

This document (EN 16404:2016) 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of an identical text or by endorsement, at the latest by July 2016, and conflicting national standards shall be withdrawn at the latest by July 2016.

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 16404:2014.

The main changes from the previous edition are listed below:

— clarification of the use of re-railing beams and/or support points;

— clarification of jacking equipment clearances;

— additional requirements for lifting low floor vehicles;

— definition of smaller jack space envelopes for jacks up to 20 t capacity;

— requirements for the use of jack adaptors with lifting brackets;

— lifting requirements when using cranes;

— Annex E: Definition of a non-standard 340 kN lifting bracket as used on GB locomotives.

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.

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

Rail vehicles are designed so that re-railing and recovery operations after a derailment or accident can be safely undertaken without exposing persons to undue risk during lifting and jacking operations.

For rolling stock of interoperable trains there is a need to define common requirements in terms of lifting and jacking operations, equipment space envelopes and lifting accessories.

Foreseeable factors that can influence a re-railing or recovery operation include:

— final vehicle position relative to the track;

— weight transfer due to final vehicle orientation (inclination or roll);

— vehicle load, possible overloading or uneven loading;

— load movement or shifting;

— embedding of parts of the vehicle in the ground;

— sinking of jacks (soft ground);

— structural distortion/damage;

— jerking or snatching of lifting equipment.

The majority of these factors cannot be quantified either in advance or during a recovery operation and therefore precise requirements cannot be set out in this European Standard and accordingly design scenarios are used. The resulting requirements together with competent persons undertaking the re-railing or recovery operation using the documentation specified are considered to be sufficient to ensure that the overall objectives are satisfied.

1 Scope

This European Standard is applicable to all railway vehicles that will operate under the Interoperability Directives taking into consideration the recommendations given in Annex F on the application of the standard (migration rule).

Rolling stock of the following types are excluded from the scope of this draft European Standard:

— metros, tramways, and other light rail vehicles;

— vehicles for the operation of local, urban or suburban passenger services on networks that are functionally separate from the rest of the railway system;

— vehicles exclusively used on privately owned railway infrastructure that exist solely for use by the owner for its own freight operations;

— vehicles reserved for a strictly local, historical or touristic use.

On-track machines are in the scope of this European Standard only when in transport (running) configuration on their own rail wheels, either self-propelled or hauled.

However, the requirements may be appropriate for other applications that have similar operational conditions. It specifies the principles and processes to be followed to achieve satisfactory arrangements for re-railing or recovery of railway vehicles and to validate the design against the relevant performance and safety requirements.

The interface between the re-railing and recovery equipment and the vehicle structure is considered as the interface between the jack contact faces or the lifting bracket contact areas. The structural requirements for the vehicle structure are set out in EN 12663-1 and EN 12663-2.

NOTE Railway vehicles that will operate under the Interoperability Directives correspond to the categories L, P-I, P-II, F-I and F-II defined in EN 12663–1.

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

EN 12663-2, *Railway applications - Structural requirements of railway vehicle bodies - Part 2: Freight wagons*

EN 13155, *Cranes — Safety — Non-fixed load lifting attachments*

EN 15663, *Railway applications - Definition of vehicle reference masses*

EN 15877-1, *Railway applications - Marking on railway vehicles - Part 1: Freight wagons*

EN 15877-2, *Railway applications - Markings of railway vehicles - Part 2: External markings on coaches, motive power units, locomotives and on-track machines*

EN 22768-1, *General tolerances - Part 1: Tolerances for linear and angular dimensions without individual tolerance indications (ISO 2768-1)*

3 Terms and definitions

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

3.1
articulated vehicle with shared running gear
system of articulation where each vehicle has its own secondary suspension but shares running gear (often referred to as Jacobs bogies)

Note 1 to entry: Typically each car body is supported at 4 points. Trains made up of vehicles of this type are a particular type of fixed formation train.

3.2
articulated vehicles with three point support
system of articulation where each vehicle has one bogie complete with its own secondary suspension and at the other end a single point connection to the adjacent vehicle in the train

Note 1 to entry: Trains made up of vehicles of this type are a particular type of fixed formation train.

3.3
fixed formation
train formation that can only be reconfigured in a workshop environment

Note 1 to entry: A fixed formation train can be made up of either articulated or otherwise conventional vehicles.

3.4
lifting
action of raising or lowering a vehicle

3.4.1
crane lifting
action of raising or lowering a vehicle by pulling upwards from above using appropriate equipment such as cranes

3.4.2
jacking
action of raising or lowering a vehicle by pushing upwards from underneath using appropriate equipment such as jacks

3.5
lifting point
particular points provided on the car body and/or running gear to position or locate appropriate equipment to raise or lower a vehicle using either cranes or jacks

3.5.1
crane lifting point
particular points provided on the car body and/or running gear to position or locate appropriate equipment to raise or lower a vehicle using cranes

3.5.2
jacking point
particular points provided on the car body and/or running gear to position or locate appropriate equipment to raise or lower a vehicle using jacks

3.6
lifting bracket
removable item of equipment that provides the functionality of a lifting point when attached to the vehicle using a lifting pocket

3.6.1
crane lifting bracket
removable item of equipment that provides the functionality of a crane lifting point when attached to the vehicle using a lifting pocket

3.6.2
jacking bracket
removable item of equipment that provides the functionality of a jacking point when attached to the vehicle using a lifting pocket

3.7
lifting and jacking bracket
removable item of equipment that provides the functionality of both a jacking and a crane lifting point when attached to the vehicle using a lifting pocket

3.8
lifting pocket
recess or other interface on the vehicle structure intended for the attachment of a lifting bracket

Note 1 to entry : This item interfaces with a lifting bracket to form a lifting point.

3.9
On-track Machines
OTM
mobile railway infrastructure construction and maintenance equipment

3.10
re-railing
operation consisting of raising and translating a derailed railway vehicle in order to put it back on the rails

Note 1 to entry: This operation is carried out at the site of the incident, by means of rescue equipment used by specialist rescue teams.

3.11
re-railing beam
beam that can be placed transversally beneath a derailed vehicle that can be used to support and traverse re-railing equipment (jacks) and thereby translate the vehicle as part of a re-railing operation

3.12
re-railing position
location or group of locations on the underframe where a re-railing beam, roller carriages and jacks can be located to permit re-railing

Note 1 to entry: This is termed ‘re-railing place’ in WAG TSI.

3.13
recovery
process of clearing the railway line of a vehicle that has been immobilized as a result of collision, derailment, accident or other incident

3.14
running gear
wheelsets, bogies and associated suspension components

Note 1 to entry : For this standard, running gear denotes wheelsets and suspension elements which have significant additional movement relative to the vehicle car body and may therefore require securing.

3.15
single end lift
vehicle lifting activity where the lifting equipment is employed at one end of a railway vehicle with the other end remaining supported by a bogie/wheelset in contact with the rails or ground

3.16
support point
designated points on a vehicle which are suitable for supporting the vehicle during or after a lifting operation

Note 1 to entry: Support points can be either lifting points or other points designated for the purpose.

3.17
vehicle end
longitudinal position between the centre of the vehicle and the end of the vehicle

3.18
wheelskate
device for rescuing vehicles where a wheelset is not fit to rotate, by lifting the affected wheelset and providing an alternative means of support and guidance in order to facilitate movement to a repair location

4 Requirements for the re-railing and recovery of rail vehicles

4.1 General requirements for all vehicles

It shall be possible to safely lift or jack a vehicle for re-railing or recovery purposes (following a derailment or some other accident or incident) using designated lifting points.

Requirements for the provision or type of lifting points for maintenance purposes are outside the scope of this European Standard though the same locations can be used for both purposes, subject to the respective design criteria being satisfied.

4.2 Required lifting operations

4.2.1 Lifting operations for all rail vehicles

Rail vehicles shall be designed for:

— lifting at the end or near the end of a rail vehicle with the other end supported by the vehicle suspension, or in the case of articulated vehicles, depending on the system of articulation used, possibly supported by an adjacent vehicle,

— lifting of the complete vehicle.

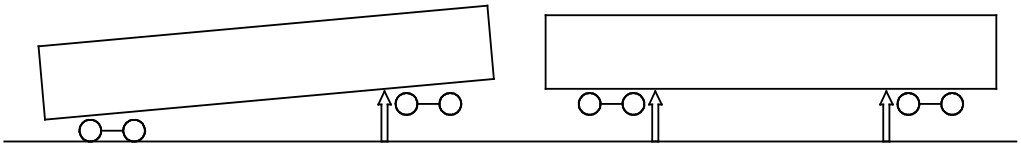


Figure 1 — Conventional vehicles: example of single end and full vehicle lifting

It shall be possible to lift a rail vehicle for re-railing or recovery purposes with the running gear secured to the car body (see 5.4).

For re-railing or recovery, it shall be possible to raise or lower a vehicle end or a complete vehicle using only jacking equipment (and lifting brackets if these are required).

NOTE For re-railing and recovery operations, lifting is undertaken by designated personnel who are trained and qualified by knowledge and practical experience to enable the re-railing and recovery operations to be carried out in accordance with the re-railing and recovery instructions for the vehicle (see Clause 8).

4.2.2 Lifting operations for articulated vehicles and/or fixed formations

For articulated vehicles and/or fixed formations it shall be possible to simultaneously lift the end or ends of adjacent vehicles in order to achieve the objectives set out above for lifting vehicles (see Figure 2 and Figure 3). Any additional requirements shall be included in the recovery documentation (see Clause 8).

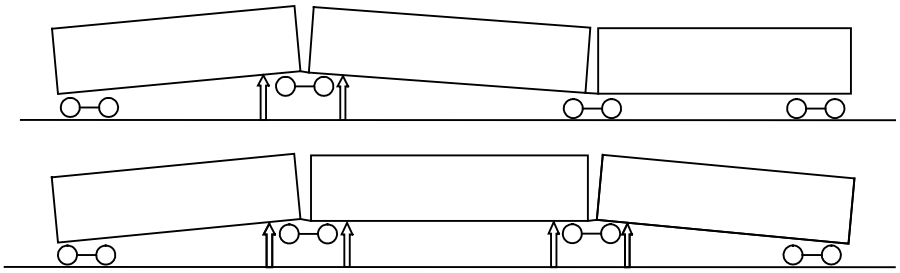


Figure 2 — Articulated vehicles with shared running gear: example of single end and full vehicle lifting

For articulated vehicles with three point support it is permissible for lifting loads to be transferred to an adjacent vehicle through the articulation joint, for example as indicated in Figure 3.

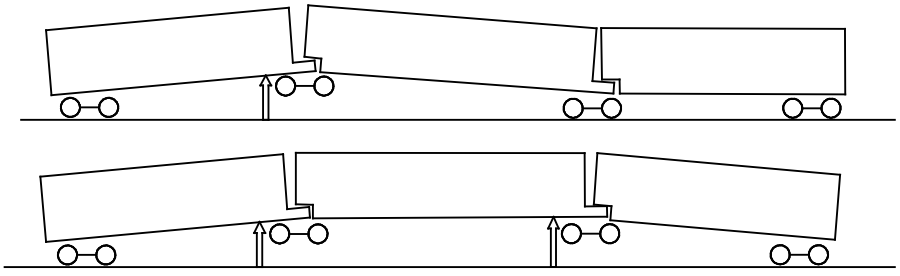


Figure 3 — Articulated vehicles with three point support: example of single end and full vehicle lifting

4.2.3 Provision of lifting points

Lifting points for re-railing and recovery shall be provided by:

— the provision of dedicated lifting points for re-railing and recovery,

and/or

— the use of lifting points which are also intended for maintenance purposes,

and/or

— removable lifting brackets with compatible attachment points or lifting pockets.

In all cases conformity with the requirements of this European Standard shall be demonstrated.

Permanent built-in lifting points for re-railing and recovery are recommended. In particular, it is recommended that freight wagons are designed to not require the use of lifting brackets for re-railing or recovery.

For heavy vehicles, for example locomotives, fully loaded freight vehicles or On-track Machines, the vehicle should be lifted using the running gear supporting the car body instead of lifting the vehicle with the running gear suspended from the car body structure to avoid structural collapse or damage.

If permanent built-in lifting points for re-railing or recovery are not provided for some or all vehicle lifting positions, attachment points or lifting pockets shall be provided to allow removable lifting brackets to be fitted in accordance with the requirements of 5.3 and 6.4.

4.2.4 Requirements for marking and documentation

Each lifting point shall be marked in accordance with the requirements of Clause 7 to clearly identify the intended function or functions of the lifting point.

4.3 Vehicle masses for lifting

The minimum vehicle mass, denoted MV, shall be the design mass in working order as defined by EN 15663, less the mass of any staff.

The maximum vehicle mass, denoted MC, to be used to determine the loads used in the design of lifting points, shall be the design mass under normal payload for the vehicle as defined by EN 15663, less the mass of any passengers and staff.

NOTE 1 For passenger vehicles, as defined in EN 15663, luggage mass is included. It is assumed that for a recovery operation while the passengers and train crew will have been evacuated, all other items remain on the vehicle.

NOTE 2 For freight vehicles, as set out in EN 15663, the maximum vehicle mass is the vehicle mass in working order plus the maximum payload specified for the vehicle. For freight vehicles, staff and/or passenger masses are zero.

5 Vehicle interface and functional requirements for lifting, re-railing and support

5.1 Lifting, re-railing and support points

5.1.1 Minimum functional requirements for jacking

In accordance with the requirements set out in 4.2, at each end of a vehicle it shall be demonstrated that the following sequence of re-railing operations can be undertaken safely:

— raise the end of the vehicle;

— support the raised vehicle;

— install a re-railing beam, roller carriages and traversing equipment;

— raise and support the vehicle on the re-railing beam and traverse as required;

— lower the vehicle to place back on the rails;

— remove all re-railing equipment.

These operations may be accomplished using any combination of the available options for re-railing positions and lifting points.

There shall be at least one pre-determined re-railing position at each vehicle end where running gear is attached.

A re-railing position shall allow the end of a rail vehicle to be safely lifted and traversed (moved laterally) by the use of either:

— a single pair of jacking points, a re-railing beam, roller carriages and jacks,

or

— a combination of vehicle jacking points and support points for use with a re-railing beam and roller carriages (except freight wagons constructed in accordance with Annex C of the Freight Wagons TSI).

If a combination of jacking and support points is used, the jacking and support positions are individually subject to the design space envelope requirements set out in this document. It is recommended that in addition the relative location of the jacking and support positions is optimised by consideration of:

— the intended use of the re-railing equipment,

— access requirements for the re-railing equipment,

— the position of the running gear,

— the rigidity of the vehicle structure.

Requirements for the combined use of re-railing beams and jacking equipment are set out in 5.1.6.

Requirements for support points are set out in 5.1.8.

5.1.2 General design requirements for lifting point locations

There shall be a minimum of four lifting points on the vehicle car body, arranged as two pairs, with at least one pair located at each vehicle end.

NOTE Subject to the approach adopted, a greater number of lifting points might be required to ensure the requirements of 5.1.1 are fulfilled.

It is recommended that in the vicinity of each set of running gear two pairs of lifting points are provided.

Additional lifting points may be provided subject to conformity with the applicable requirements set out in this European Standard. The number, position and heights of additional lifting points shall be part of the vehicle specification.

Lifting points provided for a full vehicle lift shall also be suitable for single end lifting.

For articulated vehicles at positions where the running gear is shared, lifting points shall be arranged to allow adjacent vehicle ends to be lifted simultaneously.

For lifting points at re-railing positions, requirements for maximum and minimum heights above rail are set out in 5.1.6. For lifting points at other positions, the heights of the lifting points shall be part of the vehicle specification.

Single central jacking points may be provided positioned outboard of the running gear at the vehicle ends for jacking for a single end lift. Provision and the height of such additional jacking points shall be part of the vehicle specification.

All other lifting points shall be placed along the vehicle car body sides or at the ends of the vehicle, and

— shall be arranged with a matching lifting point on the opposite side of the vehicle, i.e. arranged in pairs,

— pairs of lifting points shall be separated laterally by at least 860 mm.

5.1.3 Longitudinal location of jacking points

Jacking points for re-railing and recovery shall be located longitudinally according to Figure 4 subject to satisfying the requirements of 5.1.4 and 5.1.6:

— outboard or inboard of the running gear (zones 1 and 4 as shown in Figure 4);

or

— in a restricted zone, at a position which is greater than or equal to 360 mm longitudinally from the centreline of a designated re-railing beam space envelope (zones 2 as shown in Figure 4);

or

— if space for a re-railing beam underneath a bogie is not required, in zone 3 as shown in Figure 4.

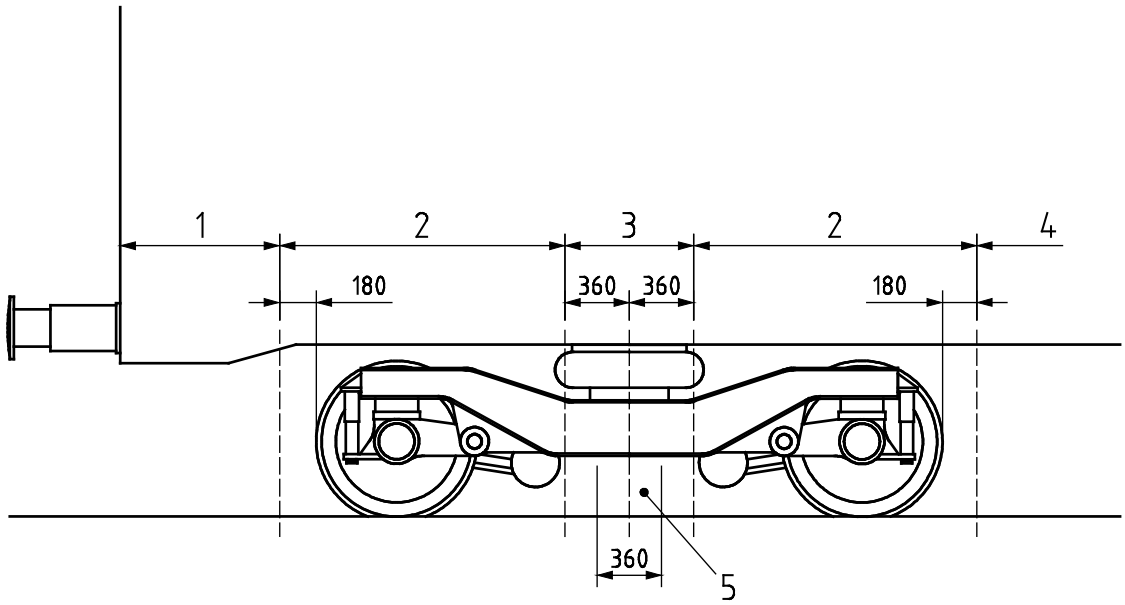
NOTE 1 In a restricted zone (zones 2 as shown in Figure 4), to satisfy the requirements of 5.1.4 and 5.1.6, a possible solution is to use jacking brackets. It is also possible to achieve the requirements of 5.1.4 and 5.1.6 in a restricted zone where compact running gear is used (e.g. inside frame bogies).

If jacking points are located in zones 2 and for a twisted bogie the required clearances cannot be achieved, additional jacking points may be used so that a pair of jacking points, one point on each side, are always available in these zones (see 5.1.4).

It is recommended that jacking points are not located within areas designed for controlled structural collapse and therefore vehicle designs incorporating structural crashworthiness can prevent the placing of jacking points in end zones that are intended to collapse under crash conditions.

For On-track Machines within the scope of this European Standard, jacking points should be provided where possible at a distance of 1 400 mm from the middle of the individual running gear.

Dimensions in millimetres



Key

1 outboard zone for jacking points

2 restricted zone for location of jacking points (see 5.1.4)

3 zone where jacking points for re-railing and recovery should not be located to allow a re-railing beam to be used under the bogie (see 5.1.9)

4 inboard zone for jacking points

5 longitudinal free space zone for a re-railing beam if required; there is no height requirement as the vehicle will be lifted before a re-railing beam is inserted

Figure 4 — Permissible jacking point positions at a vehicle end

NOTE 2 The dimensions set out in Figure 4 refer to the vertical axis of a jack that is contained in a cylindrical design space envelope of 180 mm radius and a design space envelope for a re-railing beam of 360 mm width.

5.1.4 Jacking equipment clearance zones

Clearance shall be provided underneath and around each jacking point to allow for the installation of jacking equipment and accessories.

Removable jacking brackets may be used to achieve the clearances required.

In the vicinity of jacking points the following design space envelopes shall be provided. The minimum design clearance shall be provided between any part of the vehicle, its running gear and the jacking equipment space envelope, assuming the vehicle is upright and level.

— The design clearance shall be maintained from the underside of the jacking pad down to rail level.

— A minimum jack height of 250 mm measured downwards from the top of the jack in the retracted condition shall be assumed.

— A cylindrical space envelope of 360 mm diameter shall be assumed requiring a minimum radial design clearance of 180 mm.

— For nominal jacking loads up to 20 t, a cylindrical space envelope of 280 mm diameter for the upper portion of the jack may be assumed, requiring a minimum radial design clearance of 140 mm. The jack base shall be represented by a cylindrical space envelope of 360 mm diameter with a height of 150 mm. If the vehicle design requires this option, this shall form part of the vehicle specification.

If a design space envelope of 280 mm diameter is used, the relevant dimensions given in Figure 4 (see 5.1.3) that define the boundary between zones 1 and 2, zones 2 and 3 and zones 2 and 4 may be adjusted accordingly.

Requirements for positioning of the line of action relative to jacking point geometry are set out in 5.2.

Where lifting brackets according to Annex B are used, the overhang of the lifting bracket may be increased in accordance with Table B.1, with a resulting reduction in load capacity, to provide sufficient space alongside the vehicle body profile for the jacking equipment design space envelope.

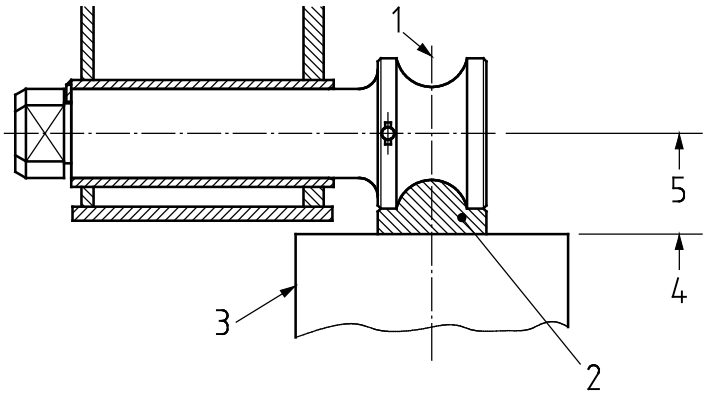
Between the top of the jack and the jacking contact surface it is permissible to use adaptors subject to the specified line of action being maintained between the jack and the vehicle jacking pad or the jack contact face of a jacking bracket as shown in Figure 5.

Any adaptors shall be designed to interface to the lifting brackets used (for an example see Figure B.3) and conform to the same performance requirements as those specified for the lifting brackets (see 6.4.2). Adaptors shall be designed to locate positively onto the lifting bracket for which they are designed so that under load the lifting bracket and adaptor function as a single item.

NOTE 1 For a lifting bracket according to Annex B, the adaptor shown in Figure B.3 gives a vertical offset of 85 mm between the top face of the jack and the lifting bracket axis (see Figure 5).

Adaptors for use with brackets shall be considered in combination with the brackets to determine the jack contact face. Below the jack contact face the appropriate jack space envelope shall be used.

Dimensions in millimetres
Diagram not to scale



Key

1 line of action
2 jack adaptor
3 jack design envelope
4 top of jack
5 lifting bracket axis

Figure 5 — Installation of adaptors at lifting point positions

Where adaptors are used and the jack is positioned partially beneath the vehicle structure (as illustrated in Figure 5), a minimum nominal clearance of 5 mm is recommended between the jack and the underside of the vehicle structure.

The design clearance from the running gear shall be determined taking into account possible extreme displacements of the running gear.

Extreme displacements of the running gear shall be determined assuming that non-structural linkages such as roll-bars, dampers, pipes or cables are not present and the items are therefore free to move until contact is made with limit stops or the car body structure.

It is permissible to determine the clearance underneath and around each lifting point assuming only lateral, longitudinal and vertical movements subject to there being alternative jacking points available in the event of the running gear being twisted or rotated such that the design space envelope is infringed. For example, in the case of a twisted bogie, if two pairs of jacking points are provided on either side of the bogie pivot, it would be acceptable for a diagonally opposed pair of jacking points being used. This possibility shall be identified in the documentation specified by Clause 8.

The only items permitted inside the specified re-railing equipment clearance zones shall be removable manually with the aid of conventional hand tools and without the use of cutting equipment, special tools or the aid of lifting equipment.

It is permissible to deviate from these space envelope requirements subject to demonstration that the jacking equipment can be installed and used safely. This demonstration may be included in the validation tests for re-railing and recovery (see Clause 9).

Deviations from the space envelope requirements shall form part of the vehicle specification and any re-railing equipment required for a particular vehicle type shall be available to all re-railing and recovery teams in areas where the vehicles shall operate.

NOTE 2 Examples of vehicle types where a deviation from the standard equipment design space envelopes could be required include OTMs or low floor vehicles.

NOTE 3 Deviation from the specified requirements requires the agreement with the relevant organisations (for example railway undertakings and infrastructure managers).

5.1.5 Lifting requirements when using cranes

Permanent crane lifting points (for example lugs) shall satisfy the proof and ultimate load requirements of 6.4.2.

Clearance shall be provided around crane lifting points to permit the installation and use of lifting accessories, for example slings, shackles and pins. Lifting accessories shall conform to applicable European Standards.

The only items permitted inside lifting equipment clearance zones shall be removable manually with the aid of conventional hand tools and without the use of cutting equipment, special tools or the aid of lifting equipment.

In the vicinity of crane lifting points for use with flexible linkages (for example slings, chains), a design clearance should be provided between the vehicle sides and the lifting equipment.

If packing pieces or load spreading pieces are required between the vehicle body and lifting equipment to prevent damage, for example due to induced lateral loads from slings, these requirements shall form part of the vehicle specification.

5.1.6 Re-railing position design space envelopes

As set out in 5.1.1, at re-railing positions a combination of vehicle locations may be used with the exception of freight wagons constructed in accordance with Annex C of the Freight Wagons TSI.

In determining the design space envelopes required at re-railing positions, an upright and level vehicle shall be assumed.

For freight wagons constructed in accordance with Annex C of the Freight Wagons TSI:

— the design space envelope set out in Figure A.1 shall be provided at the re-railing positions. For most wagons, this requires the re-railing positions to be located in Zones 1 or 4,

— the minimum height of the jack contact surface shall be 765 mm,

— it is recommended that in addition to this requirement there is clearance allowed to accommodate the design space envelope set out in Figure A.2.

For other freight wagons and other types of vehicle:

— if the re-railing position is at a single location (a single pair of jacking points), the design space envelope included in Figure A.2 and Figure A.3, shall be provided for an upright and level vehicle at re-railing positions which are either inboard or outboard of the running gear;

or

— if the re-railing position uses a combination of jacking points and support points, sufficient space shall be created when the vehicle is lifted for a re-railing beam (Figure A.2 item 6), roller carriages (Figure A.2 item 4) and spacer bars (Figure A.2 item 7) to be inserted at the support position.

The height range of the jack contact surfaces at re-railing positions are as follows:

a) it is recommended that the minimum height above rail level is not less than 500 mm;

b) where a minimum height above rail level of 500 mm cannot be achieved, a second pair of jacking points shall be provided. The minimum height above rail level of either pair of jacking points shall not be less than 350 mm;

c) minimum heights shall be determined assuming fully worn wheels, all primary suspension elements collapsed or at the downward limit of movement and where applicable, deflated air suspension; if this cannot be achieved, the height of the jack contact surfaces shall be part of the vehicle specification;

d) the maximum height above rail level shall not be greater than 1 270 mm assuming new wheels, the vehicle in its lightest operational condition and where applicable inflated air suspension.

If applicable, tilt systems shall be assumed to be inactive or isolated and the vehicle level for the purpose of determining jacking contact surface heights.

5.1.7 Additional clearances required for single end lifting

For single end lifting, at the vehicle end supported on the vehicle suspension, clearances shall be maintained between the parts of the vehicle (typically the car body and the bogies) and between the underside of the vehicle and rail level when the other end is lifted as set out in Design Scenario 2 (see 6.3.2).

A minimum clearance value is not specified. The vehicle design shall ensure that the clearances are sufficient taking into account for example manufacturing tolerances, relative movements, adjustment and wear.

Any items that would otherwise make contact with other parts of the vehicle, the rails or ground during a single end lift shall be removable manually with the aid of conventional hand tools and without the aid of lifting equipment. Such items shall be identified in the documentation specified by Clause 8.

5.1.8 Support points

Provision shall be made for vehicles to be safely supported during lifting operations to allow the lifting equipment to be repositioned or removed for subsequent operations. This shall be achieved by:

— the use of alternative lifting points as support points where these are provided (for example if separate lifting points are provided for single-end lifting and lifting a complete vehicle);

and/or

— the provision of support points alongside some or all of the vehicle lifting points or separate support points inboard or outboard of the running gear;

and/or

— support using the running gear or bogie frame (see 5.1.9). Axles shall not be used for this purpose.

Support points shall be arranged in pairs with a matching support point on the opposite side of the vehicle.

Pairs of support points shall be separated laterally by at least 860 mm.

5.1.9 Bogie support points

If the bogie frame is intended to be used as a support point, this shall form part of the vehicle specification and the following requirements shall apply.

For two-axle bogies, the bogie frame shall be designed to support a vehicle end by the use of a re-railing beam placed underneath the bogie using the central area of the underside of the bogie frame. The

longitudinal axis of the re-railing beam should be located centrally with respect to the bogie wheelbase whenever possible.

Where it is not possible to support a vehicle using a bogie with a centrally located re-railing beam, for example a 3 axle bogie or due to structural limitations, it is permissible for a position to be designated which is offset longitudinally. In this case there shall be means provided (for example using bearing pads and packing) to prevent pitching rotation (i.e. about a transverse axis) of the bogie frame and to thereby transfer the resultant loads into the vehicle car body.

The bogie frame support points shall provide contact surface areas to safely support the vehicle by using either:

— the bogie frame placed on top of a re-railing beam. The underside of the bogie shall be kept clear of pipes, cables, welded-on attachments or equipment mountings within ± 180 mm longitudinally from the nominal support position or positions,

or

— at least two dedicated support pads provided on the underside of the bogie. Each pad surface shall be flat and level with a minimum size of 150 mm x 150 mm. It is permissible for this surface to be grooved or otherwise patterned to increase effective levels of friction. If required, this shall be part of the vehicle specification. In determining the contact surface area it is permissible for the effect of grooves or patterns to be discounted.

NOTE For some types of bogie, for example where magnetic track brakes are fitted, packing may be required between the underside of the bogie frame and the re-railing equipment.

5.2 Jacking point geometry

The jack contact surface of a jacking point or a jacking bracket shall be:

— flat and level, with a minimum jack contact surface area of 10 000 mm^2;

— not less than 80 mm in length or width.

In determining space envelopes and clearances for jacking equipment, the line of action of the jack (the jack vertical centre line) may be considered to act offset from the centre of the jack contact surface provided that there is always a distance of at least 40 mm between the line of action and any edge of the contact surface.

For jacking brackets, an offset is permissible between the line of action of a jacking bracket and the line of action of a jack, subject to demonstration that the jacking equipment can be installed and used safely. This demonstration may be included in the validation tests for re-railing and recovery (see Clause 9).

It is permissible for the jack contact surface to be grooved or otherwise patterned to increase effective levels of friction. If required, this shall be part of the vehicle specification. In determining the contact surface area it is permissible for the effect of grooves or patterns to be discounted.

Where jack contact surfaces are also intended to be used for maintenance purposes, it is permissible for a central location hole to be provided. If required, this shall be part of the vehicle specification.

5.3 Lifting brackets

Where lifting brackets are used, standard lifting bracket geometric requirements and their interfaces are defined in Annex B and Annex C.

Non-standard lifting brackets are permissible, for example as defined in Annex D and Annex E. If required, these lifting brackets shall be part of the vehicle specification.

If non-standard jacking systems are used, for example internal jacks where the jacks are directly attached to the vehicle (for example using screwed or twist locking interfaces), the interfaces connecting the jacks to the vehicle shall satisfy the requirements set out in 6.4.

NOTE Non-standard brackets may be required due to gauging restrictions on the vehicle profile, for reasons of compatibility with existing vehicles and equipment, or due to the characteristics of a particular vehicle design, for example low floor designs.

Sets of any lifting brackets, pins or other accessories required for a particular vehicle type shall be either available to all re-railing and recovery teams in areas where the vehicles shall operate or the necessary items shall be carried on board.

Lifting bracket structural design requirements are set out in 6.4.

5.4 Securing of running gear to the underframe

As set out in 4.2.1, it is required that rail vehicles can be jacked or lifted for re-railing or recovery with the running gear secured to the car body. This shall be achieved by the use of one or both of the following:

— built-in features of the running gear and associated linkages, for example using movement limit stops on suspension elements;

and/or

— chains, straps, slings or other loose lifting tackle. Wherever possible permanent attachment points should be provided. Where it is not possible to provide permanent attachment points for securing the running gear, adaptors shall be provided, and shall be part of the vehicle specification.

The arrangements for securing the running gear shall form part of the vehicle specification.

With the exception of locomotives, for lifting bogie vehicles when a bogie is twisted and where separate lifting tackle (for example chains, straps or slings) is required, attachment points shall be dimensioned to allow the bogie to be supported at two diagonally opposed points.

Provision shall be made to block or limit suspension movement when re-railing or recovering a vehicle before lifting to minimize the lifting height required and to prevent uncontrolled movement.

Any resulting forces on equipment used for securing the running gear for example due to compression or unloading of the vehicle suspension shall be accounted for.

The strength of attachment points shall be determined in accordance with the requirements for vertical equipment loads set out in EN 12663-1 and/or EN 12663-2 as applicable.

Full details of requirements for securing the running gear shall be included in the re-railing instructions (see Clause 8).

6 Design load cases for re-railing and recovery equipment

6.1 General design principles

In order to ensure that persons are not exposed to any undue risk when using rescue equipment the lifting equipment interfaces shall be designed to accommodate the loadings due to recovery and re-railing operations as set out below.

Permanent local deformation of the vehicle, while undesirable, is permissible during re-railing and recovery operations. However, during these re-railing or recovery operation scenarios, catastrophic failure or collapse of the combination of the lifting equipment and the vehicle being recovered shall not occur.

The design scenarios set out in 6.3 describe limiting cases for re-railing and recovery operations with respect to the requirements of this European Standard. If all requirements of this standard are fulfilled, the design is deemed to be compliant with this European Standard and no further investigations are necessary.

The above objectives and requirements are satisfied for the car body by conformance with EN 12663-1 and/or EN 12663-2 as applicable and for any lifting brackets by compliance with 6.4.2.

6.2 Workshop vehicle lifting

Workshop lifting is outside the scope of this European Standard. However, for the purposes of determining equipment loadings for re-railing and recovery equipment the lifting load cases for normal or workshop conditions given in EN 12663-1 and/or EN 12663-2 form the basis of the reference conditions.

6.3 Re-railing and recovery design scenarios

6.3.1 Design scenario 1

The vehicle is derailed at one end, the derailed wheels rest on the sleepers. The derailed running gear shall therefore be assumed to have dropped by 230 mm in comparison with its normal condition. The rescue operation is performed at the derailed end of the vehicle while the other end is supported on the track by the other running gear, assuming that any air suspension is in the deflated condition.

NOTE 1 A drop of 230 mm represents the overall height from the centre of a sleeper to the top of rail taking account of the rail profile, rail pads, baseplates and/or the sleeper transverse profile.

It is additionally assumed when lifting with two jacks that any one of the load carrying vehicle lifting points sinks or otherwise drops vertically to be out of plane relative to the other lifting point by an amount Z.

— For lifting points with a lateral separation L of 2 000 mm or more the support shall be assumed to sink or drop by Z = 100 mm.

— For lifting points with a lateral separation L less than 2 000 mm the support shall be assumed to sink or drop according to the formula $Z = (L \times 100 / 2\,000)$ mm.

or

— A distance equal to the displacement which induces complete unloading of the lifting point, where this is a smaller value than the assumed sinking of the support.

NOTE 2 This could occur due to unfavourable ground conditions, a lack of synchronization between the lifting equipment or some other combination of adverse conditions. The range of out of plane displacement that can be controlled during a recovery operation using conventional lifting equipment is considered to be within the design limits assumed. In practice, even under adverse conditions, this will normally be a lower value. The vertical offset will be partially absorbed by twisting of the vehicle body and partially by displacement in roll of the running gear suspension supporting the vehicle at the other end.

6.3.2 Design scenario 2

The vehicle is lifted at one end to fit a wheelskate. It is assumed that the outermost wheelset is raised to give a minimum clearance of 350 mm to the rail. The rescue operation is performed at one end of the vehicle while the other end is supported on the track by the other running gear, assuming that any air suspension is in the deflated condition.

For OTMs if, due to the characteristics of a vehicle design, conformity with this scenario is not reasonably practicable, alternative arrangements shall form part of the vehicle specification.

It is additionally assumed that any one of the load carrying vehicle lifting points sinks or otherwise drops vertically to be out of plane relative to the other lifting point using the same assumptions set out for Design Scenario 1 (6.3.1).

6.3.3 Design scenario 3

The vehicle is derailed at both ends and the body is rolled about the longitudinal axis of the vehicle to an angle of 15°. An initial recovery operation is performed to bring the vehicle horizontal and level.

The following conditions are assumed.

— In the rolled condition, on the low side of the vehicle, the vehicle is assumed to be resting on equipment or underframe structures or otherwise supported independently of the vehicle suspension.

— The lifting points used shall be suitable for a full vehicle lift.

— In bringing the vehicle to a level position the vehicle can rotate about the wheel treads on the high side of the vehicle. It shall be assumed that lifting loads are applied alternately at each lifting point such that on the low side of the vehicle, at any given time, the vehicle is being lifted at a single point.

— The vehicle suspension is secured in accordance with 5.4.

Subsequent operations are assumed to be equivalent to Design Scenarios 1 or 2.

6.4 Lifting brackets

6.4.1 Lifting bracket structural design requirements

The mass to be lifted is set out in 4.3.

The nominal design forces F_{DES} shall be determined at each lifting point for a single ended lift and/or for a full vehicle lift according to the intended lifting operations at that lifting point, assuming that all points are fully supported and in plane.

Where it is intended that both a full vehicle lift and a single ended lift shall be permitted at a given lifting point, the highest nominal loading shall be used.

Where the use of standard lifting brackets or other accessories is required, the following requirements shall be satisfied:

— For vehicles where the maximum vertical force for normal conditions F_{DES} is less than or equal to a load of 220 kN, the vehicle shall be designed to accept lifting brackets in accordance with Annex B.

or

— For vehicles where the maximum vertical force for normal conditions F_{DES} is less than or equal to a load of 335 kN, the vehicle shall be designed to accept lifting brackets in accordance with Annex C.

As an alternative, subject to the requirements for non-standard lifting brackets set out in 5.3:

— For vehicles where lifting brackets are required and the maximum vertical force for normal conditions F_{DES} is less than or equal to a load of 170 kN, it is permissible for the vehicle to be designed to accept lifting brackets in accordance with Annex D.

or

— For vehicles where lifting brackets are required and the maximum vertical force for normal conditions F_{DES} is less than or equal to a load of 340 kN, it is permissible for the vehicle to be designed to accept lifting brackets in accordance with Annex E.

NOTE The lifting brackets set out in Annexes D and E were developed as standard equipment in Great Britain for carriages and locomotives.

EN 22768-1 "coarse" tolerances shall be applied where tolerances are not specified on the normative diagrams in Annex B, Annex C, Annex D and Annex E.

For vehicles where lifting brackets are required and the maximum vertical force for normal conditions is greater than a load of 335 kN (or 340 kN where brackets to Annex E might be used), a non-standard lifting bracket and interface shall be designed to meet the requirements.

If non-standard lifting brackets are specified the design shall be validated for the value of F_{DES} required in accordance with 6.4.2 and the design shall ensure that these brackets are incompatible with the car body interfaces for standard brackets.

Where the use of lifting brackets is required, only one type of lifting bracket shall be necessary for the re-railing or recovery of a vehicle or a fixed formation.

It is permissible to change the form of the outboard ends of the lifting brackets if required to be compatible with particular lifting equipment subject to:

— the effective distances between the line of action for lifting and the reaction points not being increased (the forces applied to the car body by the lever action of the bracket shall not be increased as this will invalidate the design assumptions for the corresponding lifting pocket),

— no changes to the vehicle interfaces,

— the clearances specified in 5.1.4 (and 5.1.6 where appropriate) are maintained,

— successful validation of the modified bracket design.

Due to the high rigidity of jacking equipment, where there is an offset between the line of action of a jacking bracket and the centre line of a jack (see 5.2), the nominal position for the line of action of the lifting bracket may be assumed for the purposes of calculations.

Lifting brackets that are rotated to lock into position shall provide an indication when locked in place by either:

— the use of a locking bar which is horizontal (as shown in Figure B.1 and Figure B.2) when locked,

or

— a permanent marking of a line which is horizontal when locked (as shown in Figure C.1 and Figure C.2).

This requirement does not apply to brackets for jacking only, where the jacking surface is horizontal when the bracket is locked (as shown in Figure C.3).

6.4.2 Lifting bracket strength requirements

Lifting brackets shall be designed, validated and marked to withstand the proof and ultimate loads specified in EN 13155.

The material used to manufacture lifting brackets is outside the scope of this European Standard.

7 Markings for lifting points

Each lifting point shall be marked in accordance with EN 15877-1 or EN 15877-2. Only one marking shall be used at a given lifting point to indicate suitability for either a single end lift or a full vehicle lift in accordance with the following marking types:

— lifting without running gear;

— lifting at 4 points simultaneously with or without running gear (a full vehicle lift);

— lifting or re-railing with or without running gear at one end.

If a lifting point is marked for a full vehicle lift the lifting point shall also be suitable for a single end lift as set out in 5.1.2 and shall therefore comply with the requirements of 5.1.7 and 6.3.

8 Documentation for re-railing and recovery

8.1 General documentation requirements

Re-railing and recovery documentation shall be produced for each type of rail vehicle.

As a minimum this shall consist of:

— a recovery risk assessment,

— a set of lifting instructions,

— a lifting diagram.

8.2 Recovery Risk Assessment

Each rail vehicle should be assessed to determine foreseeable hazards to recovery staff that can be identified, for example:

— payload;

— fuel;

— oils (for engines, gearboxes and transmissions, hydraulic systems, transformers, etc.);

— compressed air;

— electricity (batteries, stored electric charge);

— effluent;

— hot and/or pressurized water as coolant or for heating purposes;

— water (e.g. passenger vehicle storage tanks);

— mass of items to be removed prior to lifting (see 5.1.4, 5.1.5, 5.1.7).

All risks identified should be documented in a recovery risk assessment. When a vehicle modification results in a change to re-railing and recovery procedures or documentation the risk assessment shall be updated.

8.3 Lifting instructions

Lifting instructions shall be prepared for each rail vehicle. These shall be available on paper in A4 format and electronically.

The instructions shall include:

— instructions for re-railing after a partial derailment (one end only derailed) with reference to Design Scenario 1;

— instructions for re-railing after a full derailment (both ends of a vehicle derailed) with reference to Design Scenario 3;

— instructions for lifting and jacking operations required to permit wheelskates to be fitted with reference to Design Scenario 2.

NOTE Instructions for fitting a given wheelskate design are outside the scope of this document.

The lifting instructions shall include:

— the positions of locking and release mechanisms for the brakes, including parking brake and the relevant procedures;

— the position of the battery and battery isolator. Earthing or electrical isolation requirements and procedures to minimize the risk of electric shock;

— pneumatic drain and isolation requirements and procedures;

— isolation requirements and procedures for any hydraulic systems;

— detailed procedures giving locations, removal and re-assembly instructions for components which require removal prior to lifting;

— detailed procedures giving attachment locations and details of any recommended items for securing or limiting the movements of the running gear for lifting operations;

— any procedures required to mitigate particular hazards identified in the recovery risk assessment;

— any requirements applicable to vehicle doors during re-railing and recovery operations for example whether particular doors should be open or closed.

Wherever possible diagrams using pictograms consistent with the actual vehicle markings as set out in EN 15877-1 and EN 15877-2 shall be included to illustrate the operations required.

8.4 Lifting diagram

8.4.1 General lifting diagram requirements

The lifting diagram shall be available on paper in A4 or A3 format and electronically. The electronic version of the diagram shall be capable of being printed legibly on A3 paper when required.

For articulated vehicles or articulated trains, an extended A4 × n format may be adopted provided that paper copies are capable of being folded and bound in A4 format.

The lifting diagram shall contain the following:

— a side elevation;

— an end elevation and/or cross-sections;

— mass data.

The data on the lifting diagram shall relate only to requirements for lifting the vehicle, with its running gear. Particular requirements relating to operations on certain parts of the vehicle body (e.g. roof, hoods, etc.) or large equipment (e.g. transformers, equipment cases, etc.) are outside the scope of this European Standard but it is however permissible for any relevant documents to be referenced on the lifting diagram.

8.4.2 Side elevation

The side elevation shall show the vehicle in outline and set out the positions of the lifting points and any support points. These points shall be identified using a system that gives each point its own unique reference.

To avoid confusion, wherever possible the vehicle end designations should correspond to those used by the manufacturer, maintainers and operators.

For an articulated vehicle the orientation selected shall be part of the vehicle specification.

The following dimensions shall be given on the diagram:

— longitudinal distances between the lifting point centres;

— longitudinal distances between any support points;

— the position of the centre of gravity;

— the distance between bogie centres or axles for two axle vehicles;

— the length over the car body and nominal height of the vehicle;

— the overall length of the vehicle taking account of any drawgear or buffers.

If lifting brackets are required this shall be indicated on the diagram at the applicable lifting points.

8.4.3 End elevation and/or cross-sections

Transverse cross-sections or part sections shall show the vehicle profile and the outer profile of the running gear at positions corresponding to the lifting points and any support points.

If lifting brackets are required, these shall be shown at the applicable positions.

The following dimensions shall be given on each sectional view, relative to the vehicle centre-line for the given position:

— the distance to the lifting point centre;

— the distance to the line of action for lifting operations, where applicable and if different to the lifting point centre position;

— the maximum car body semi-width;

— the minimum height of the lifting point or support point;

— the minimum vertical lift required for the running gear to be lifted from the track.

8.4.4 Mass data

At each lifting point, the effective mass in tonnes to be raised or lowered as a single end lift shall be shown on the diagram, preferably alongside the position on the longitudinal view.

The maximum and minimum masses as defined in 4.3 shall be shown with the designations MV'n' for the minimum mass and MC'n' for the maximum mass and where 'n' denotes the lifting point designation.

The overall vehicle minimum and maximum masses as defined in 4.3 shall be shown on the diagram.

The running gear masses shall be shown on the diagram.

9 Validation

For all newly designed vehicles, a re-railing test shall be undertaken to demonstrate that the objectives for re-railing and recovery are satisfied.

The re-railing test shall simulate Design Scenario 2 set out in 6.3.2 and shall be used to validate the lifting instructions. The assumed sinking of any one of the supports shall not be applied for this test.

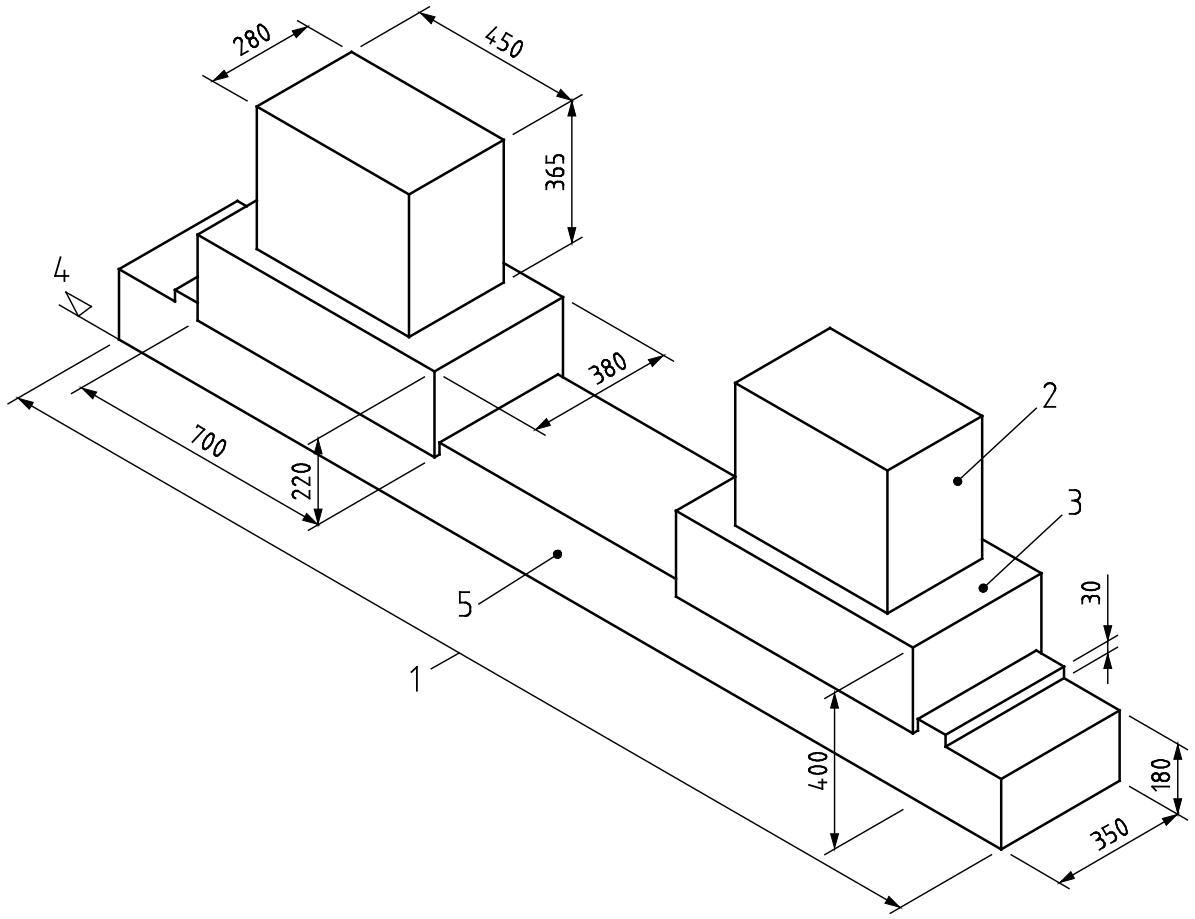
NOTE Validation of the effect of any re-railing and recovery loads acting on the vehicle structure are addressed by EN 12663–1 and EN 12663–2.

It is not necessary to carry out tests if there is verification data available from previous tests on an equivalent structure.

Annex A
(normative)

Space envelopes for re-railing equipment

Dimensions in millimetres



Key

1 overall length to suit re-railing operation

2 space envelope for jacking equipment

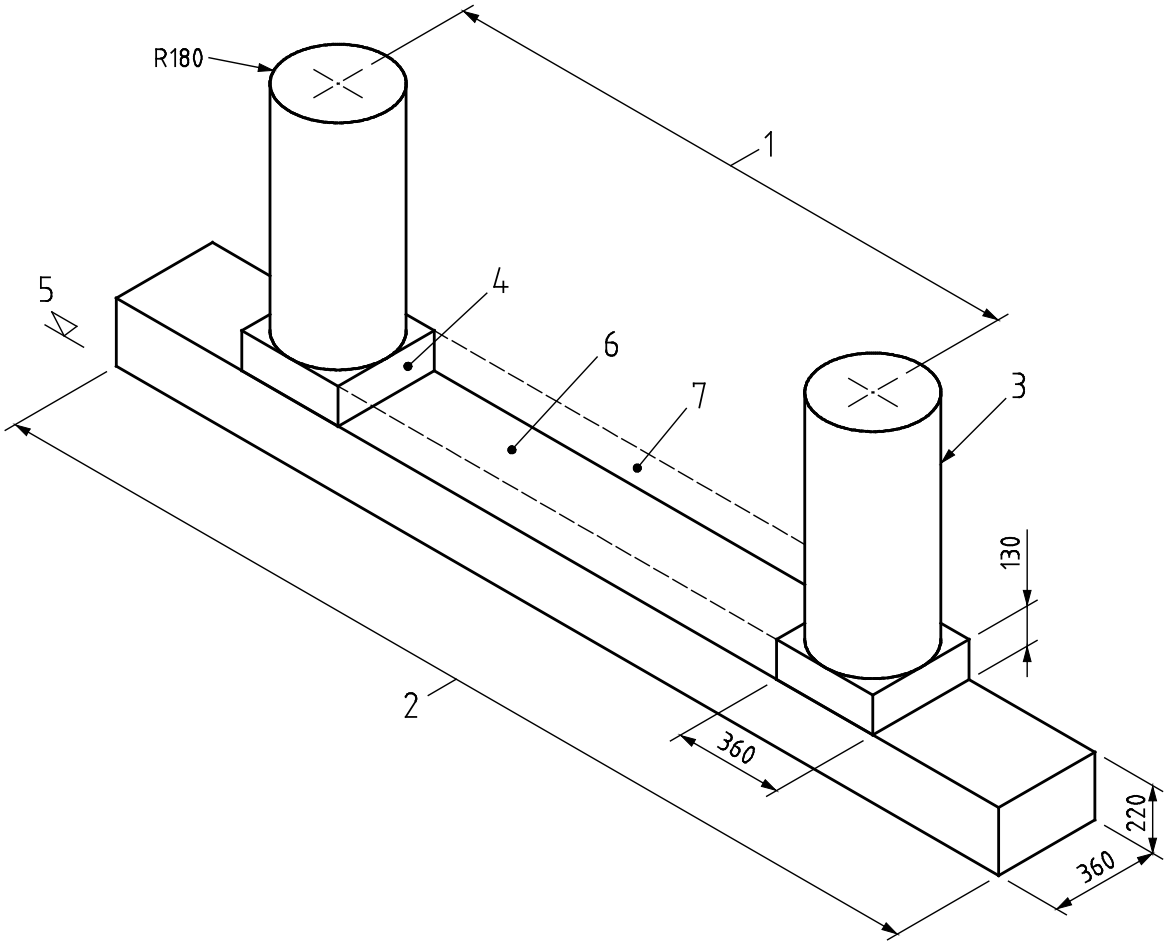
3 roller carriage space envelope

4 rail level/ground level

5 re-railing beam space envelope

Figure A.1 — Space envelope requirements for re-railing operations for freight wagons constructed in accordance with Annex C of the Freight Wagons TSI

Dimensions in millimetres

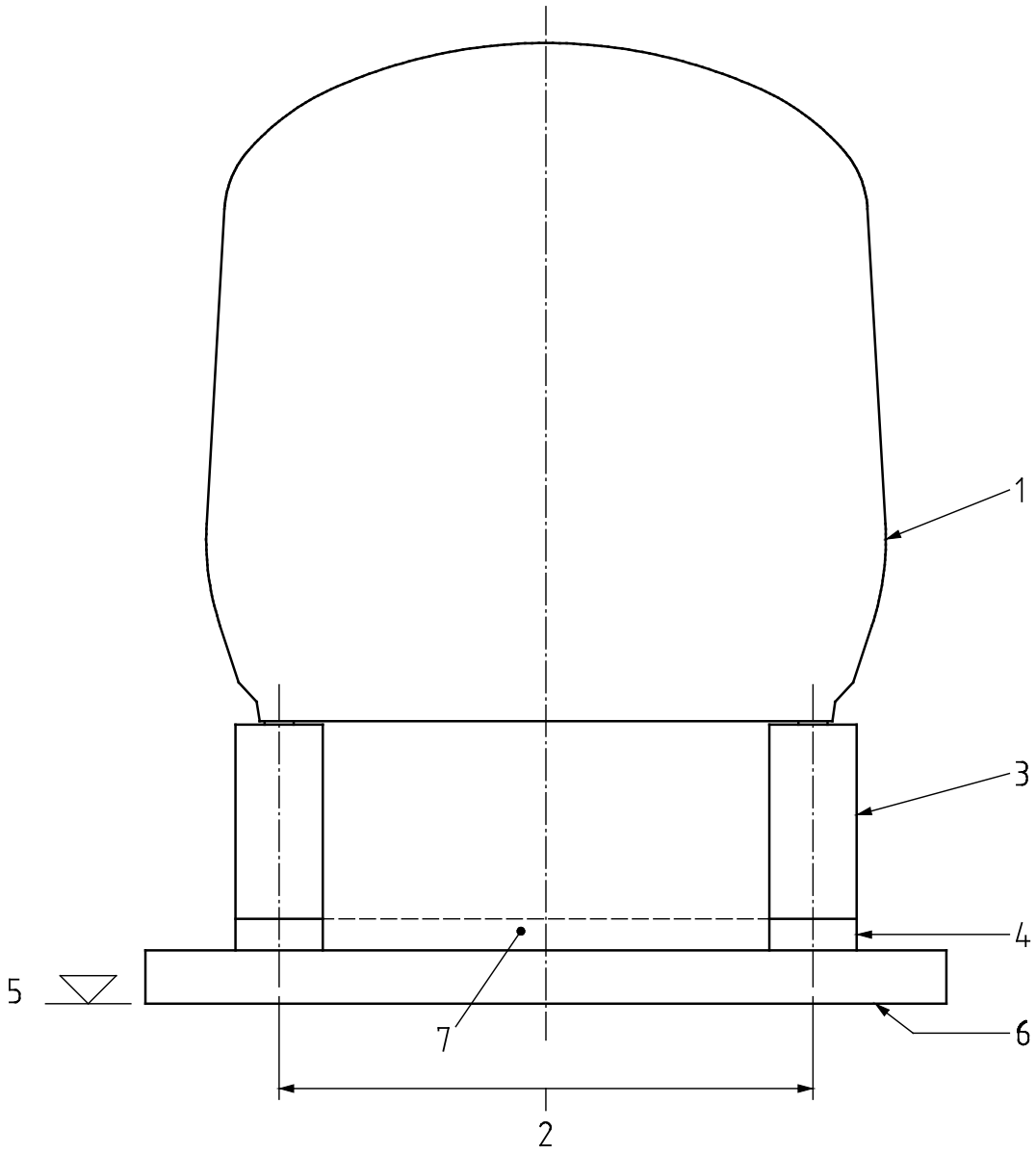


Key

1 jacking pad centres
2 overall length to suit re-railing operation
3 space envelope for jacking equipment
4 roller carriage space envelope
5 rail level/ground level
6 re-railing beam space envelope
7 space envelope for roller carriage spacer bars

Figure A.2 — Space envelope requirements for re-railing equipment

The equipment shown in Figure A.2 may be used individually or in any appropriate combination (e.g. beam only (item 6), beam + rollers (items 4 and 6) or the full set of equipment as shown).



Key

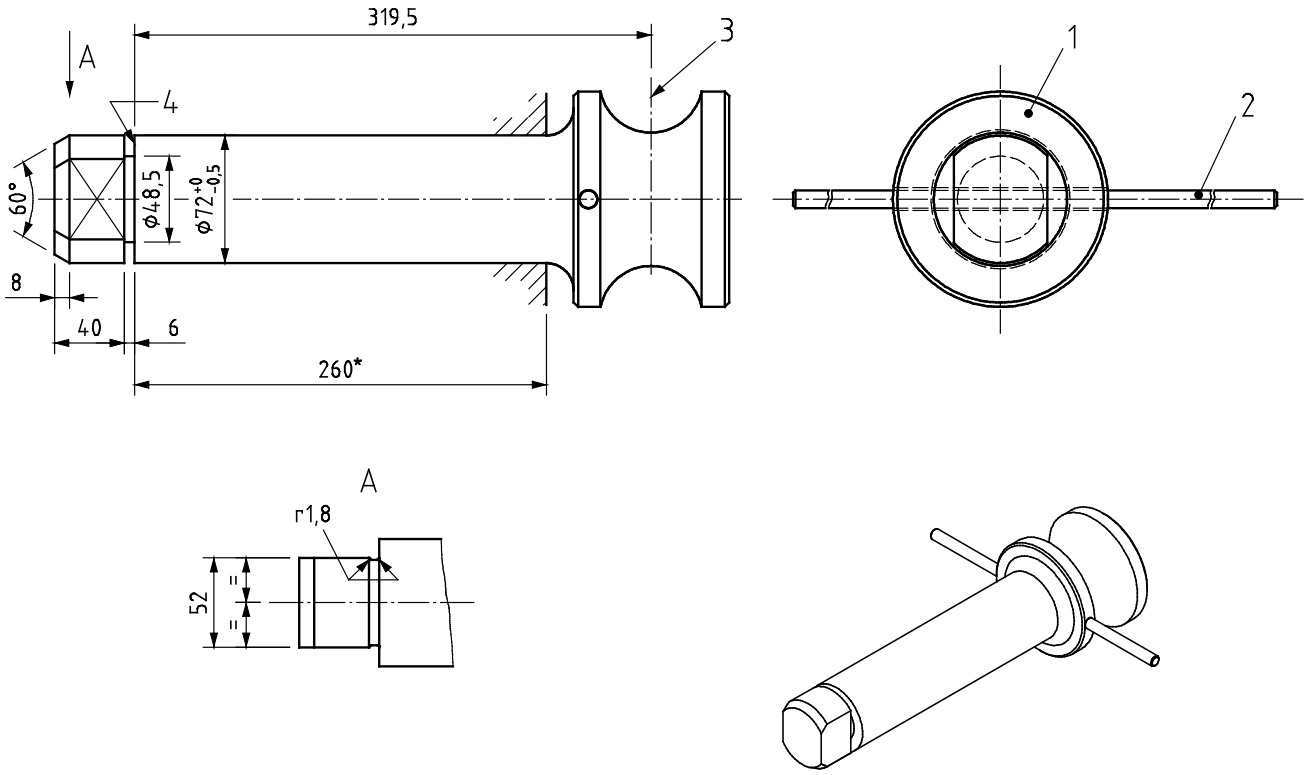
1 section through typical vehicle
2 jacking pad centres
3 space envelope for jacking equipment
4 roller carriage space envelope
5 rail level/ground level
6 re-railing beam space envelope
7 space envelope for roller carriage spacer bars

Figure A.3 — Space envelope requirements for re-railing operations

Annex B
(normative)

Standard lifting bracket (100 kN to 220 kN)

Dimensions in millimetres



Key

1 lifting bracket

2 locking bar – lifting bracket locked when bar horizontal

3 line of action for lifting

4 locking plane

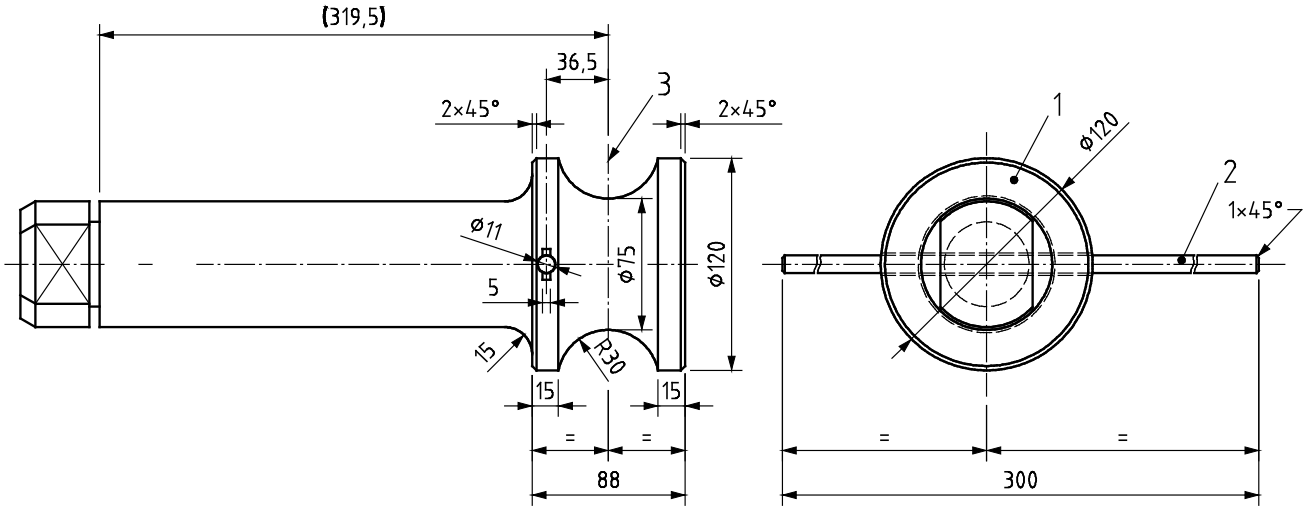
* specified diameter to be maintained over this length

Figure B.1 — Standard 100 kN to 220 kN Lifting Bracket (normative)

NOTE 1 This design of lifting bracket is primarily intended for lifting passenger vehicles with relatively flat bodysides up to a mass of 82 t (assuming an even mass distribution).

For brackets for use with jacking equipment, with a separate adaptor (as the example set out in Figure B.3) or by other means, the jacking face shall be at least 85 mm below the longitudinal axis of the bracket.

Dimensions in millimetres



Key

1 lifting bracket

2 locking bar – lifting bracket locked when bar horizontal

3 line of action for lifting

Figure B.2 — Standard 100 kN to 220 kN Lifting Bracket (informative)

NOTE 2 Figure B.2 shows an accepted arrangement for the interface between the lifting bracket and lifting equipment.

For jacking equipment the adaptor set out in Figure B.3 is required.

Dimensions in millimetres

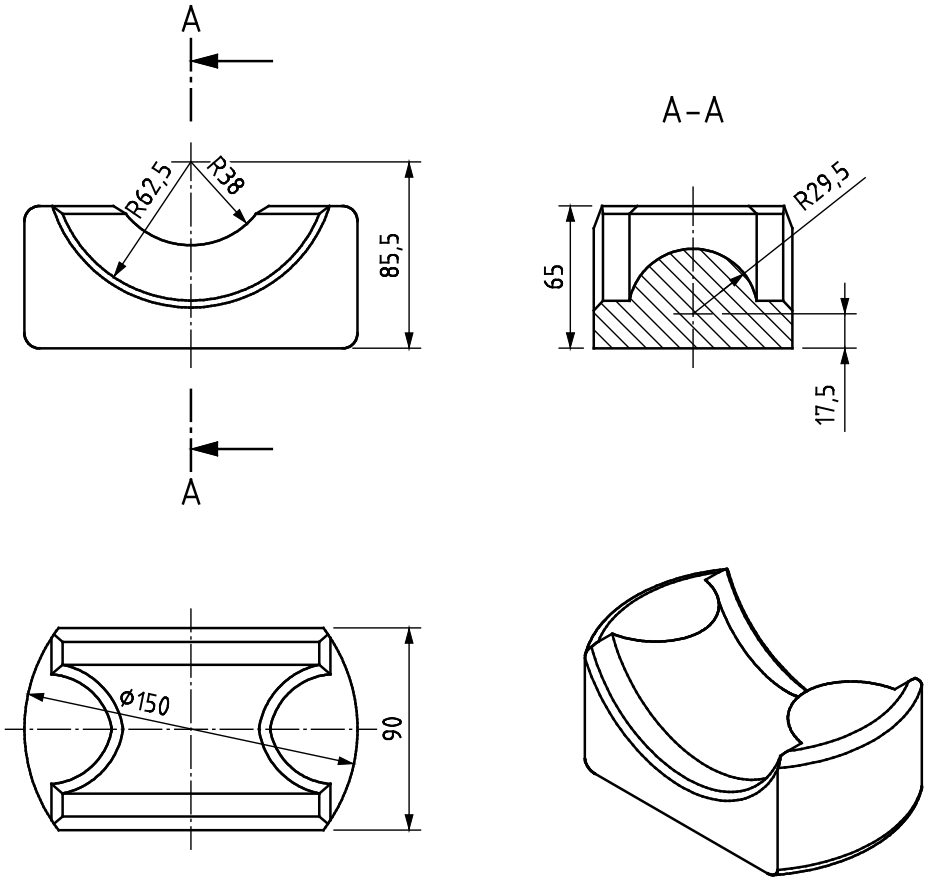
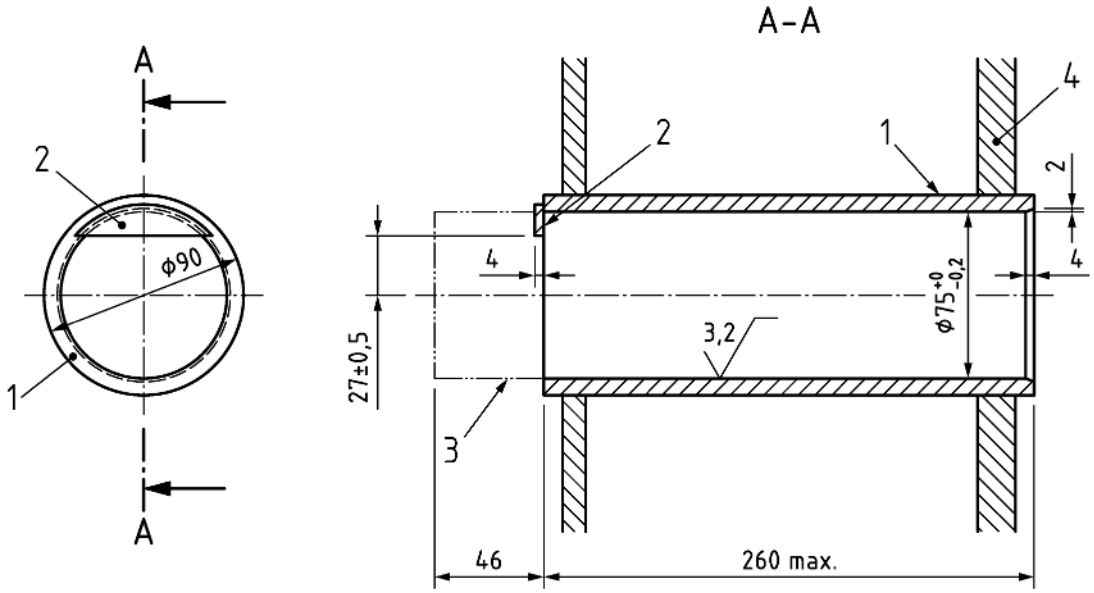


Figure B.3 — Jack adaptor for standard 100 kN to 220 kN Lifting Bracket (informative)

NOTE 3 This adaptor may have a central locating peg on its base for use with jacks with a corresponding hole in the jack face. Such a peg is typically 25 mm diameter (+0 mm,-0,2 mm) and 10 mm deep.

Dimensions in millimetres



Key

1 sleeve

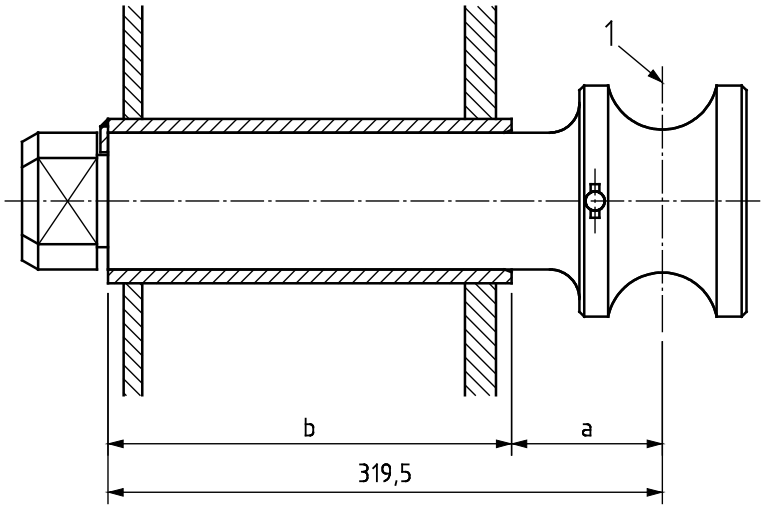
2 locking plate (lower edge horizontal)

3 clearance volume for bracket end

4 outer face of vehicle

Figure B.4 — Car body interface requirements for standard 100 kN to 220 kN Lifting Bracket (normative)

Dimensions in millimetres



Key

1 line of action for lifting

a overhang

b engagement length

Figure B.5 — Installation of standard 100 kN to 220 kN Lifting Bracket (normative)

The maximum load values for the standard 100 kN to 220 kN Lifting Bracket are a function of the engagement length as given in Table B.1.

Table B.1 — Maximum load values standard 100 kN to 220 kN Lifting Bracket

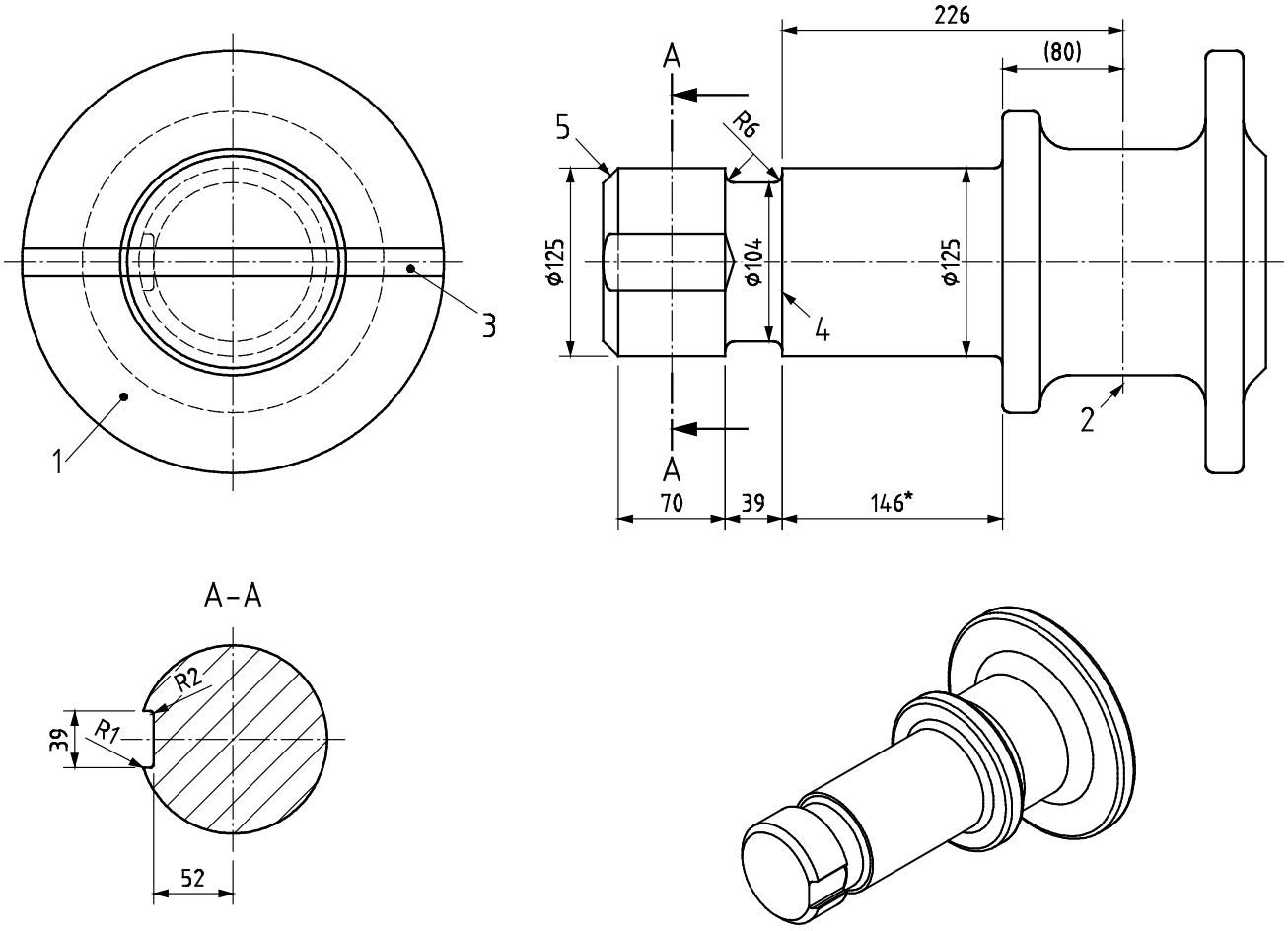
Engagement length mm b	Overhang length mm a	Maximum load kN (safety factors according to EN 13155)	Maximum nominal load tonnes (informative)
190	129,5	100	10,5
225	94,5	140	14,25
260	59,5	220	20,5
NOTE Values rounded to the nearest 10 kN and 0,25 t respectively.			

For intermediate engagement values the maximum bracket load shall be determined by calculation. It is permissible to use classical beam theory assuming a rigid abutment for this purpose.

Annex C
(normative)

Standard lifting bracket (for up to 335 kN)

Dimensions in millimetres



Key

1 lifting bracket

2 line of action for lifting

3 marking to show locked position

4 locking groove datum plane

5 end chamfer, length not to exceed 10 mm

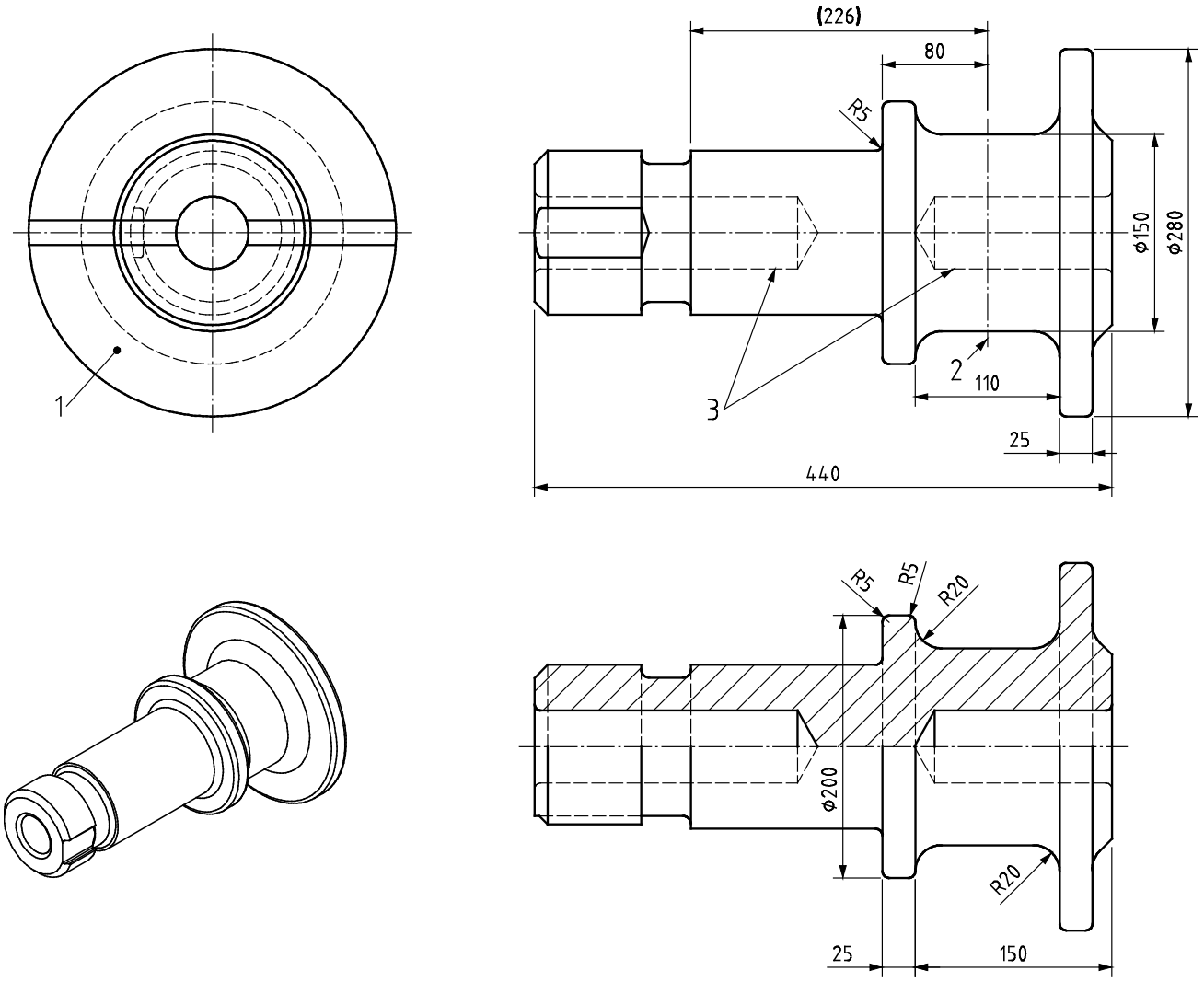
* specified diameter to be maintained over minimum of 141 mm measured from the locking groove datum

If a fillet radius is required, radius not to exceed 5 mm.

Figure C.1 — Standard 335 kN Lifting Bracket (normative)

NOTE 1 This design of lifting bracket is primarily intended for lifting locomotives of up to 136 t mass (assuming an even mass distribution).

Dimensions in millimetres



Key

1 lifting bracket

2 line of action for lifting

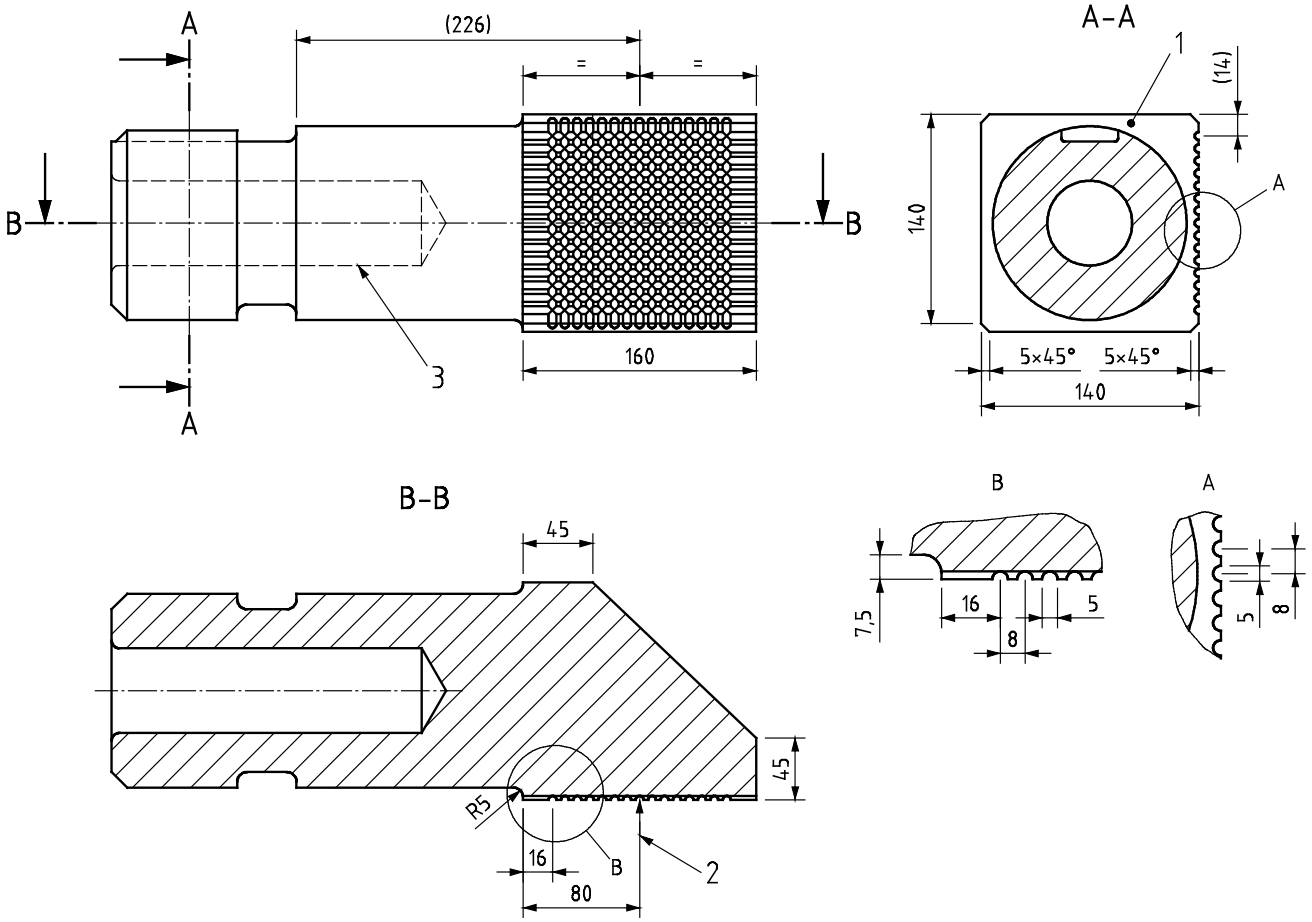
3 bored holes for mass reduction – indicative dimensions, subject to satisfaction of performance requirements

Figure C.2 — Standard 335 kN Crane Lifting Bracket (informative)

This or any other variant is acceptable provided that the normative requirements set out in Figure C.1 are respected.

NOTE 2 Figure C.2 shows an accepted arrangement for the interface between the lifting bracket and lifting equipment only.

Dimensions in millimetres



Key

1 jacking bracket

2 line of action for jacking

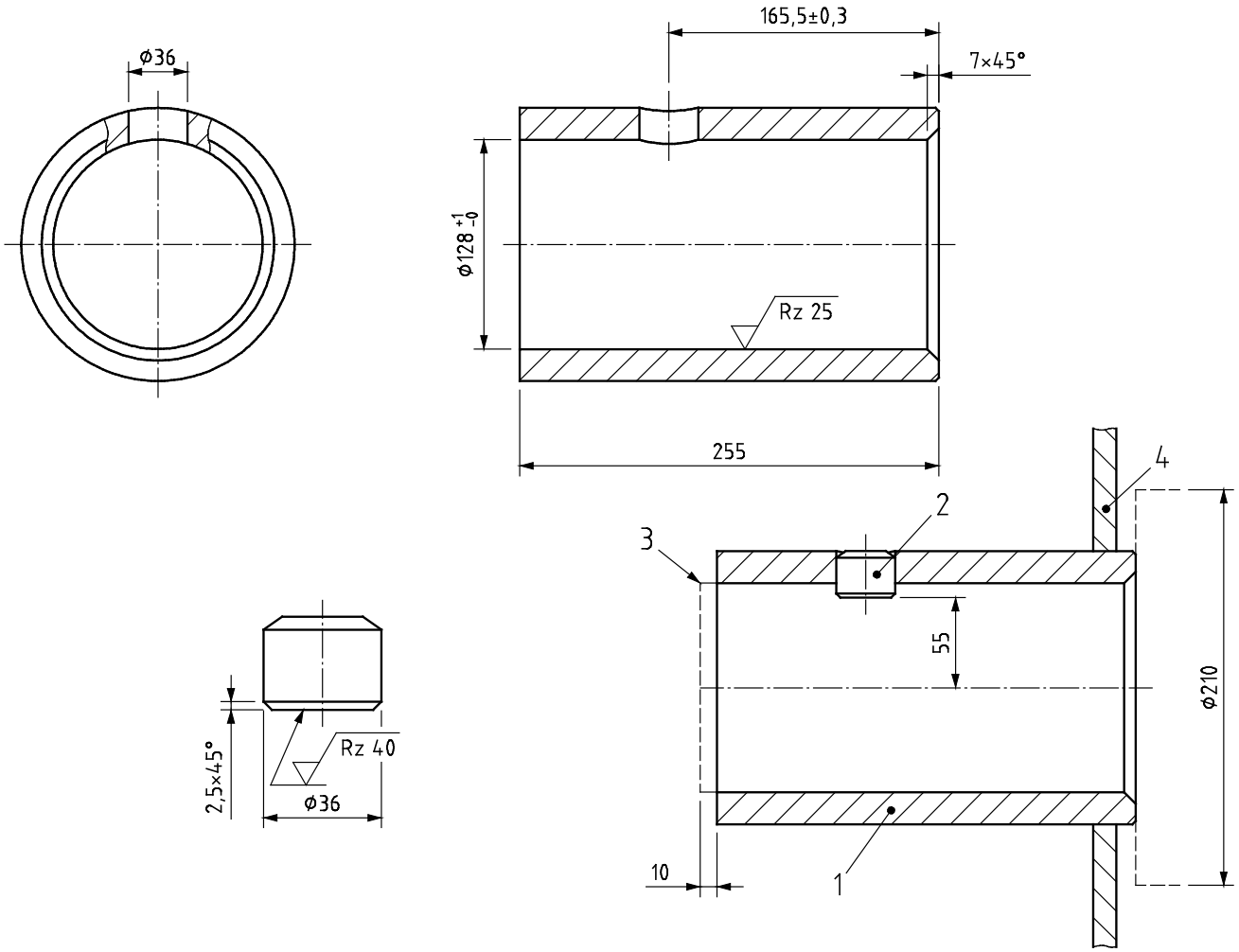
3 bored hole for mass reduction – indicative dimensions, subject to satisfaction of performance requirements

Figure C.3 — Standard 335 kN Jacking Bracket (informative)

This or any other variant is acceptable provided that the normative requirements set out in Figure C.1 are respected.

NOTE 3 Figure C.3 shows an accepted alternative design for use with jacks only which has been used for many years in Europe for lifting locomotives.

Dimensions in millimetres



Key

1 sleeve

2 locking peg (permanently attached to sleeve)

3 clearance volume for bracket end

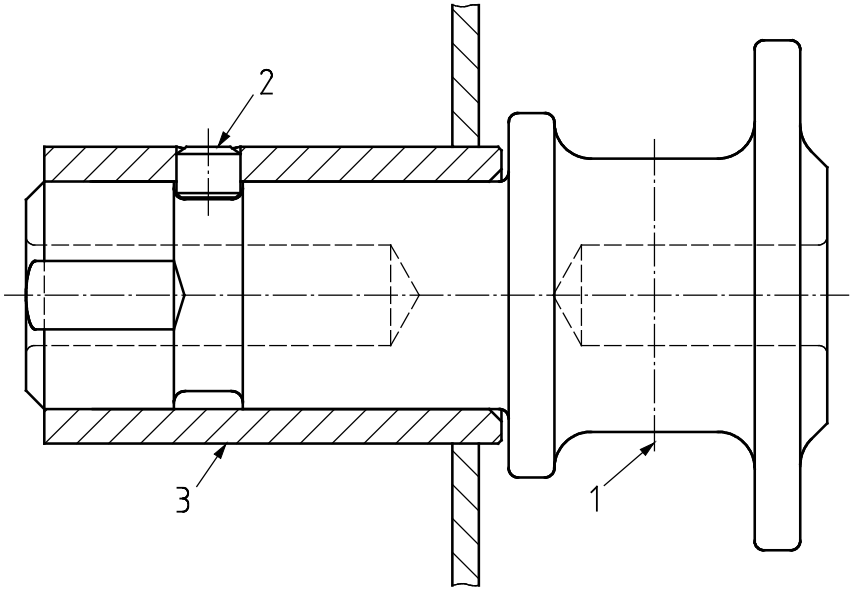
4 outer face of vehicle

Figure C.4 — Car body interface details for standard 335 kN Lifting Bracket (normative)

If space permits, the clearance volume can be ensured by using a longer tube.

NOTE 4 The tube length is a minimum.

Dimensions in millimetres



Key

1 line of action for lifting

2 locking peg

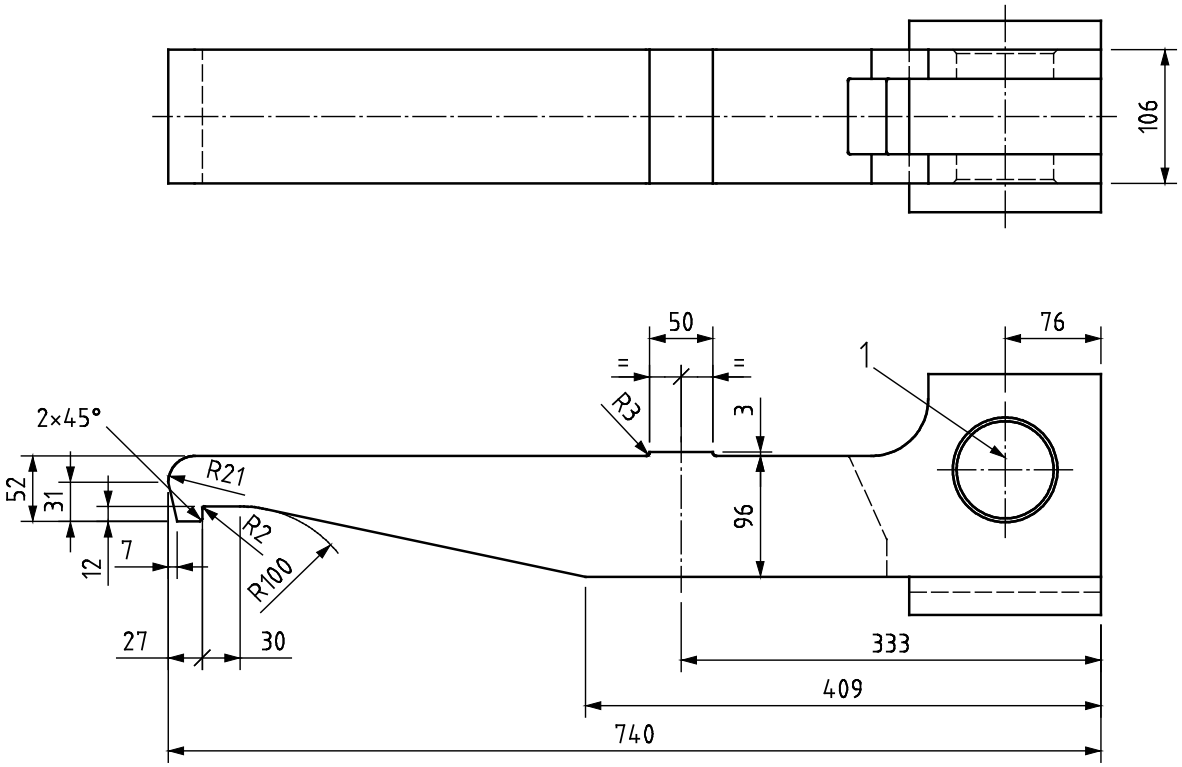
3 sleeve

Figure C.5 — Installation of standard 335 kN Lifting Bracket (normative)

Annex D
(normative)

Lifting bracket (for up to 170 kN)

Dimensions in millimetres



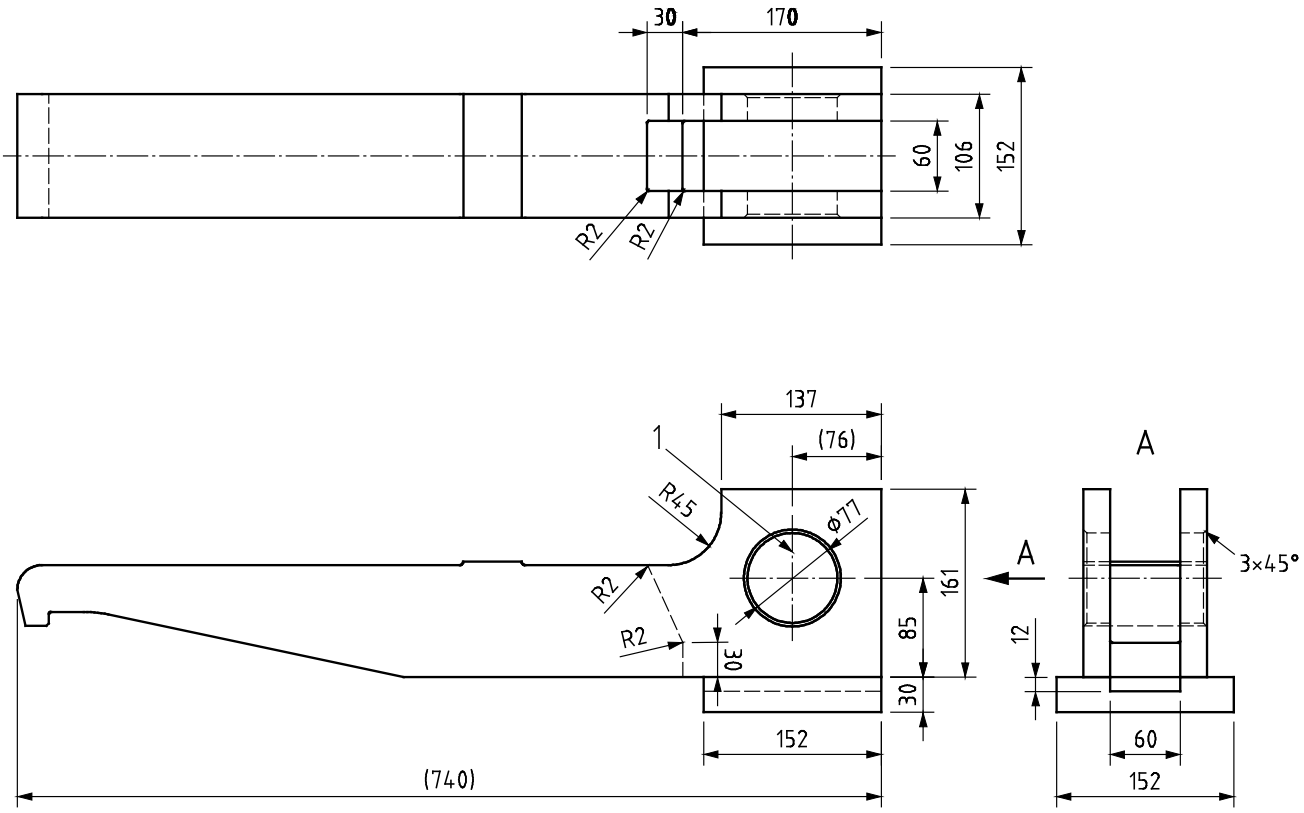
Key

1 line of action for lifting

Figure D.1 —170 kN Lifting Bracket (normative)

NOTE 1 This design of lifting bracket is intended for lifting passenger vehicles with relatively curved bodysides and restricted access due to loading gauge limitations up to a mass of 70 t (assuming an even mass distribution).

Dimensions in millimetres



Key

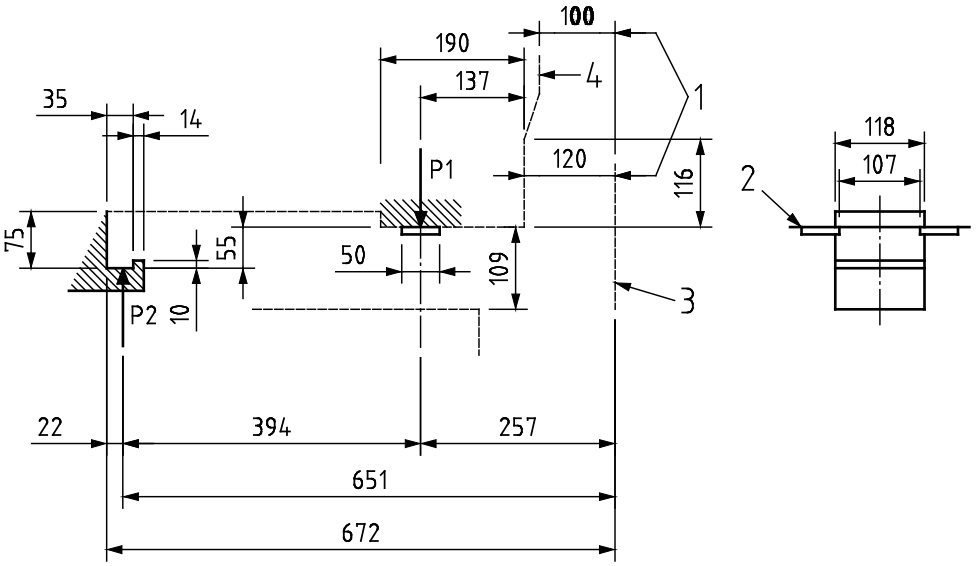
1 line of action for lifting

Figure D.2 —170 kN lifting bracket (informative)

NOTE 2 This figure shows an accepted arrangement for the interface between the lifting bracket and lifting equipment. This design of bracket is suitable for the use of either jacks or cranes for re-railing or recovery.

For lifting using a crane, a suitable pin is required to attach the lifting equipment using the 77 mm diameter hole shown. The hole diameter can be varied to suit particular equipment.

Dimensions in millimetres



Key

1 minimum clearances from lifting line of action and side of vehicle

2 50 × 10 cross section x 50 long lateral retaining bars

3 line of action for lifting

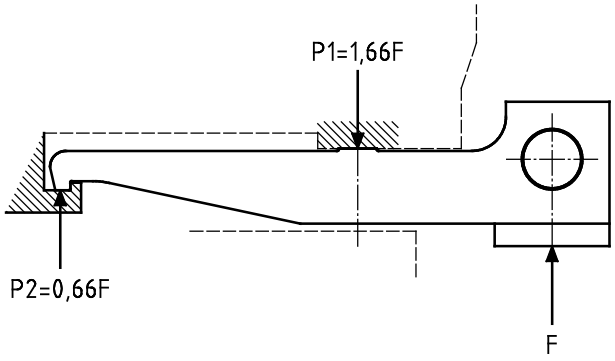
4 vehicle side wall

P1 line of upper reaction force

P2 line of lower reaction force

Figure D.3 — Car body interface requirements for 170 kN Lifting Bracket (normative)

In the vicinity of the reaction point P1 alternative features may be used to provide lateral location for the bracket in place of key items 2, the lateral retaining bars shown.



Key

F externally applied lifting force

P1 nominal upper reaction force

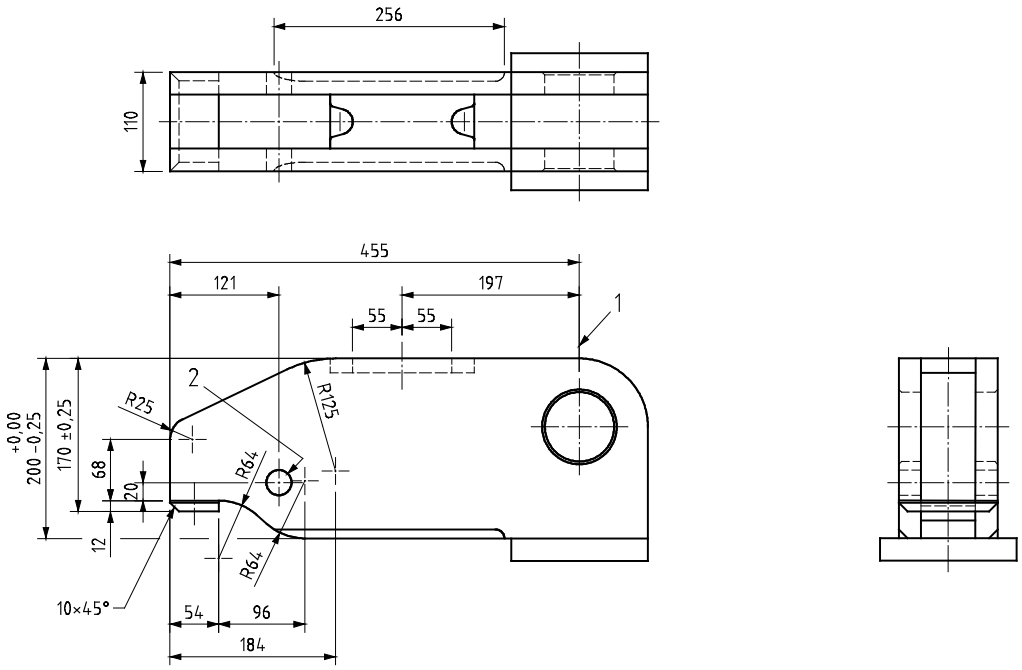
P2 nominal lower reaction force

Figure D.4 — Installation of 170 kN Lifting Bracket (normative)

Annex E
(normative)

Lifting bracket (for up to 340 kN)

Dimensions in millimetres



Key

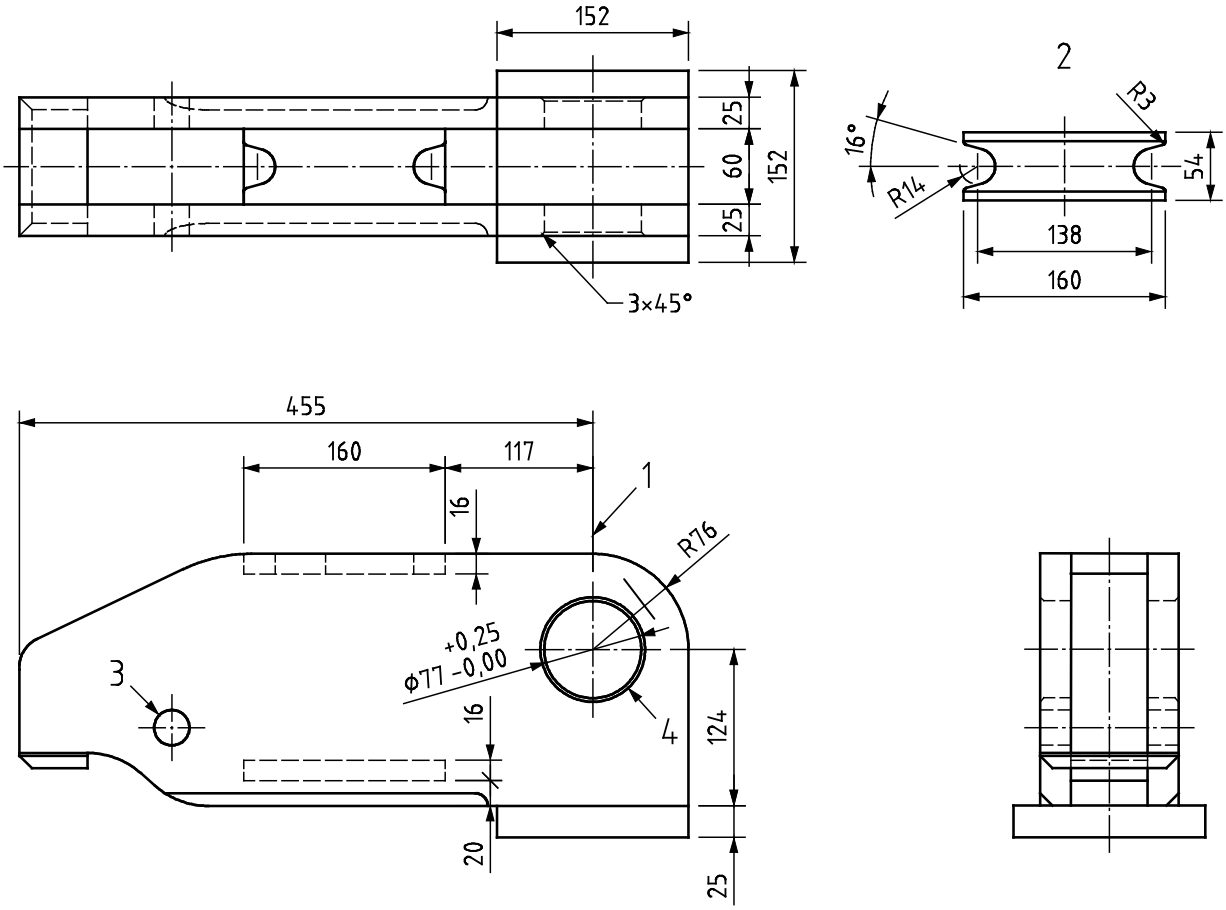
1 line of action for lifting

2 28 mm diameter holes for retention pin

Figure E.1 —340 kN Lifting Bracket (normative)

NOTE 1 This design of lifting bracket is intended for lifting locomotives up to a mass of 140 t (assuming an even mass distribution).

Dimensions in millimetres



Key

1 line of action for lifting

2 upper bearing pad detail

3 28 mm diameter holes for retention pin

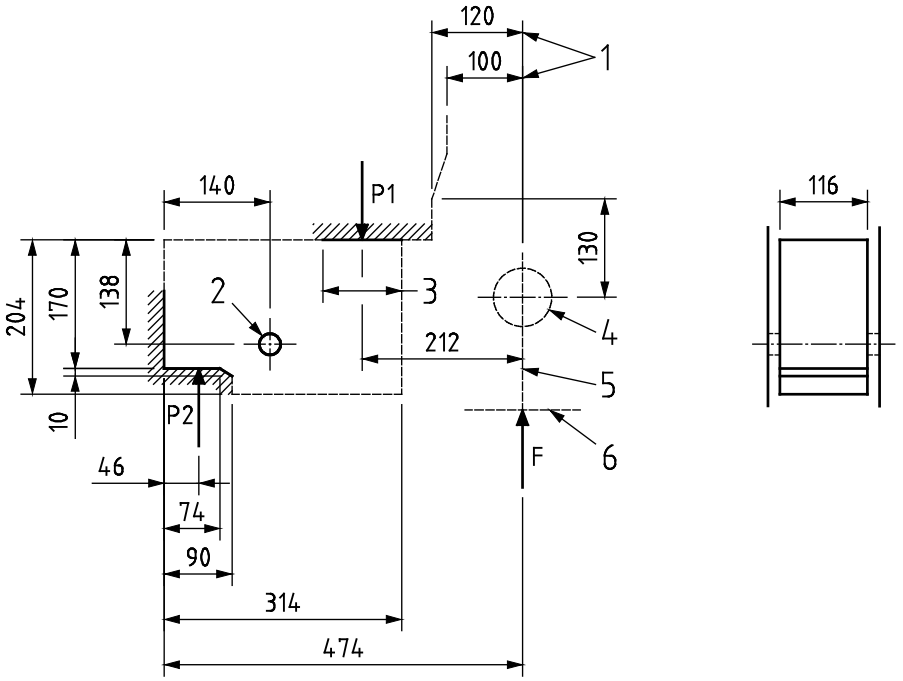
4 77 mm diameter holes for lifting pin

Figure E.2 —340 kN crane lifting and jacking bracket (informative)

NOTE 2 This figure shows an accepted arrangement for the interface between the lifting bracket and lifting equipment.

For lifting using a crane, a suitable pin is required to attach the lifting equipment using the 77 mm diameter hole shown. The hole diameter can be varied to suit particular equipment.

Dimensions in millimetres



Key

1 minimum clearances from lifting line of action and vehicle side

2 hole for bracket retaining pin – 25 mm one side, tapped M30 other side, orientation to suit access for retaining pin

3 upper bracket contact face

4 position of lifting eye

5 lifting line of action

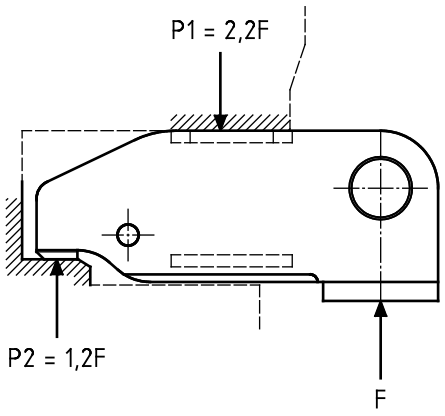
6 jacking contact surface

F externally applied lifting force

P1 line of upper reaction force

P2 line of lower reaction force

Figure E.3 — Car body interface requirements for 340 kN Lifting Bracket (normative)



Key

F externally applied lifting force

P1 nominal upper reaction force

P2 nominal lower reaction force

Figure E.4 — Installation of 340 kN Lifting Bracket (normative)

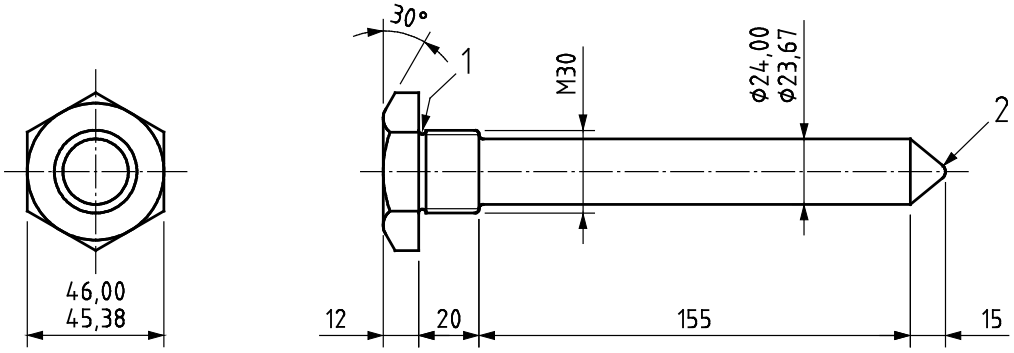


Figure E.5 — Bracket retaining pin for 340 kN Lifting Bracket (normative)

Annex F
(informative)

Migration rule for this European Standard

The obligation to apply a standard can be stated by law, a regulation or a private contract, but cannot be stated in the standard itself. However, the stakeholders who are represented in the CEN Technical Committee responsible for the standard are of the opinion that the standard should be applied as follows.

Unless specifically called for by a European Regulation or TSI, the standard, for which the CEN received a mandate by the EC under the Interoperability Directives, should NOT be used for homologation and certification or authorization for putting into service purposes of rolling stock, when such rolling stock falls under one of the following exemption categories:

— rolling stock that is purchased under a contract already signed or was at the final phase of the tendering procedure at the date of publication (dop) of this European Standard;

— renewed or upgraded rolling stock where the work that would be necessary to achieve compliance requires structural alterations that would necessitate re-validation of the vehicle structural integrity.

Also exempt during a transitional period are:

— rolling stock that are purchased under options of contracts already signed, or at the final phase of a tendering procedure, at the date of publication (dop) of this European Standard;

— rolling stock built in accordance with an existing design approval, having received a homologation, certification or an authorization for putting into service within the European Union before the date of publication (dop) of this European Standard, which is purchased under contracts signed during this transitional period.

The proposed transitional period of 4 years should start from dop.

These exemptions should continue to apply during the whole operational life of the rolling stock concerned, and would also include parts for maintenance and repair, as long as this rolling stock is neither renewed nor upgraded.

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 mandates 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 Freight Wagons and Table ZA.2 for Locomotives and Passenger Rolling stock 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 Commission Regulation (EU) 321/2013 concerning the technical specification for interoperability relating to the subsystem 'rolling stock – freight wagons' of the rail system in the European Union

Clauses/ subclauses of this European Standard	Chapters/§/annexes of the TSI	Corresponding text, articles/§/annexes of the Directive 2008/57/EC	Comments
The whole standard applies	4. Characterisation of the subsystem 4.2 Functional and technical specifications of the subsystem 4.2.2 Structures and mechanical parts §4.2.2.2 Strength of unit 4.3 Functional and technical specification of the interfaces §4.3.2 Interface with the subsystem "operation and traffic management" Appendix C: Additional optional conditions C.4 Free space under lifting points	Annex III, Essential requirements 1 General requirements 1.1 Safety Clause 1.1.1, 1.1.3, 1.1.5 2. Requirements Specific to Subsystem 2.5 Maintenance 2.5.1 Health and safety 2.5.3 Technical compatibility	

[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 Commission Regulation (EU) No 1302/2014 a technical specification for interoperability relating to the 'rolling stock — locomotives and passenger rolling stock 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 applies	4. Characterisation rolling stock of the subsystem 4.2 Functional and technical specification 4.2.2 Structure and mechanical parts §4.2.2.6 Lifting and jacking 4.2.12 Documentation for operation and maintenance §4.2.12.5 Lifting diagram and instructions Appendix C: Special provisions for on-track machines (OTM) C.2 Lifting and jacking	Annex III, Essential requirements 1 General requirements 1.1 Safety Clause 1.1.1, 1.1.3, 1.1.5 2. Requirements Specific to Subsystem 2.5 Maintenance 2.5.1 Health and safety 2.5.3 Technical compatibility	The standard is applicable to On-track Machines only for transit mode.

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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