BRITISH STANDARD

BS EN
15179:2007

Railway applications — Braking — Requirements for the brake system of coaches

The European Standard EN 15179:2007 has the status of a British Standard

ICS 45.060.20

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 15179.

EN 15179 has been drafted to support the rolling stock technical specification for interoperability (TSI) for passenger coaches and carriages. The scope of EN 15179 is limited to coaches and carriages interchanged under the RIC (Regolamento Internazionale Carrozze — an agreement governing the exchange and use of coaches in international traffic) arrangements, and as such is not warranted to be compatible with coaches used solely in the UK. The UK has not used the UIC air brake as the basis for the brake system design and there are a significant number of references to UIC leaflets, for which the suitability for use in the UK has not been verified. These leaflets represent historical best practice on railways that have used UIC (Union International des Chemins de Fer — the International Union of Railways) practice, and in some cases these leaflets are not up-to-date. Users should be aware of the requirements of the TSI before making use of EN 15179.

Annex E has been produced specifically to support the application of this standard in the UK.

The UK participation in its preparation was entrusted to Technical Committee RAE/2, Railway track components.

A list of organizations represented on RAE/2 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.

Compliance with a British Standard cannot confer immunity from legal obligations.

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CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

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Foreword

This document (EN 15179:2007) 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 2008, and conflicting national standards shall be withdrawn at the latest by March 2008.

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Currently, in the standard gauge area, there are EU regulations in the form of interoperability directives and the associated TSI that also contain specifications for the braking of railway vehicles. Before this time, brake engineering regulations only existed as internal railway documents in the form of UIC leaflets.

Agreements based on these govern the conditions for vehicle transfers between the individual railways. The relationship between the infrastructures and the minimum brake engineering requirements on trains and their individual vehicles is defined in EN 14198.This covers mainly generic vehicle regulations that should be assigned to individual vehicles by corresponding specifications.

With this European Standard, all suppliers will in future be able to offer in a Europe-wide tender invitation passenger coaches that have a defined basic brake engineering system and meet the minimum brake engineering requirements, taking into account the vehicle types

1 Scope

This European Standard defines basic requirements for the braking of passenger coaches in trains hauled by locomotives as described in EN 14198, using UIC air brakes (RIC traffic) operating on routes of the European railways and their infrastructure systems.

Normative Annex E is provided for passenger coaches limited to internal use in the UK.

This European Standard covers:

— all new vehicle designs of the passenger coach type of construction (day coaches, restaurant cars, sleeper coaches, driving trailers, baggage cars, couchette coaches);

— all new constructions of existing vehicle types;

— other vehicles (e.g. motorail vehicles) that may also be included in passenger trains;

— all major overhauls of the above-mentioned vehicles if they involve redesigning or extensive alteration to the brake system[1] of the vehicle concerned.

The vehicles meet the following technical criteria:

— inclusion in trains in accordance with EN 14198 in regular railway operation is possible (coupling capacity);

— the maximum speed is between 100 km/h and 200 km/h;

— the lower vehicle limitations of prEN 15273-1, prEN 15273-2, prEN 15273-3 are adhered to.

2 Normative references

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

EN 286-3, *Simple unfired pressure vessels designed to contain air or nitrogen — Part 3: Steel pressure vessels designed for air braking equipment and auxiliary pneumatic equipment for railway rolling stock*

EN 286-4, *Simple unfired pressure vessels designed to contain air or nitrogen — Part 4: Aluminium alloy pressure vessels designed for air braking equipment and auxiliary pneumatic equipment for railway rolling stock*

EN 10220, *Seamless and welded steel tubes — Dimensions and masses per unit length*

EN 10305-4, *Steel tubes for precision applications — Technical delivery conditions — Part 4: Seamless cold drawn tubes for hydraulic and pneumatic power systems*

EN 10305-6, *Steel tubes for precision applications — Technical delivery conditions — Part 6: Welded cold drawn tubes for hydraulic and pneumatic power systems*

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[1] or alterations to the vehicle weight also.

EN 14198:2004, *Railway applications — Braking — Requirements for the brake system of trains hauled by a locomotive*

EN 14478:2005, *Railway applications — Braking — Generic vocabulary*

EN 14535-1, *Railway applications — Brake disks for railway rolling stock — Part 1: Brake discs pressed or shrunk onto the axle or drive shaft, dimensions and quality requirements*

EN 14601, *Railway applications — Straight and angled end cocks for brake pipe and main reservoir pipe*

prEN 15220-1, *Railway applications — Brake indicators — Part 1: Pneumatic operation brake indicators*

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

prEN 15273-3, *Railway applications — Gauges — Part 3: Obstacle gauge*

prEN 15327-1, *Railway applications — Passenger alarm subsystem — Part 1: General requirements and passenger interface for the passenger emergency brake system*

prEN 15328, *Railway applications — Braking — Brake pads*

prEN 15355, *Railway applications — Braking — Distributor valves*

prEN 15595, *Railway applications — Braking — Wheel slip prevention equipment*

prEN 15611, *Railway applications — Braking — Relay valves*

prEN 15612, *Railway applications — Braking — Brake pipe accelerator valve*

EN 50125-1, *Railway applications — Environmental conditions for equipment — Part 1: Equipment on board rolling stock*

prEN 14535-2[2], *Railway applications — Brake discs for railway rolling stock — Part 2: Brake discs mounted onto the wheel rim, wheel web or wheel hub, dimensions and quality requirements*

UIC 541-1:2003[3], *Brakes — Regulations concerning the construction of the various brake components*

UIC 541-3:1984, *Brakes — Disc brakes and their application —- General conditions for the approval of brake pads*

UIC 541-5, *Brakes — Electro-pneumatic brake (ep-brake) — Electro-pneumatic emergency brake override (EBO)*

UIC 541-06, *Brakes — Regulations concerning the construction of the various brake components — Magnetic brakes*

UIC 544-1, *Brakes — Braking power*

UIC 545:2003, *Brakes — Inscriptions, marks and signs*

UIC 546, *Brakes — High-power brakes for passenger trains*

UIC 550, *Power supply installations for passenger stock*

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[2] To be published.

[3] Available from: UIC Direction Générale, 16 rue Jean Rey, F-75015 Paris.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14198:2004, EN 14478:2005 and the following apply.

3.1
passenger coach
vehicle without its own traction unit, for conveying people and comprising

— a body;

— running gear (e.g. 2 bogies);

— specific connectors at coach ends (coupling capacity);

— brake installation;

— service installations for passengers (air conditioning, catering, luggage transport etc.);

— a driving cab if the vehicle is a driving trailer.

Passenger coaches may also comprise two or more bodies with associated running gear (modules) forming a functional unit. The connectors (connections) between the modules may be individually designed. The end connectors of the functional unit should be suitable for the interchange conditions. Coaches for which special traction units are mandatory (ICE, TGV) are not considered to be passenger coaches

3.2
automatic train brake
brake at train level, the action of which is based on the fact that a break in the brake pipe (pipe for control commands) in the two parts of the train automatically leads to application of the brakes

3.3
brake release device
device operable from each side of the coach which, when operated, releases the brake

NOTE In UIC distributors, this equalizes the pressure in the control chamber to the value of the pressure in the brake pipe or below

3.4
brake release
device operable from each side of the coach which, when operated, releases the brake

3.5
load-proportional brake
control device for automatically matching the brake force to the specific vehicle load, whereby the adjustment may be in steps or continuous

3.6
indicating and warning devices
devices that show the status of the brake system or sub-systems. The information is given by windows, position of handles, analogue gauges, digital displays, lamps or buzzers

NOTE For indicating the status in service, a binary indication (on/off) is used. Analogue gauges (dials or digital displays) are for maintenance purposes

3.7
end cock
device according to EN 14601

3.8
brake hose couplings
flexible hose connections at the end of the coach with brake-hose coupling head to UIC 541-1, of different shapes for brake pipe and main reservoir pipe

NOTE A European Standard is in preparation for this (WI 00256241)

3.9
auxiliary tread brake
tread brake acting generally on one side of the wheels to support the power of the disc brake.

3.10
release time
on brake release, the time taken for the brake cylinder pressure to fall in accordance with prEN 15355

3.11
maximum mass
sum of the operating load of the coach and the maximum payload

NOTE 1 In contrast to the total mass, it takes into account extreme occupancy

NOTE 2 A European Standard is in preparation for this (WI 00256224).

3.12
laden mass
sum of the operating load of the coach and the nominal payload

NOTE A European Standard is in preparation for this (EN 00256224).

3.13
constant mass assumption
fictional value for the mass of the passengers in a coach. It is based on 100 % of seats occupied. The mandatory constant mass assumption is specified in UIC 410 for the different types of vehicles

NOTE A European Standard is in preparation for this (WI 00256224).

4 Symbols and abbreviations

For the purposes of this European Standard, the following symbols and abbreviations apply in accordance with existing UIC leaflets:

BP: Air brake pipe

MRP: Main reservoir pipe

DBV: Driver's brake valve

ED: Electro-dynamic brake

EP: Electro-pneumatic brake

ep(UIC): Electro-pneumatic brake as specified in UIC 541-5

BA: Brake pipe accelerator

FRA Federal Railway Authority

RCOR Railways Construction and Operating Regulations

WSP: Wheel slide protection

HD: Hydro-dynamic brake

EP/EBO: Electro-pneumatic emergency brake override

Mg: Magnetic track brake

RGS Railway Group Standard

Wb Eddy-current brake

λ: Effective braking power

R: Air reservoir

On/Off: Brake On/Off controller

G, P, R: Brake positions according to UIC

DV: Distributor valve

AL: Automatic load-proportional brake

SO Top edge of rail

5 Requirements

5.1 General

The Railway Authorities shall include this European Standard as part of the requirements for the brake installation. The manufacturers shall indicate in the tender where the requirements of the standard are not met.

Vehicles as specified in this standard shall totally meet the relevant generic requirements described in EN 14198 for the train and the resulting requirements for the individual vehicles.

These requirements are defined for the individual vehicle in the clauses:

— brake control;

— thermal capacity;

— brake performance;

— other brake components.

The specific requirements are allocated in vehicle classes. The specific brake systems mandatory for the particular vehicle class are contained in Table A.1.

Each vehicle class is divided into subclasses for additional brake devices.

5.2 Climatic conditions

In general, the requirements of EN 50125-1 apply. The requirements listed below are minimum requirements. The temperature class according to EN 50125-1 shall be specified by the Railway Authoritiy.

The functional ability of the brake shall be achieved under the following conditions unless deviations have been agreed for the associated vehicle:

— outside temperature – 25 °C to + 40 °C (in sunshine up to + 70 °C);

— altitude up to 1 370 m above sea level;

— relative humidity up to 100 %;

— snowfall, lying snow up to 300 mm above top edge of rail;

— rain, ice;

— gusts of wind up to 30 m/s

The special climatic conditions in tunnels (e.g. Simplon up to 27 °C and 100 % relative humidity in winter also) should be noted.

5.3 Brake control

5.3.1 Basic principles

The brake installation for each vehicle shall meet the requirements of the UIC brake system.

The basic system arrangement is shown in Figure H.1.

If other brake systems are used, the UIC brake system shall be subordinate as a pneumatic back-up brake (safety level). With the UIC-type brake system, it is allowed to provide electro-pneumatic control support for the BP.

The functional arrangement of the system is shown in Figure H.2.

The brake control system shall be able to provide the passenger train and goods train brake types and the associated brake positions and have the standardized operating and indicating devices on the coach sides.

5.3.2 Components of the basic system

The components described in the following are brake components in the coach that are to be assigned to train level 5 or vehicle level 6 in accordance with Figure H.2.

5.3.2.1 Air brake pipe (BP) and main reservoir pipe (MRP)

All vehicles shall be equipped with a continuous air brake pipe (BP) and a continuous main reservoir pipe (MRP) in a bifurcated connection each with an inside diameter of at least 25 mm. The basic function of the brake system (transmission of braking command and control function, energy supply) shall be possible via the BP alone. The compressed air in the BP shall not be used for other purposes not related to the brake installation.

The compressed air in the MRP can be used for supplying energy to other loads in the vehicle (door operating, toilets, air springs etc.) in addition to supplying energy for the brake installation.

The air pipes shall be installed free of water collection pockets and be as straight as possible utilizing large bend radii (minimum dimension for bend radius $5 \times D_a$ = outside diameter). The bifurcation shall be achieved by means of a Y-connection. Filters or other components that would reduce the cross-section of the BP shall not be fitted. If low points are unavoidable in routing the pipes, easily accessible drainage devices shall be fitted.

Free passage through BPs and MRPs shall be capable of being verified by means of a ball test. The diameter of the ball to be used shall be 19 mm. Steel pipes used shall meet the requirements of EN 10220 or EN 10305-4 or EN 10305-6.

The number of pipe fittings used shall be kept to a practical minimum and all fittings shall be accessible without having to disassemble other equipment.

Connections consisting of threads on the pipes are not permitted.

The pipe connections at the coach end shall meet the UIC requirements. A recommended method of fitting is described in 5.3.2.6. This takes account of the installation space for the end cocks and the space requirement of other pipe connections also for the possible counter-movements of the vehicles to be coupled.

5.3.2.2 Controller

Every vehicle shall be equipped with at least one distributor valve which complies with the requirements of prEN 15355. The maximum BP volume of 25 l shall be assigned to any distributor valve.

For connection into the coach brake system, the diagram illustrated in Figure H.2 of this European Standard applies.

The controller indicated as item 10 is connected by its large pipe cross-section to the BP and is connected to the E-store (reserve air tank (R-tank) and the devices generating the brake force thus allowing single-pipe operation (operation without MRP). The supply to the energy store is from the BP through the controller.

Every controller shall be equipped with an isolation device that can be operated from both sides of the vehicle.

Every controller shall be equipped with one or more isolation devices that can be operated from both sides of the vehicle. Operation of these devices shall isolate the controller from the brake pipe and the main reservoir pipe and isolate any other brake related devices (e.g. track brake, etc.) from the main reservoir pipe. The brake cylinders and the auxiliary reservoir shall then be vented, either automatically or manually using another control device that can also be operated from both sides of the vehicle. Free passage of air through the BP and MRP shall be maintained on that vehicle.

Every controller shall also be equipped with a device that allows the brake on that vehicle to be released when it is applied (release valve).

Every controller shall be equipped with a mode switch for the selection of brake positions (e.g. G, P, R, R+Mg) that can be operated from both sides of the vehicle.

Test points shall be fitted for the verification of the correct functioning of the controller; at least the output pressure and the load- and speed-dependent pressures, e.g. brake cylinder pressures.

5.3.2.3 Energy store

Every controller shall be connected to an energy store so that energy can be fed from this store into the devices generating the brake force when a brake command is given. The energy store shall be dimensioned so that, when the brake is applied, the available brake power at each point in the train journey and for all track conditions meets the requirements of the UIC brake system. The inexhaustibiity as defined in EN 14198 shall be achieved.

The energy store for pneumatically-operated brake systems shall also be fed from the MRP via filter, pressure-reducing valve, isolating cock and non-return valve.

The energy store for compressed air shall be in accordance with EN 286-3 and EN 286-4. Maintenance aspects are covered by UIC 541-07 or other applicable documents, e.g. DIN 5590 and DIN 5580.

Requirements of the energy stores for electrically-operated brake systems shall be according to UIC 550.

5.3.2.4 Passenger emergency brake and emergency brake override

5.3.2.4.1 Basic principles – system interfaces

All passenger vehicles shall be equipped with a passenger emergency brake.

The passenger emergency brake is located in the "Decentralized command initiation for automatic application of brakes" block (see EN 14198 and Figure H.1 of this European Standard) and on actuation of an operating element (emergency brake handle according to prEN 15327-1) initiates the triggering of an emergency brake valve and thus the activation of the automatic brake of the train. Automatic application of the brake at train level is initiated. Activation of the automatic train brake by operation of an emergency brake handle shall also be possible with the vehicle brake isolated.

When a passenger emergency brake handle has been operated, it shall be automatically locked in this position.

An activated emergency brake becomes ineffective with the actuation by the train crew of the resetting device on the applied emergency brake box or activation of the EBO by the train driver in accordance with the operating regulations of the Railway Authorities.

The signals between the emergency brake handle and the emergency brake valve may be transmitted pneumatically, electrically or mechanically. The signal line shall not be capable of being interrupted/blocked. An exception is the EBO.

The requirements of Clause II of UIC 541-1:2003 and prEN 15327-1 shall be met. The relevant provisions of the national approval authorities shall be met, unless superordinate regulations exist.

5.3.2.4.2 Emergency brake override (EBO)

An emergency brake override function shall be provided if mandatory in the vehicle specification. Equipping with EBO is mandatory for travelling over certain infrastructures (e.g. high-speed tracks, tracks with long tunnels). For details concerning rolling stock used only nationally or in bilateral traffic, see national regulations.

The aim of the EBO is for the applied passenger emergency brake to be overridden through a positive action of the driver in accordance with the operating rules of the relevant railway in order to keep the train in motion or to enable an immediate restart.

In order to attain the shortest release time of the brake, all vehicles equipped with the EBO function shall be equipped with an ep assist brake.

In order to signal clearly to the driver that the passenger emergency brake has been applied and to enable him to override it quickly, where appropriate, the status shall be clearly indicated by an indicator light or audibly by a horn or announcement in the active cab. In the vehicle/train section in which the emergency brake has been applied, a red flashing indicator light shall indicate to the crew the emergency brake that has been applied until the emergency brake handle is reset.

It shall be possible to test the signal transmission paths for the applied emergency brake and the emergency brake override within the context of the brake test in the train.

For trains hauled by locomotives, the EBO systems as specified in UIC 541-5 with control via a separate line as shown in Figure H.4 shall be used.

NOTE Other national systems are currently in use and may continue to be used for internal traffic of certain Railway Authorities, e.g. the DB system with control via a UIC 558 line. A functional description of this system is included in Annex F for information.

5.3.2.4.3 Operating elements of the passenger emergency brake

Vehicles conveying passengers shall have clearly visible and accessible emergency brake handles by means of which emergency braking is possible. Erroneous activation of the device shall not be possible

The passenger shall be able to reach emergency brake handles without having to pass through a door. In the vestibules at the ends of the coaches and in the toilets and washrooms, no emergency brake handles need to be deployed.

The technical design of the emergency brake handles is specified in prEN 15327-1. Guidelines as to the location of these components within the vehicle are given in Annex F.

5.3.2.5 Indicator and actuation devices

Each vehicle shall be fitted with devices to enable functional testing, monitoring and actuation of the brake installation. These devices shall also permit testing of the brakes in service (brake test) in accordance with the regulations of the Railway Authorities.

These devices shall meet the requirements of the following regulations:

— for changeover devices: UIC 541-1;

— for quick release valves: UIC 541-1;

— for brake isolating cocks: UIC 541-1;

— for disk brakes: prEN 15220-1;

— for magnetic track brakes: UIC 541-06;

— for regenerative brakes: UIC 546.

The following general principles apply:

— visible and operational from both sides of the vehicle;

— clear and unmistakeable indication of the status of the associated brake equipment from both sides of the train. Indicator panels in intermediate positions (split colour panels) are not allowed;

NOTE Sudden and smooth changeover from one indication status to the other: "smooth" is understood to mean that the changeover period from one indicator status to the other is not to exceed 2 s. Deviation from this is permitted if the changeover phase is clearly recognized by the tester

— clear assignment of the indicator panels to the object principle: a specific indicator panel shall be provided for each distributor/load brake valve. Indicator panels shall be marked only for handbrake or spring-loaded brake;

— if more than one signal source supplies an indicator panel, the following priority shall apply;

— brake functional;

— brake not released;

— brake released.

If it is not possible to evaluate the information from several signal sources conclusively on one indicator panel, the signal sources shall be separated.

The correctness of the match of the colours and symbols with the actual state of the brakes shall be ensured. .

5.3.2.6 Coach connections

The arrangement of the brake components at the end of the coach shall be in accordance with EN 14601. Connections shall be arranged as shown in Figures H.3, H.4 and H.5.

Figure H.3a shows the arrangement of the communications jumpers in accordance with UIC 568. These jumpers transmit low-power 24 V electric signals and commands.

Figure H.3c shows the layout of the BP and MRP. The double arrangement of the pipe outlets (bifurcation) is mandatory so that the hose connections cannot be crossed.

The handles (F) for the isolating cocks shall be mounted opposite the drawgear, i.e. left-hand and right-hand types shall be used. The handle position shown indicates the closed cock position.

5.3.3 Additional braking devices

5.3.3.1 General

Equipping coaches with additional braking devices is regulated according to the subclasses of the coach classes in Table A.1

5.3.3.2 ep-brake

The requirements of UIC 541-5 shall be met. Figure H.4 illustrates the installation of the UIC ep-control cable. The associated dimensions are given in Table 1.

In addition, other ep-brake control systems (e.g. via the UIC-IS line, cores 9 to 12, according to UIC 558) may be agreed upon. Installation of the cables is shown in Figure H.5.

Table 1 — Table of dimensions relating to Figure H.4

XX Coupling cable	
A	475 to 660
B	125 to 375
C	530 to 600/650[a]
L	1440 to 1450
α	25° to 35°
a 650 mm allowed for passenger coaches	

YY Dummy socket	
D	Freely selectable providing all other dimensions specified in Figure H.4 are respected
E	
F	

ZZ Socket	
G	475 to 660[b]
H	125 to 275
I	535 to 605
β	0 to15°
b The dimension G_{max} = 660 mm may be increased by ΔG if the dimension I_{max} = 605 mm is reduced by ΔI simultaneously ($\Delta I = 0{,}75\ \Delta G$). ΔG_{max} 80 mm	

5.3.3.3 Magnetic track brake

The requirements of UIC 541-06 shall be met.

The requirements of this subclause also apply if a different source of energy is required for operating the Mg brake.

NOTE Additional requirements on the Mg brake will be contained in a future European Standard.

5.3.3.4 Brake pipe accelerator

The accelerator shall be designed in accordance with prEN 15612.

5.3.3.5 Wheel slide protection

Passenger coaches with brake positions R and R+Mg shall be equipped with wheel slide protection according to the requirements of prEN 15595.

For passenger coaches with only brake position P, the use of wheel slide protection is recommended.

If several brakes act on one axle or wheel, the brakes may be controlled by just one wheel slide protection system or by separate wheel slide protection systems. In both cases, careful matching is required so that the wheel slide protection function is reliably ensured (i.e. braking distance optimization in the event of unfavourable wheel/rail adhesion conditions, prevention of wheel locking).

The wheel slide protection system shall be selected such that a reduction in the total brake force on the relevant axle to zero can be achieved reliably (to prevent wheel locking).

5.4 Thermal capacity

5.4.1 Principles

The following braking modes are to be considered with regard to the operating conditions:

a) braking to a stop

Two rapid successive operations from maximum speed at maximum weight on the level with fully functional brake installation without the effect of any adhesion value independent brakes.

b) drag braking

Requirements from downward runs (drag braking) and failure scenarios (brake faults) shall be taken into account if they are not covered by the most unfavourable agreed operating case.

The reference travel section is currently the Gotthard-Süd route between Airolo and Biasca with v_{max} = 80 km/h, a mean gradient of i = 21 ‰ and a distance of 46 km.

If higher or lower performance requirements for both a) or b) above are necessary or possible, then these performance requirements shall be defined by the lead Railway Authorities in the form of brake load collectives (most unfavourable operating case agreed)

5.4.2 Disc brake

The disc brake represents the main component of the mechanical brake installation.

It consists of axle-mounted brake discs in accordance with EN 14535-1 or wheel-mounted brake discs in accordance with prEN 14535-2 and the associated brake actuators. The disc brake shall automatically adjust to compensate for the wear of the brake pad and the brake disc. It shall be possible to incorporate parking/handbrake functions.

Brake pads in accordance with prEN 15328 shall be used. The products to be used may be specified by the purchaser.

When installing axle-mounted brake discs, the bottom reference line as specified in Figure 4 of prEN 15273-2:2005 for the smallest possible wheel tread diameter shall not be exceeded.

The following wheelset load/brake disc limit values are recommended for standard cast iron brake discs and organic brake pads in accordance with UIC 541-3 up to 200 km/h:

Axle-mounted brake disc	∅ 610 x 110 mm	5,8 t
Axle-mounted brake disc	∅ 640 x 110 mm	6,0 t
Wheel-mounted brake disc	∅ 610 mm	5,5 t

Limit values deviating from these (e.g. for other friction surfaces or conditions of use) may be agreed upon, in which case, the procedure described in 5.4.1 shall be followed.

5.4.3 Tread brake

New vehicles shall not in principle be equipped with a tread brake as the only effective adhesive value dependent brake.

Use as an additional tread brake supplementing the disc brake is permitted. Its maximum proportion of power is 20 % of the total power of the brake system relative to the brake force at the circumference of the wheel for disc brakes.

The brake system shall automatically adjust to compensate for the wear of the brake block and the wheel.

The friction materials for the cast iron brake blocks and their geometrical form are defined in prEN 15329 and WI 00256239.

5.4.4 Dynamic brakes

Dynamic brakes replace or supplement the friction brake. They shall be designed as a self-contained subsystem of the coach as electro-dynamic, hydraulic or eddy-current brakes and be controlled via the central brake control pipe. The brake force characteristic for the same brake requirement (BP pressure step) shall be the same as that resulting from the requirements for the brake control and brake mechanics.
The braking power with blending shall also comply with these requirements. The power required in the different brake positions shall be met in accordance with 5.5.

5.5 Brake performance

5.5.1 General

The brake components of passenger train coaches shall be capable of supplying the required braking performances related to the stopping distance.

Each brake position corresponds to a specific braking performance range. The brake positions are assigned to the vehicle classes in Annex A. A general overview is given in Annex B.

All wheelsets shall be braked in such a way that the level of wheel/rail adhesion demanded is nominally the same for all wheelsets.

The quotient of the brake force relative to the wheel circumference and wheel contact surface force shall be approximately the same for all the wheelsets. Deviations may be agreed upon. The conditions of UIC 544-1 shall be adhered to regarding adhesion value limits.

The brake force in the individual brake positions is expressed by the braked weight.

The braked weight shall be inscribed on the vehicle. Details are specified in 5.6.3.

If the vehicle classification according to Annex A and Annex B is maintained, it is possible for operational reasons to inscribe a smaller braked weight.

The braked weight will be determined according to UIC 544-1.

5.5.2 Brake positions (basic system)

5.5.2.1 Brake position G

The requirements of prEN 15355 shall apply.

5.5.2.2 Brake position P

The requirements of prEN 15355 and prEN 15611 shall apply.

5.5.2.3 Brake position R

The requirements of prEN 15355, prEN 15611 and UIC 546 shall apply.

5.5.3 Brake positions and additional brake system

5.5.3.1 Brake position with brake pipe accelerator

The brake pipe accelerator as described in 5.3.3.4 is effective principally in all brake positions.

The efficiency of the brake pipe accelerator shall only be regarded in the brake calculation if the brake is operated in the brake positions R and R+Mg.

The braked weight including the brake pipe accelerator is inscribed in red figures on the coach.

5.5.3.2 Brake position with Mg-brake

The requirements of UIC 541-06 shall apply.

5.5.3.3 Brake position with ep-assist brake

For installed ep-assist brake components, no special brake position is to be provided in passenger coaches. The ep-braking command shall be provided exclusively by the driver's brake valve in the driving cab. Isolation devices are only provided in the case of defects/malfunctions. The ep-assist brake status according to UIC 541-5 is detected by the control unit in the driving cab.

5.5.3.4 Brake position with automatic load-proportional braking

For automatic load-proportional braking, no additional brake positions exist. Its existence is identified in the brake inscription in accordance with UIC 545. Automatic load-proportional braking is to be provided if the empty/loaded ratio of the vehicle for the high performance brake <R> in accordance with UIC 546 is more than 1,26 and for the brake pipe accelerator R_{rot} it exceeds the value 1,14. The technical design is in accordance with prEN 15611 and prEN 15625.

5.6 Other brake components

5.6.1 Parking brake

Each coach shall be equipped with a parking brake.

The parking brake shall be act on at least half of all the wheelsets, but on at least two of them. It shall securely hold the empty vehicle on a gradient of 35 ‰. The braked weight is determined according to UIC 544-1.

An indicator shall be provided so that the application status of the parking brake can be easily determined. Deviations shall be agreed in the specification sheets.

The holding effect shall result from a force on the handwheel of 0,5 kN.

Where a parking brake is operated by a handwheel, it may be accommodated behind a flap with a square key closure. This flap shall be marked with the handbrake symbol as specified in Annex 10 of UIC 545:2003.

5.6.2 Arrangement of components at the end of the coach

Figure H.5 shows the geometric relationships of the components to be fitted at the end of the coach in accordance with the relevant dimensional tolerances.
The dimensions for the drawgear and buffing gear and the Berne rectangle (specification in the "Technical Unit for Railway Vehicles") are invariable.

These areas take into account the geometry of the adjacent vehicle during coupling operations, the buffer stroke, the lateral and the angular misalignment when negotiating tight and reverse curves and defined transitions. The lower vehicle gauge (see also clause 1 of this European Standard) shall not be exceeded under extreme conditions and the pipes shall not part.

5.6.3 Brake inscriptions and braked weight inscriptions

5.6.3.1 General

All braked weights inscribed on the vehicle (except hand/parking brake) relate to the brake pipe control level.

5.6.3.2 Principles

The following shall be inscribed on each side of each vehicle in a position that is unmistakably and easily legible for the operating personnel:

— designation of the brake;

— braked weights;

— vehicle masses.

It shall be clear as to which designation applies to what.

5.6.3.3 Designation of the brake

The designation of the brake is formed by a line of different individual designations such as the type of brake, existing brake positions, additional brake components and gives information on the brake system of each particular vehicle.

The individual designation groups listed below are formed and in this order are binding for the composition of the short designation:

1 brake types;

2 supplementary designations;

3 brake positions;

4 devices for brake force adjustment;

5 additional brakes;

6 information on wheel brakes;

7 special devices.

5.6.3.4 Braked weights

All braked weights inscribed on the vehicle (except hand/parking brake) relate to the brake pipe control level in accordance with the UIC regulations.

One braked weight shall be inscribed for each brake position available on the vehicle.

Details are specified in UIC 545.

If the total braked weight of one brake position results from brake installations that can be isolated individually, each individual braked weight shall be inscribed (e.g. P 2 x 30 t = 60 t).

The build-up of the braked weight inscriptions on the coach body is generally over two lines, with the highest braked weight beginning at the top left as follows:

R+Mg (red)	R (red)	P
-	R	G

If a brake pipe accelerator according to prEN 15612 is also fitted, the braked weight figures in brake positions R and R+Mg (R + WB) shall be inscribed in red. Where appropriate, the figure shall follow in white.

The braked weight inscriptions adjacent to the position selector shall correspond to those on the coach body.

5.6.3.5 Vehicle masses

The weight grid in RIC, sheet 3, contains the service mass, total mass, number of seats and load.

NOTE A European Standard is being prepared on this (WI 00256224).

5.7 Other specifications

5.7.1 Maintenance, accessibility

Collecting areas and easily accessible discharge possibilities shall be provided for any existing condensate as it is to be assumed that the pressurized air supply via BP and MRP will contain contamination and moisture. The condensate will be collected in air reservoirs it flows through or in settling tanks to be provided next to any brake control components

5.7.2 Fault finding

Diagnosis of the brake installation has the purpose of error detection and, principally, this shall be done by a maintenance workshop.

5.7.3 Operating conditions

5.7.3.1 Brake test

The brake test shall verify that all available brakes on each vehicle within a train formation function correctly before the train departs. For this, indicator and actuation devices as specified in 5.3.2.5 are available. The brake function is checked and verified in accordance with a driver action.

5.7.3.2 Travelling over high-speed routes

Travelling over high-speed routes is subject to the requirements of the High Speed TSI. These are not complied with by the passenger coaches as defined in this standard. The requirements of WI 00256190 and WI 00256237 apply.

5.7.3.3 Operation on routes with long tunnel sections

Certain national legislation requires specific technical conditions to be met for operation through long tunnel sections. These include measures in case of fire and evacuation at a suitable place. For this, the EBO according to 5.3.2.4.2 is mandatory.

5.7.3.4 Extraordinary conditions

Extraordinary conditions are specifically climatic conditions. If passenger coaches are operating under extreme climatic conditions, these requirements shall be specified as deviating from 5.2 of this European Standard in accordance with EN 14198

5.7.4 Special requirements for multi-section coaches (modular passenger train)

The following requirements apply to passenger coaches that consist of interconnected coach segments which can withstand breaking forces of at least 1 200 kN:

— controllers do not have to be allocated per coach but may be arranged within the coach segments according to 5.3.2.2. For these, additional brake equipment (Mg, Wb, HD) shall be assigned to these controllers.

NOTE A European Standard on multiple units will be prepared by WG 22.

5.7.5 Requirements for equipment fitted at driving positions in driving trailers

The driving positions of driving trailers shall be fitted with brake equipment identical to that installed in locomotives. Driver's brake valve, additional braking devices, emergency brake device, indicators for BP and MRP pressure, brake cylinder pressure and control switch for sanding equipment shall be fitted.

NOTE The requirements of UIC 651 and for driver's brake valves the requirements of UIC 541-03 should apply.

More details of the equipment to be fitted at driving positions are included in Annex D

5.8 Requirements for internal traffic in the United Kingdom

The requirements defined in this body of standards retain their validity if vehicles or trains are transferred from outside onto the United Kingdom network.

For internal traffic within the United Kingdom, the requirements for coaches contained in Annex E of EN 14198:2004 apply.

Specific requirements for passenger coaches are contained in Annex E.

Annex A
(normative)

Brake system of vehicles with UIC air brake

Table A.1 contains the passenger coach braking equipment required for each vehicle class. The vehicle classes and the associated train configurations are specified in EN 14198.

Table A.1 — Brake systems of passenger coaches with UIC brake system

		Vehicle class											
		A1				A2				A3			
Brake position	G (see UIC 543)	❍				❍				❍			
	P RIC- (see UIC 543)	●				❍				❍			
	R	-				●				-			
	R Rhombus	-				-				●			
	R red	-				--				-			
	R red + mg	-				-				-			
	R red + mg + ep	-				-				-			
Subclass		**.0**	**.1**	**.2**	**.3**	**.0**	**.1**	**.2**	**.3**	**.0**	**.1**	**.2**	**.3**
Additional brake device	ep UIC 541.5	-	●	●	-	-	●	●		-	●	●	
	EBO UIC 541.5	-	-	●	-	-	-	●		-	-	●	
	BA prEN 15612	-	-	-	●	-	-	-		-	-	-	
	Mg UIC 541.06	-	-	-	-	-	-	-		-	-	-	
	λ [a]	(see UIC 543)				(see UIC 546)				(see UIC 546)			

Table A.1 *(concluded)*

		Vehicle class											
		A4				A5				A6			
Brake position	G (see UIC 543	❍				❍				❍			
	P RIC- (see UIC 543)	❍				❍				❍			
	R	-				-				-			
	R Rhombus	-				●				●			
	R red	●				●				-			
	R red + mg	-				●				-			
	R red + mg + ep	-								●			
Subclass		**.0**	**.1**	**.2**	**.3**	**.0**	**.1**	**.2**	**.3**	**.0**	**.1**	**.2**	**.3**
Additional brake device	ep UIC 541.5	-	●	●		-	●	●		●	●		
	EBO UIC 541.5	-	-	●		-	-	●		-	●		
	BA prEN 15612	●	●	●		●	●	●		-	-		
	Mg UIC 541.6	-	-	-		●	●	●		●	●		
	λ [a]	(see UIC 543				(see UIC 546)				(see UIC 546)			

[a] The effective braking powers λ required in the UIC leaflets listed in clause 2 are determined in accordance with the requirements of UIC 544-1 based on the braking distances for rapid braking.

● equipment mandatory

❍ equipment optional

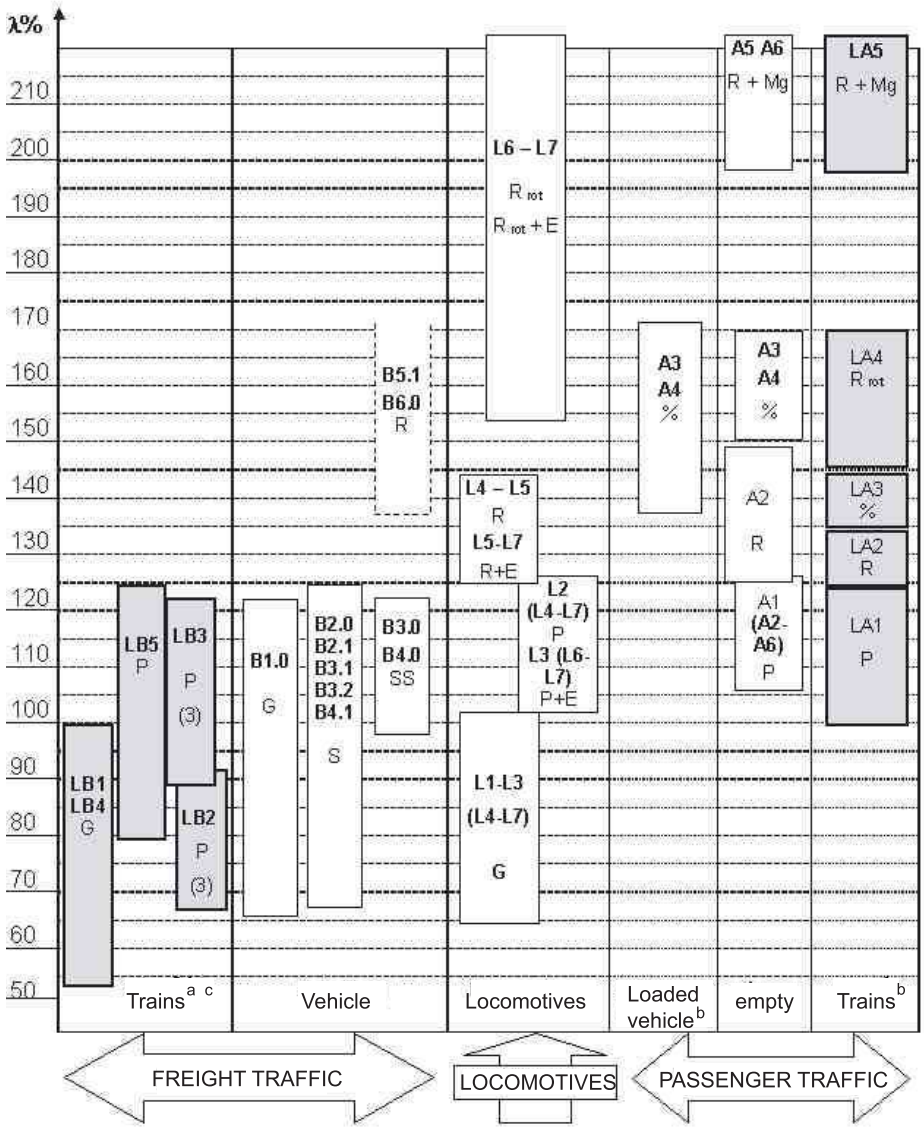
- not applicable

Annex B
(normative)

Common train configurations

Figure B.1 shows a summary of common train configurations and the mandatory effective braking power.

The train configurations are specified in EN 14198.



Key

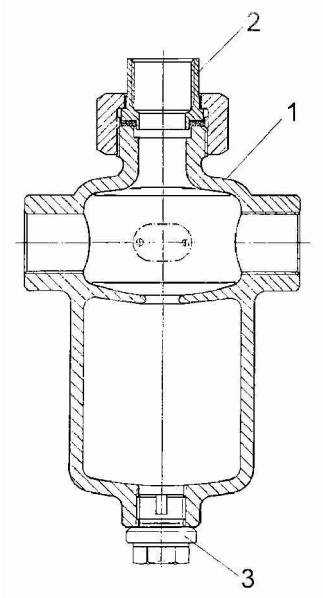
a) valid for load state normal mass
b) valid for load state total weight (= tare weight + allowance in accordance with UIC 410)
c) as a function of the length of the train as specified in UIC 421
X in %

Figure B.1 — Graphical representation of the vehicle-train composition-effective braking power relationships

Annex C
(informative)

Drainage devices, valves

Figures C.1 to C.4 show illustrations of drainage devices and valves.



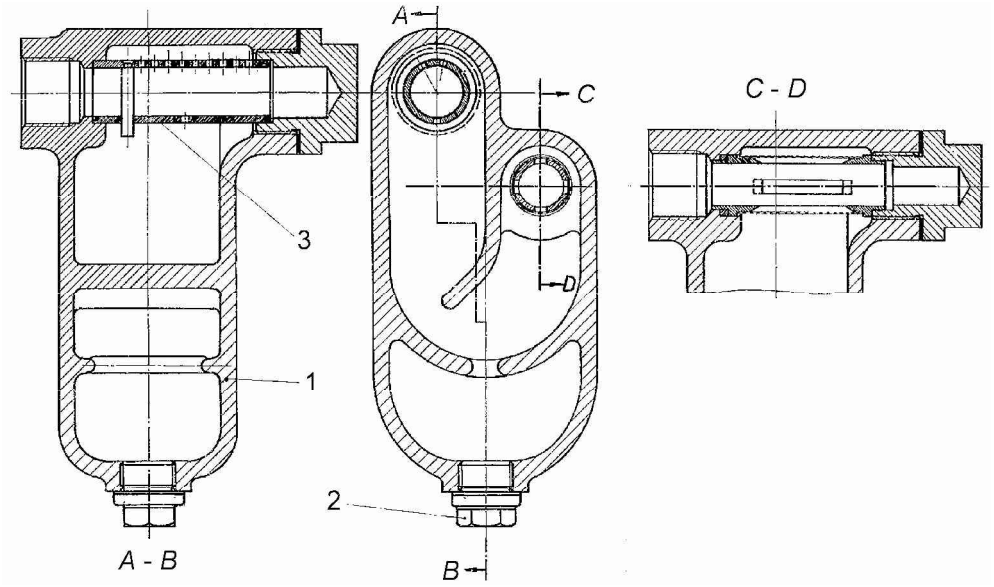
Key

1 Housing

2 Air branch to adjacent point

3 Screw plug as shown in Figure C.4

Figure C.1 — Drip cup with straight pipe passage and top connection for air branch to adjacent point



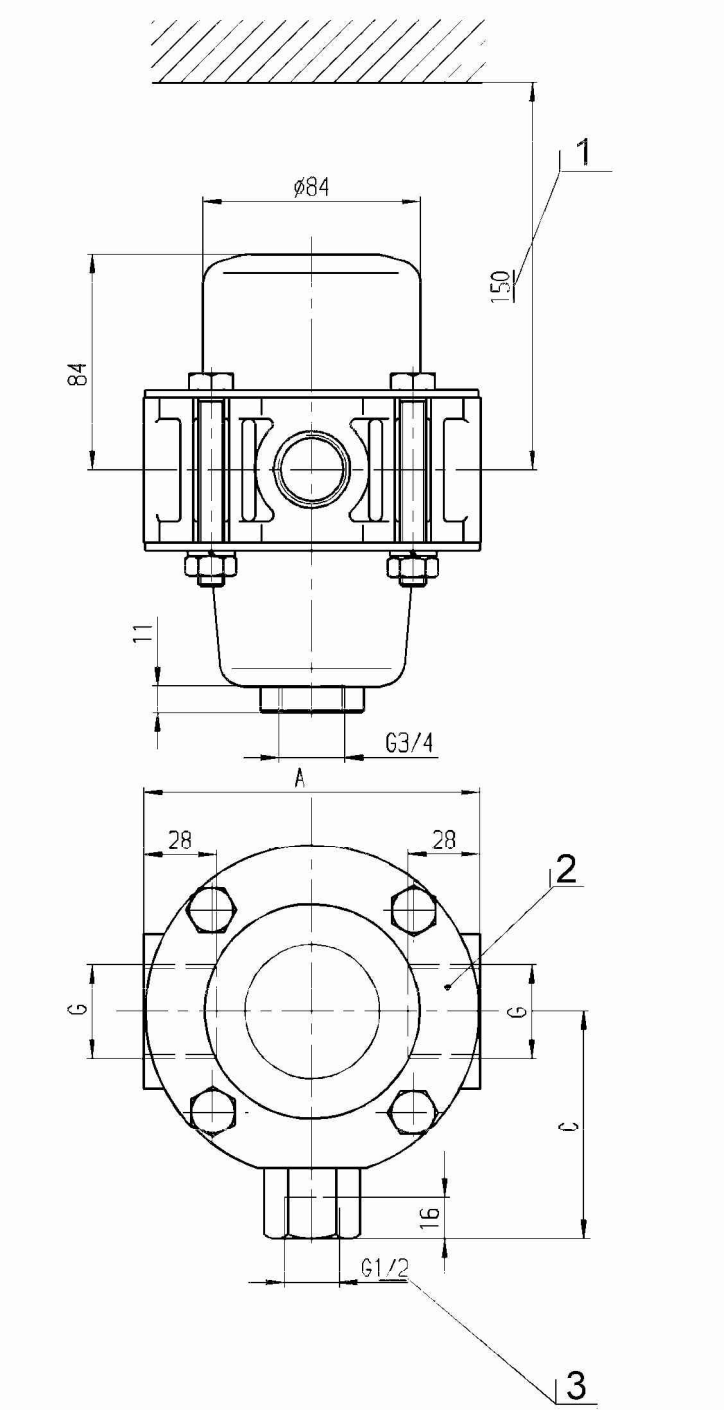
Key

1 Housing

2 Air branch to adjacent point

3 Screw plug as shown in Figure C.4

Figure C.2 — Air filter with filter insert and offset air passage



Key

1 Space for changing the filter insert

2 Brake pipe

3 To distributor

Figure C.3 — Air filter with side outlet, centrifugal filter

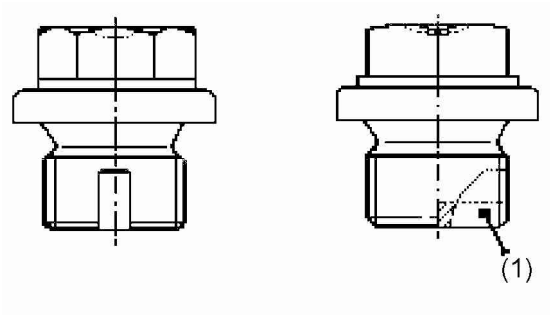


Figure C.4a — Type A - Sealing by means of sealing ring in accordance with DIN 7603

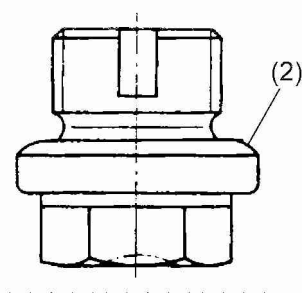


Figure C.4b —Type B - Sealing with fused-on seal

Annex D
(informative)

Equipment fitted at driving positions in driving trailers

The brake components listed in 5.7.5 represent the basic components for each driving position. In addition, there are a series of functions to be enabled that influence or indicate the braking functions.

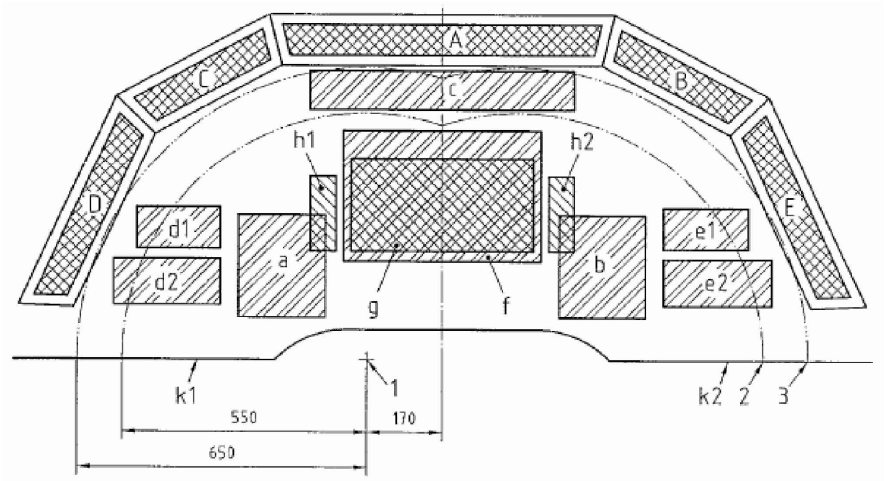
These are DBV functions such as filling stroke and assimilation control function and isolating device, indicators and operating elements for the ep/EBO. The DBV shall be capable of operating an emergency brake in any case that activates all the brakes of the train.

In addition, direct access to the BP shall be made available that initiates automatic application of the brakes.

The direct braking device acts directly on the brake force application system of at least the bogie and is used for holding the train for a short time during a service stop and directing shunting movements. For this, it shall be easy to control and it shall be possible to apply and release rapidly. Its brake force shall be equal to that of the brake position P.

The operating and indicating devices are arranged according to the usual practices of the Railway Authorities. For railways with right-hand drive operation, the arrangement shown in the figure below is often used.

Dimensions in millimetres



Key

Information levels

Upper operating level

Lower operating level

Key (*concluded*)

1	Shoulder point
2	Easy reach area
3	Maximum reach area
A	Speeds (commanded, actual, target, optimum,), traction and brake forces, displays important for service, (driver´s cab signalling, fault monitoring)
B	Displays for drive-independent brake installations, timetable information, if available
C	Displays of important operating values/plain text displays on fault finding results in the traction equipment and the total vehicle, alternative to B: timetable information
D	Preferred: telecommunications devices
E	If required, displays for dispatch and door-closing devices and other optional displays required by the user
a/b	Operating elements for traction and speed control command with integrated driver´s vigilance device, operating element for train brakes
c	Pushbuttons/switches to be operated frequently during the journey (e.g. headlamp, sand, train power supply, windscreen heating, instrument and document illumination), arranged in preferred groups
d1	Main operating elements of the traction devices (e.g. direction of travel, main switch, auxiliaries, start-up devices)
d2	Operating elements for train protection systems
e1/e2	others, and operating devices for the vehicle/train, mainly for dispatch device, train information in groups, selector for overhead energy supply
f	Space for written timetable documents
g	Large foot-operated switch for driver's vigilance device
h1/h2	Other possible foot-operated switches, currently second, independent operation of the signalling device in h2

Vertically to the left and right of the foot space:

k1	Further optional operating levels for auxiliary functions, e.g. air conditioning/heating and test switches and the like
k2	Emergency valve in extended reach area during seated operation, further auxiliary functions, e.g. windscreen wiper/washer installation

Figure D.1 — Arrangement of operating and information elements

Annex E
(normative)

Requirements for internal traffic in the United Kingdom

E.1 General

The requirements defined in this standard retain their validity if vehicles or trains are transferred from outside onto the United Kingdom network. In addition, the requirements of the RID Regulations are applicable.

E.2 Normative references

Passenger Trains: Railway Group Standard GM/RT2041 Braking System Requirements and Performance for Trailer Coaching Stock.

GM/RT2045 Braking Principles for Rail Vehicles.

Trains above 125 miles per hour (200 km/h): Railway Group Standard GM/RT2046 Braking System Requirements and Performance for Trains which Operate above 125 miles/hour.

E.3 Brake systems other than those covered by the requirements of UIC

Where a particular Railway Authority does not require that the brake system on a locomotive hauled train complies with the requirements of UIC, as stated in 5.5 of this standard, an alternative brake control system may be used. Typical examples of such brake control systems are as follows:

— automatic air brake (single- or two-pipe);

— automatic air brake with electro-pneumatic (EP) assist;

— automatic air brake and electro-pneumatic (EP) control;

— air brake with electro-pneumatic (EP) control.

The train may combine additional types of brake system. However, where utilized, there shall be a smooth transition between the systems so that the braking performance is not affected.

The particular brake control system and performance requirements shall meet the specified requirements of the relevant Railway Authority.

In the case of trains operating on the UK infrastructure, Railway Group Standard requirements shall be met as stated throughout 5.6 and F.2 in this standard. In particular, the requirements of Railway Group Standard GM/RT2045 – Braking Principles for Rail Vehicles shall be complied with. This document defines the principles of operation and performance requirements of rail vehicle brake systems to enable safety of operation and safe inter-working practices within the UK.

E.4 Functions at train level

The brake system utilized shall meet the requirements of 5.1, 5.3, and 5.4 of this standard.

The brake system shall be proven to be safe and reliable in operation on the relevant Railway Authority Network or another major railway network having equivalent conditions and speeds to the relevant railway infrastructure.

All vehicles in the train shall be fitted with a power brake which is continuous throughout the train and automatic in operation, providing an emergency brake that defaults to brake applied.

In the case of an automatic air brake, the air brake pipe shall provide this function.

In the case of the single-pipe automatic air brake, the air brake pipe (BP) provides the control command and the energy supply to the distributor auxiliary reservoir, which provides the store of energy for the air brake. The air supply provided by the air brake pipe for the single- or two-pipe system shall not be used for other purposes not relevant to the brake system, unless required for interlocking with other safety critical systems which themselves would not compromise the integrity of the brake system.

The two-pipe air brake system shall have an air feed to the auxiliary reservoir from a main reservoir pipe (MRP). This pipe may also feed other ancillary air systems on the vehicle.

The BP and MRP shall be provided with an inter-vehicle coupling system to provide the required continuity throughout the train. The coupling system shall be designed to be automatically or manually connected, and if manually connected, shall have a method of isolating the coupling system from the air supply and rapidly venting the air pressure in the coupling system prior to disconnecting. If the BP coupling system is disconnected due to a failure, the coupling system shall rapidly vent the air pressure and ensure that an emergency brake application occurs.

The inter-vehicle brake control coupling shall not allow the connection of incompatible brake control systems.

Dependant on the type of train, the brake system of each vehicle shall provide for G (slow acting) or P (quick acting), or be capable of changeover to either brake timings.

Suitable driver's brake controllers located in the driving cabs of the locomotive and any driving trailer vehicle shall control the brake system. They shall enable graduated application and release of the service brake between the fully released and fully applied conditions. Service brake applications shall only be possible from that driving position which the driver/train manager has designated as the operative driving position.

The driver's brake controller shall also have a separate emergency brake application position beyond the full service position where the control system enables this to be incorporated. A separate emergency brake application control device shall be incorporated in addition to the one on the driver's brake controller.

E.5 Functions at vehicle level

E.5.1 Brake command and control

The minimum requirement is that for an automatic air brake system there shall be a control device and associated auxiliary reservoir connected to the air brake pipe. For EP air brake systems there shall be a control device connected to the brake command lines, together with an associated brake supply reservoir for storage of the brake energy.

Additional brake equipment can be used dependant on the vehicle type and in accordance with the requirements of the Railway Authority and Customer specification. Examples of the additional equipment are as follows:

— load controlled braking;

— emergency brake acceleration (EBA);

— wheel slide protection (WSP);

— emergency brake override (EBO);

— direct air brake (locomotive only);

— magnetic rail brakes;

— eddy current brakes.

E.5.2 Brake force application system

The brake force application system shall be designed to:

a) have sufficient thermal capacity and/or cooling to prevent the occurrence of unacceptable high temperatures that could adversely affect braking or the structural integrity of the braking components, taking into account the planned braking duty cycle, including drag braking;

b) accept loads that will arise from the braking forces and from the dynamic environment associated with its particular location on the vehicle;

c) use materials that do not generate/emit or that prevent the generation/emission of any products that are considered to be hazardous to health.

The relevant Railway Authority or Authorities upon whose infrastructure it is planned to run the vehicles shall define the braking duty requirements. The design shall account for specific requirements regarding number of brake applications possible without replenishment of the auxiliary/brake supply reservoir, the gradients to be encountered on the planned routes, the effects of WSP operation and number of allowable failed components within a system etc. as applicable.

For vehicles that are to be used in International services, the brake force application system shall be designed for the most arduous duty, currently the Gotthard-Sud route, or another alternative which shall be specified by the applicable Railway Authorities or Customer, at the commencement of the design.

Currently, the main brake force application system is the friction brake, either tread brake or disc brake. However, other systems may be incorporated which themselves shall be suitably designed to meet the energy dissipation requirement. Examples of such systems are as follows:

— electro-magnetic track brake;

— eddy current brake;

— dynamic brake e.g. regenerative/rheostatic/retarder.

E.6 Braking performance

E.6.1 General

The key performance parameter is characterized by the stopping distance/initial speed relationship of the vehicle or train. This can be defined in accordance with the requirements of the relevant Railway Authority, or expressed in terms of “braking power” as used in the systems designed to the UIC requirements. See 5.5.4.

E.6.2 Braking performance of trains operating on UK infrastructures

In the case of non–UIC requirements as used in the UK, the braking performance requirements for locomotive hauled trains shall be as specified in the following Railway Group Standards;

— Passenger trains: Railway Group Standard GM/RT2041 Braking System Requirements and Performance for Trailer Coaching Stock;

— GM/RT2045 BRAKING Principles for Rail Vehicles;

— Trains above 125 miles per hours (200 km/h): Railway Group Standard GM/RT2046 Braking System Requirements and Performance for Trains which Operate above 125 miles/hour.

The brake force data for a rail vehicle shall be calculated to enable the total equivalent brake force available in a train to be established. The requirements for the calculation of brake force values shall be conducted in accordance with Railway Group Standard GM/RT2040

The abovementioned RGSs contain the stopping distances relative to the speeds. However, the Figures and Tables cannot be viewed in isolation, i.e. without reference to the specific requirements laid down in the relevant Railway Group Standard.

The braking performance relies on the normal level of adhesion being available that is necessary to sustain the brake retarding force demanded. In conditions of low wheel/rail adhesion, the friction force that can be maintained at the wheel/rail interface is reduced and other measures to achieve the required stopping distance are necessary (e.g. reduction in speed, railhead surface conditioning, etc.).

Annex F
(informative)

Functional representation of the EBO system of the DB

F.1 Introduction

For railways operated in Germany, the Eisenbahn-Bau- und Betriebsordnung (EBO) specifies the equipment in passenger vehicles with emergency brake devices and their basic functions. The characteristics, other functions and fields of application are specified in other regulations, some of which are also valid internationally. According to them, an emergency brake applied by a passenger shall lead to braking independently of the driver.

The EBO, the High-Speed Trains TSI and prEN 45545-6 require that an emergency brake applied (by the driver) shall be capable of being released in order to prevent the train from being stopped in hazardous areas and to enable the journey to be continued immediately to a suitable stop. This procedure is designated below as "emergency brake override" (EBO).

According to FRA requirements on operation in tunnels, tunnels over 1 000 m long shall only be travelled through if there is an effective EBO available.

F.2 Design of the emergency brake override in conjunction with electro-pneumatic brake control

F.2.1 Electro-pneumatic brake control (ep)

The vehicles are equipped with an indirectly-acting automatic air brake.

The driver's brake valve installation controls and regulates the pressure centrally in the brake pipe as in the case of a purely pneumatic brake. With the additional electro-pneumatic control (ep), it is possible in accordance with the relevant specifications of the driver's brake valve to control electro-magnetic valves installed in the vehicle that also permit decentralized direct venting. The brake pipe is also filled via electro-magnetic valves from the main reservoir pipe.

In this way, the operating times of the indirectly-acting air brake are reduced as the distributors respond simultaneously in all the vehicles.

Applying the passenger emergency brake opens a valve in the corresponding vehicle via which the brake pipe is vented.

F.2.2 Emergency brake override (EBO)

For the emergency brake override (EBO), the following are also fitted to the passenger emergency brake device:

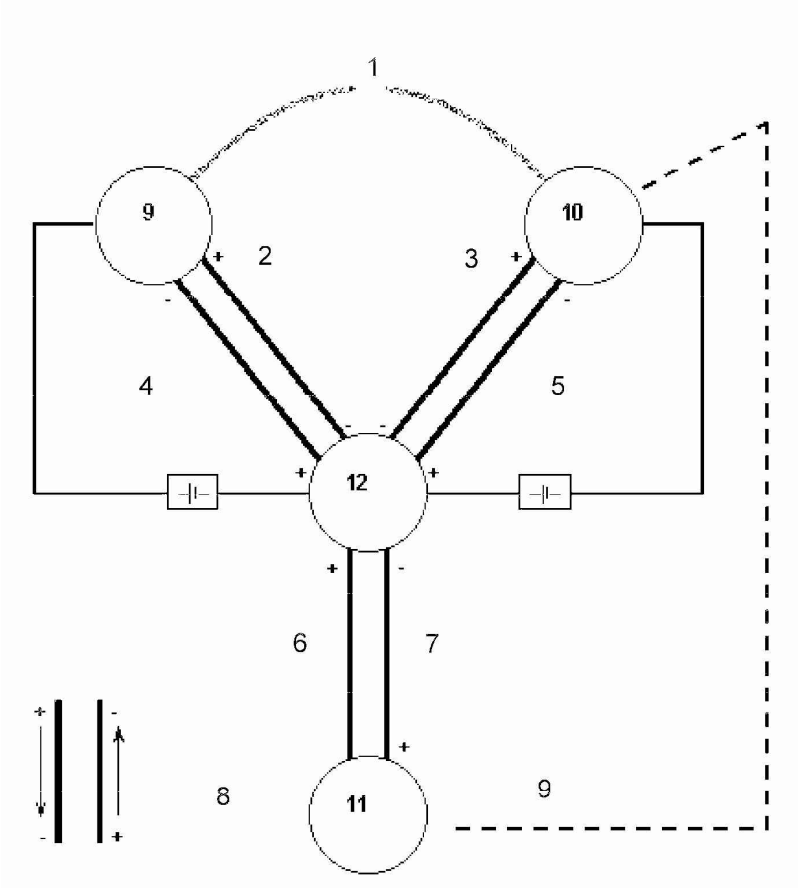
— a signalling contact that triggers a signal in the driver's position;

— an electro-magnetic valve that can be actuated electrically from the leading vehicle and isolates the outlet again.

In this way, it is possible to clear an initiated emergency braking procedure by an intended action.

F.3 Transmission systems for information and control commands in the DB system

In trains hauled by a locomotive, 13- or 18-core control lines in accordance with UIC 558 are used for transmitting commands and signals (Figure F.1).



Key

1 ~ 1 kHz – frequency for emergency brake signal

2 Close door (lock)

3 Light on

4 Release emergency brake

5 ep brake

6 ep release

7 Light off

8 Battery voltage 24 V = (direction of polarity)

9 ~ ZWS

Figure F.1 — Transmission of control commands via the IS line

The commands are transmitted as follows by means of 24 V d.c.:

— "ep brake": cores 10-12, with opposing polarity for "light on";

— "ep release": cores 11-12, with opposing polarity, for "light off";

— "EBO" cores 09-12, with opposing polarity for "close doors"

As core 12 as the common return line receives the EBO/ep brake control commands of different polarity compared to the commands for central door shutting and for lighting control, the command groups shall be interlocked against each other as follows:

— in the leading vehicle with ep/EBO commands, the door locking and central lighting control are isolated in order to prevent a direct short-circuit of the voltage supply to the two groups;

— when control commands are applied simultaneously for the EBO/ep from the leading vehicle and for the doors and train lighting from a coach, a series connection of the voltage sources of the two vehicles occurs. In the vehicles, electronic current limitations reduce the current flow to the control circuits for doors and train lighting.

In this way, the brake system commands always have priority over those for train lighting and entry doors.

The emergency brake devices in the train are monitored via cores 9 and 10 with an a.c. voltage of U_{rms} = 1 V at a frequency of 1 kHz. This is generated from a transducer installed in the leading vehicle.

When a passenger emergency brake is applied in a coach, a switch in the emergency brake train box connects this voltage source to a series circuit L-C on the so-called vehicle card. The resulting current flow in the resulting series resonant circuit triggers the signal in the leading vehicle.

Figure F.2 shows the functions of the cores in the IS line and its electrical definition.

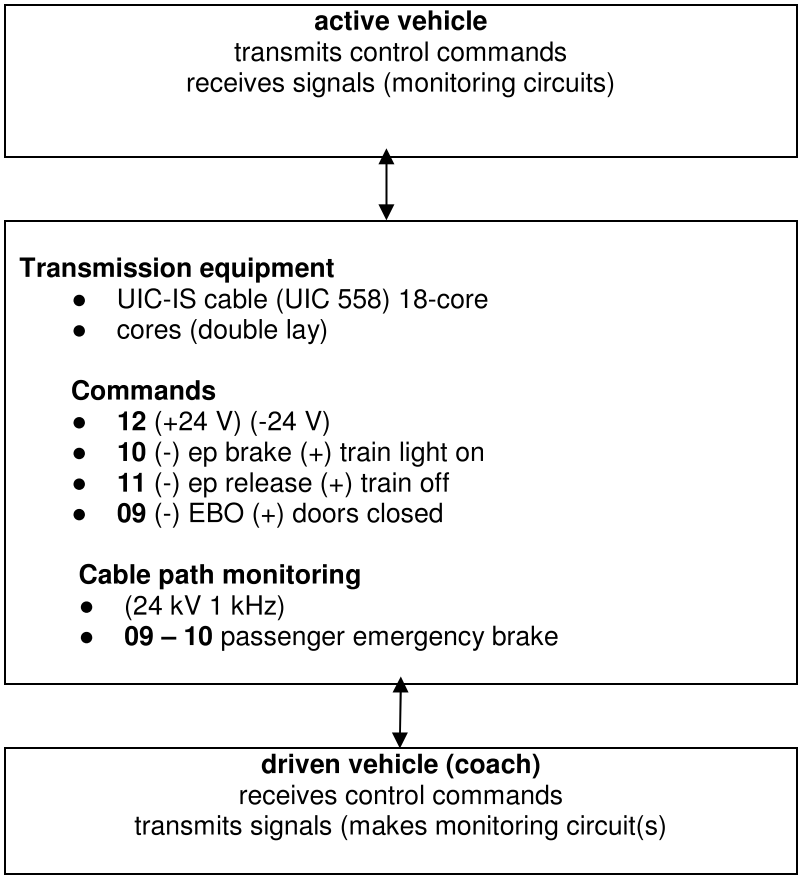


Figure F.2 — Summary of the control commands on the IS cable

In contrast to the UIC 541-5 system, there is no continuous monitoring of the safety-relevant paths for the brake commands and passenger emergency brake signal. A break in the connection during the journey is not signalled.

Simultaneous transmission of the lighting and door control system and the EBO is not possible.

Annex G
(informative)

Emergency brake handles

Emergency brakes shall be arranged so that the maximum distance of 12 m to the nearest emergency brake application device (generally the handle of the emergency brake box) is maintained.

The handle height shall not exceed 2,05 m above the floor surface (vertical distance) and not be less than 1,50 m from the floor surface (vertical distance). If a lateral grabbing motion is required (seen from the lateral axis of the body), the height of the handle shall be reduced accordingly.

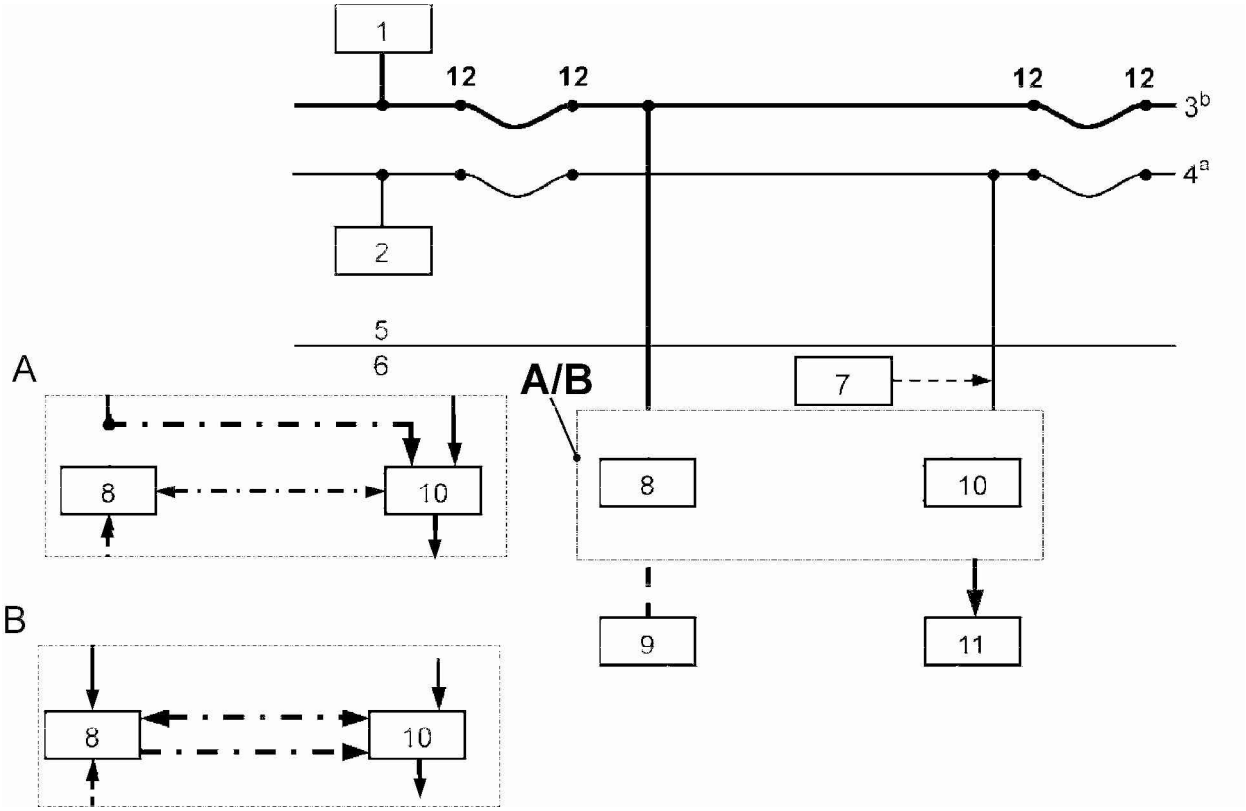
The emergency brake handles shall be located so that unintentional operation caused by confusion, e.g. mistaking for a handhold or window handle or catching with an item of luggage, is excluded as far as possible. If necessary, the emergency brake handles shall be provided with suitable covers from the top or sides. However, this shall not restrict the capacity to operate or reset the brake. The emergency brake handle shall be clearly recognizable from a distance of at least 6 m.

The emergency brake handles shall not be covered by items of luggage and/or clothing. In cases of doubt, reference shall be made to the position of the emergency brake handles by means of suitable pictograms (e.g. emergency brake handle symbol with arrow pointing in the direction of the emergency brake handle).

Annex H
(informative)

Basic arrangement of the brake system and arrangement of the brake pipes

The basic arrangement of a brake system is illustrated in Figure H.1.



Key

1	Central energy source	7	Decentralized command for automatic application of brakes
2	Central command device	8	Energy store
3	Energy medium line(s)	9	Decentralized energy source
4	Control command line(s)	10	Controller
5	Train level	11	Devices generating brake force
6	Vehicle level	12	Elements at the ends of the vehicle

Unbroken line: mandatory connection

Energy medium line

Control command line

Broken lines:

Connection also possible

Connection via path A and/or path B

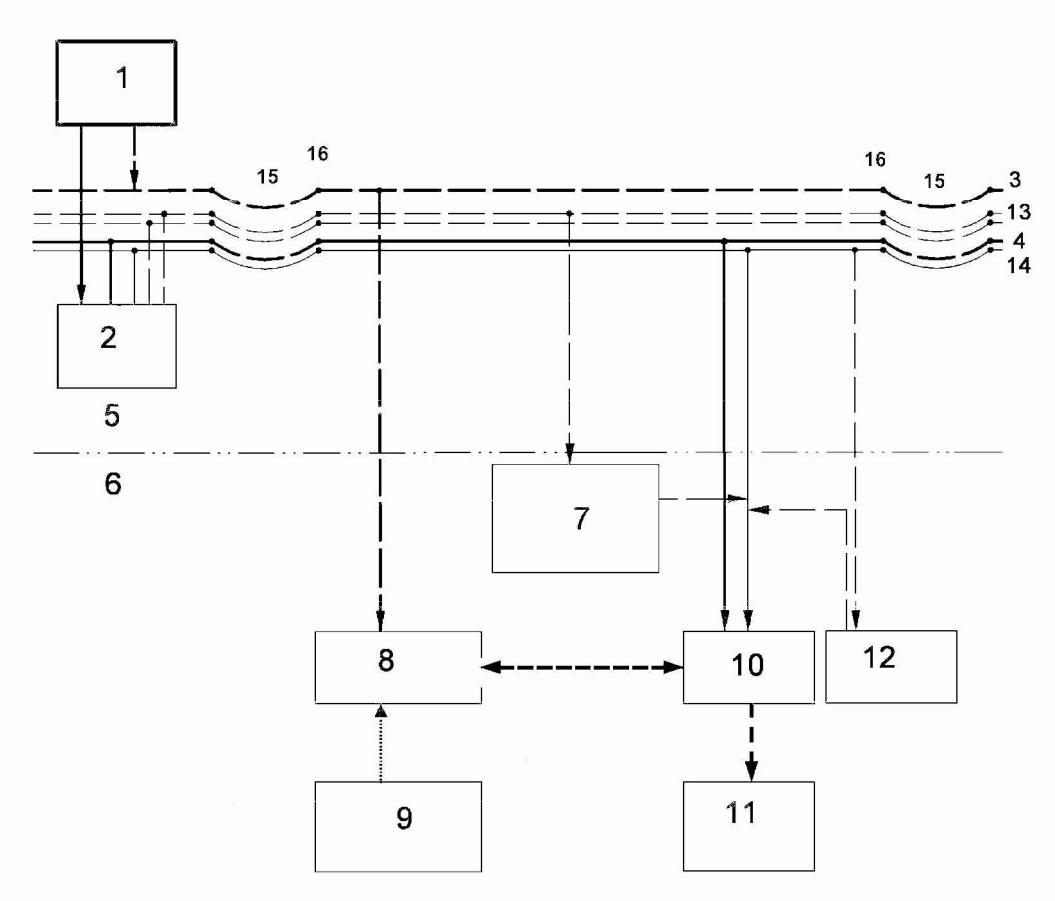
Key (*concluded*)

a Number of lines freely selectable; joint transmission of energy medium and control command over the same line is allowed

b MRP is mandatory for: EBO/ep, magnetic track brake, eddy-current brake

Figure H.1 — Basic arrangement of a brake system

The function arrangement of the system is shown in Figure H.2.



Key

1 Central energy source
2 Central command device
3 Energy medium line[a]
4 Brake pipe
5 Train level
6 Vehicle level
7 Decentralized command for automatic application of brakes
8 Energy store
9 Separate energy source
10 Controller
11 Devices generating brake force
12 Supplementary controller
13 EBO/ep, BP[b]
14 Bus line for digital data transmission (optional)[b]
15 Brake-hose couplings
16 Air isolating cocks (end cocks)

Bold lines: mandatory connection

Energy medium line (air)

Control command line

Key (*concluded*)

Thin lines: Connection also possible

– – – – – – – – Control command line

---------- Element connection lines

[a] MRP is mandatory for: EBO, magnetic track brake, eddy-current brake

[b] Number of lines freely selectable; joint transmission of energy medium and control command over the same line is allowed

Figure H.2 — UIC system

Figure H.3 illustrates the arrangement of the air lines and communication jumpers at the end of the coach.

Dimensions in mm

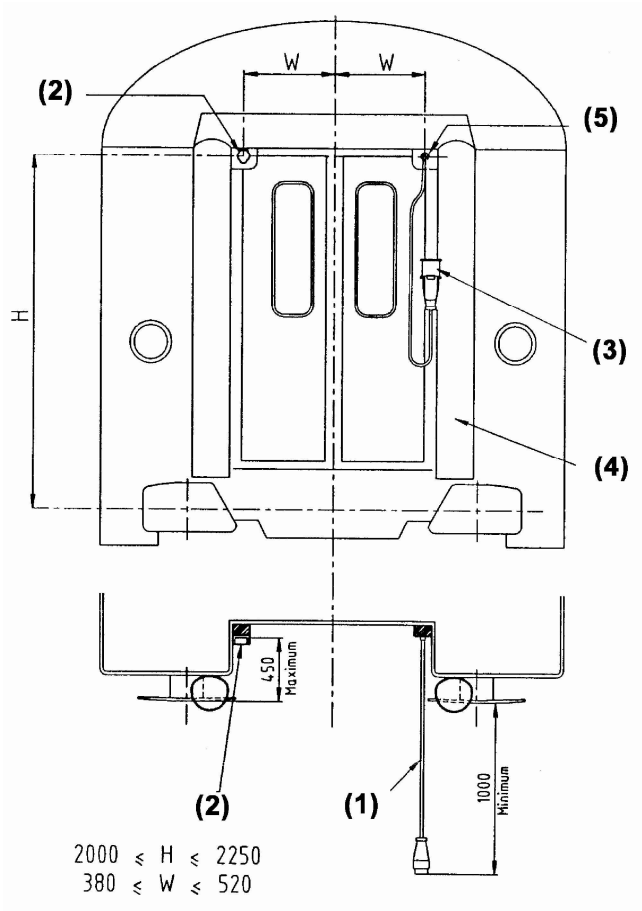


Figure H.3a — Arrangement of communication jumpers

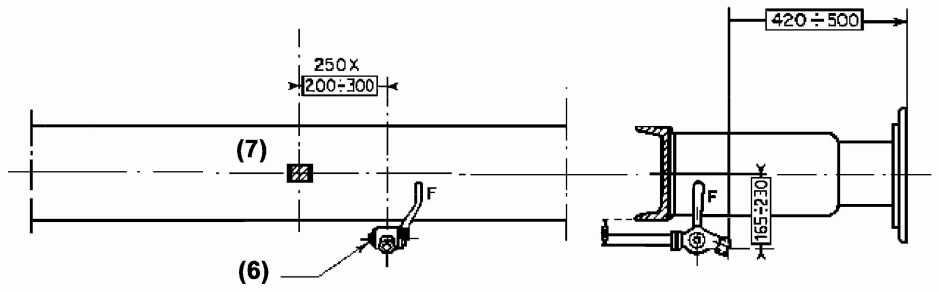


Figure H.3b — Arrangement for vehicles with BP only

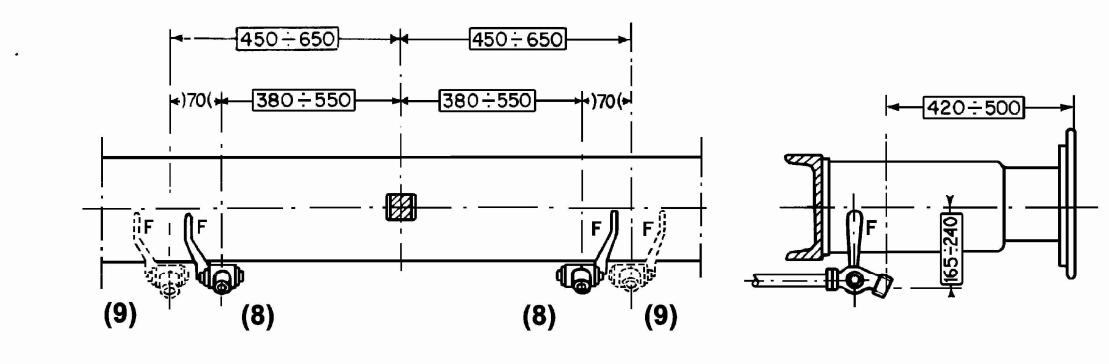


Figure H.3c Arrangement of the vehicles with BP and MRP

Key

1 Cable to UIC 558

2 Socket (elec.)to UIC 558

3 Dummy socket to UIC 558

4 Gangway coupler to UIC 566

5 Cable outlet

6 End cock for BP fitted to the left or right of the drawgear, handle (F) shown in closed position and turned away from the drawgear

7 Centre of drawgear

8 End cock for BP, handle (F) shown in closed position and turned away from the drawgear

9 End cock for MRP, handle (F) shown in closed position and turned away from the drawgear

Figure H.3 — Arrangement of brake pipes and communication jumpers at the end of the coach

The UIC ep cable arrangement according to UIC 541-5 is shown in Figure H.4.

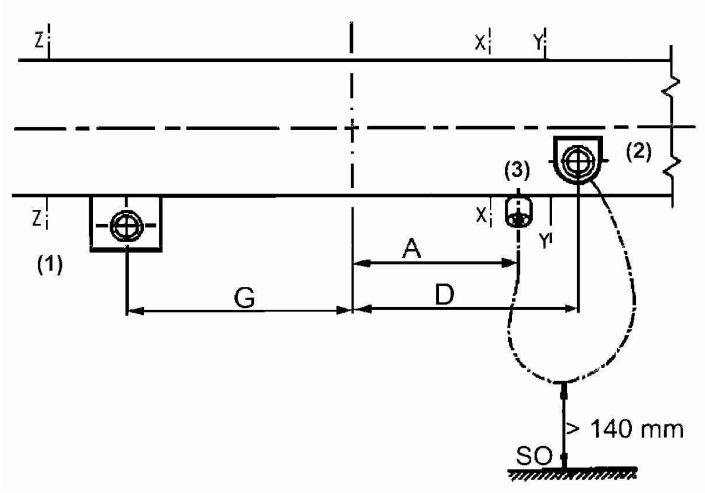


Figure H.4a — Arrangement of ep control cable

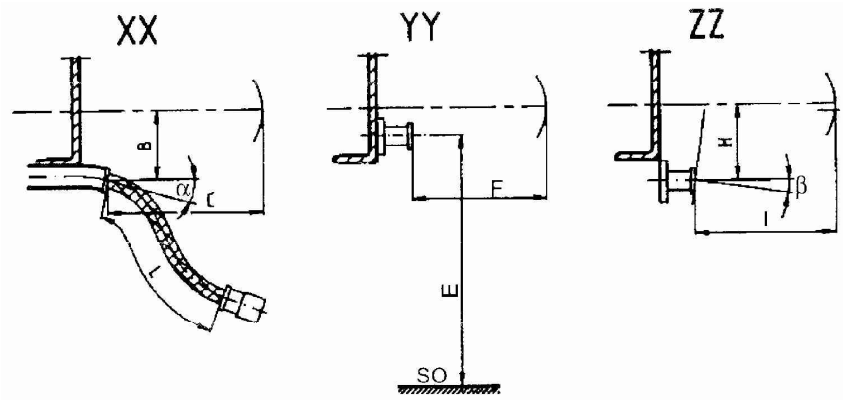


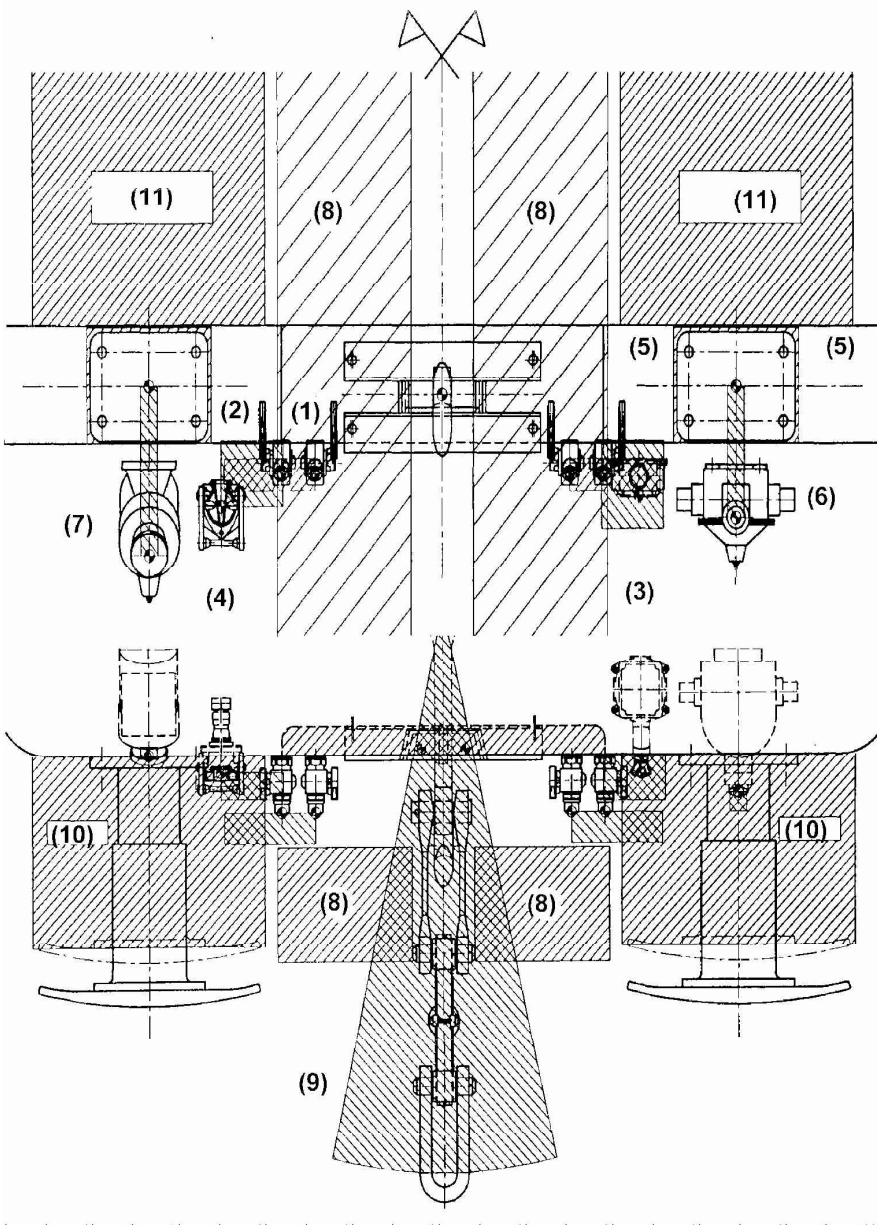
Figure H.4b — Cross-section of Figure H.4a

Key

1 ep-socket
2 ep-dummy socket for plug
3 ep-cable with plug
4 Top of rail
5 Buffer in its free position

Figure H.4 — Arrangement of UIC-ep-cables according to UIC 541-5

The attachment arrangements at the end of the coach, free spaces are illustrated in Figure H.5



Key

1 BP end cocks in accordance with UIC 541-1, item deviating from 5.3.2.6 of this standard

2 MRP end cocks in accordance with UIC 541-1

3 ep-communication jumper cable in accordance with UIC 541-5

4 ep-communication jumper socket in accordance with UIC 541-5

5 ep-communication jumper dummy socket in accordance with UIC 541-5

6 Central power line cable in accordance with UIC 552

7 Central power line socket in accordance with UIC 552

8 "Berne rectangle", safety zone for shunter

9 Drawgear displacement

10 Buffer head space

11 Coach end wall

Figure H.5 — Attachment arrangement at the end of the coach, free spaces

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