SLOVENSKI STANDARD
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SIST EN 14198:2017+A2:2021

Železniške naprave - Zavore - Zahteve, ki jih morajo izpolnjevati zavorni sistemi vlakov, vlečeni z lokomotivami

Railway applications - Braking - Requirements for the brake system of trains hauled by locomotives

Bahnanwendungen - Bremsen - Anforderungen an die Bremsausrüstung lokbespannter Züge

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ICS:

45.040	Materiali in deli za železniško tehniko	Materials and components for railway engineering
45.060.01	Železniška vozila na splošno	Railway rolling stock in general

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14198

March 2026

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English Version

Railway applications - Braking - Requirements for the brake system of trains hauled by locomotives

Applications ferroviaires - Freinage - Exigences concernant le système de freinage des trains tractés par locomotive

Bahnanwendungen - Bremsen - Anforderungen an die Bremsausrüstung lokbespannter Züge

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European foreword

This document (EN 14198:2026) 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of an identical text or by endorsement, at the latest by September 2026, and conflicting national standards shall be withdrawn at the latest by September 2026.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14198:2016+A2:2021.

This document includes the following significant technical changes with respect to EN 14198:2016+A2:2021:

— normative references have been updated;

— definitions have been modified;

— functional requirements at train level for brake modes and positions, for EP assist and for emergency brake application have been modified;

— requirements for direct brake have been modified;

— requirements for brake management have been modified;

— performance requirements for adhesion have been modified;

— Annex A “Vehicle requirements” has been modified;

— Annex D “Corresponding standards EN – UIC” has been updated;

— Annex E “Brake pipe pressure control system” has been updated;

— Annex F “Venting performance of emergency valves” has been updated;

— Annex ZA has been updated.

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This document has been prepared under a Standardization Request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annex ZA, which is an integral part of this document.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website. According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

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1 Scope

This document specifies basic requirements for the braking of trains hauled by locomotives.

This document is applicable for trains hauled by locomotives and vehicles intended for use in general operation or in fixed or predefined formation.

NOTE This ensures technical compatibility of the brake function between vehicles of various origins in a train (see 5.4).

If concerned, the EN-UIC brake architecture described in this document (see 5.4) is also applicable to brakes for multiple units and high-speed trains and urban rail described in the EN 16185 series and the EN 15734 series and the EN 13452 series respectively.

This document also takes into account electrical and electronic control functions and additional brake systems like dynamic brakes and adhesion independent brakes.

The brake system requirements, which are specific for railbound construction and maintenance machines are set out in EN 14033-1.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 837-1:1996,[1] *Pressure gauges — Part 1: Bourdon tube pressure gauges — Dimensions, metrology, requirements and testing*

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EN 10220:2002, *Seamless and welded steel tubes - Dimensions and masses per unit length*

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EN 10305-4:2016, *Steel tubes for precision applications - Technical delivery conditions - Part 4: Seamless cold drawn tubes for hydraulic and pneumatic power systems*

EN 10305-6:2016, *Steel tubes for precision applications - Technical delivery conditions - Part 6: Welded cold drawn tubes for hydraulic and pneumatic power systems*

EN 14531-1:2015+A1:2018, *Railway applications - Methods for calculation of stopping and slowing distances and immobilization braking - Part 1: General algorithms utilizing mean value calculation for train sets or single vehicles*

EN 14531-2:2015, *Railway applications - Methods for calculation of stopping and slowing distances and immobilization braking - Part 2: Step by step calculations for train sets or single vehicles*

EN 14535-1:2019, *Railway applications - Brake discs for railway rolling stock - Part 1: Brake discs pressed or shrunk onto the axle or drive shaft, dimensions and quality requirements*

EN 14535-2:2019, *Railway applications - Brake discs for railway rolling stock - Part 2: Brake discs mounted onto the wheel, dimensions and quality requirements*

EN 14601:2024, *Railway applications - Straight and angled end cocks for brake pipe and main reservoir pipe*

EN 15220:2016, *Railway applications - Brake indicators*

[1] Document impacted by AC:1998.

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EN 15273-2:2013+A1:2016, *Railway applications - Gauges - Part 2: Rolling stock gauge*

EN 15328:2020+A1:2024, *Railway applications - Braking - Brake pads*

EN 15329:2019, *Railway applications - Braking - Brake block holder and brake block key*

EN 15355:2019+A1:2023, *Railway applications - Braking - Distributor valves and distributor-isolating devices*

EN 15595:2018+A1:2023, *Railway applications - Braking - Wheel slide protection*

EN 15611:2020+A1:2022, *Railway applications - Braking - Relay valves*

EN 15612:2020, *Railway applications - Braking - Brake pipe accelerator*

EN 15663:2017+A2:2024, *Railway applications - Vehicle reference masses*

EN 15807:2021, *Railway applications - Pneumatic half couplings*

EN 15877-1:2024, *Railway applications - Markings of railway vehicles - Part 1: Freight wagons*

EN 15877-2:2013, *Railway applications - Markings of railway vehicles - Part 2: External markings on coaches, motive power units, locomotives and on track machines*

EN 16186-2:2017, *Railway applications - Driver's cab - Part 2: Integration of displays, controls and indicators*

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EN 16207:2024, *Railway applications - Braking - Functional and performance criteria of magnetic track brake systems for use in railway rolling stock*

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EN 16241:2014+A1:2016, *Railway applications - Slack adjuster*

EN 16334-1:2014+A1:2022, *Railway applications - Passenger Alarm System - Part 1: System requirements for mainline rail*

EN 16451:2024, *Railway applications - Braking - Brake pad holder*

EN 16452:2015+A1:2019, *Railway applications - Braking - Brake blocks*

EN 16834:2019, *Railway applications - Braking - Brake performance*

EN 45545-1:2013, *Railway applications - Fire protection on railway vehicles - Part 1: General*

EN 45545-2:2020+A1:2023, *Railway applications - Fire protection on railway vehicles - Part 2: Requirements for fire behaviour of materials and components*

EN 45545-3:2024, *Railway applications - Fire protection on railway vehicles - Part 3: Fire resistance requirements for fire barriers*

EN 45545-4:2024, *Railway applications - Fire protection on railway vehicles - Part 4: Fire safety requirements for rolling stock design*

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EN 45545-5:2013+A1:2015, *Railway applications - Fire protection on railway vehicles - Part 5: Fire safety requirements for electrical equipment including that of trolley buses, track guided buses and magnetic levitation vehicles*

EN 45545-6:2024, *Railway applications - Fire protection on railway vehicles - Part 6: Fire control and management systems*

EN 45545-7:2013, *Railway applications - Fire protection on railway vehicles - Part 7: Fire safety requirements for flammable liquid and flammable gas installations*

EN 50125-1:2014, *Railway applications - Environmental conditions for equipment - Part 1: Rolling stock and on-board equipment*

EN 50163:2004, *Railway applications - Supply voltages of traction systems*

EN 50553:2012,[2] *Railway applications — Requirements for running capability in case of fire on board of rolling stock*

EN ISO 1127:1996, *Stainless steel tubes - Dimensions, tolerances and conventional masses per unit length (ISO 1127:1992)*

EN ISO 24478:2024, *Railway applications - Braking - General vocabulary (ISO 24478:2023, including corrected version 2024-04)*

ISO 4975:2022, *Railway applications — Braking system — Quality of compressed air for pneumatic apparatus and systems*

ISO 20138-1:2018, *Railway applications — Calculation of braking performance (stopping, slowing and stationary braking) — Part 1: General algorithms utilizing mean value calculation*

ISO 24221:2024, *Railway applications — Braking system — General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 24478:2024 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
general operation
mode of operation of units intended to be coupled with other units in a train formation which is not specified at design stage

3.2
automatic brake application
automatic application of the brakes when the trainwide brake control signal is lost

[2] Document impacted by A1:2016, A2:2020 and AC:2013.

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3.3
unit
assessable entity which may be a single vehicle/locomotive or a group of vehicles that operate in a fixed formation

3.4
train
operational formation consisting of one or more units

3.5
rear view position
position in the front cab, where the driver can observe the rear end of the train and can command the traction and brake system for shunting

3.6
active driver's cab
only cab enabled to generate trainwide control signal for traction and service braking

3.7
brake command vehicle
vehicle where the active driver's cab is located

3.8
emergency brake performance
result of an emergency brake application in terms of stopping distances, retardation and brake response time

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3.9
locomotive
traction vehicle in accordance with EN 17343 and equipped with EN-UIC brake system

3.10
build-up time
period of time related to the brake cylinder pressure during emergency brake application on a single vehicle in accordance with EN ISO 24478 where *a* is the beginning of the pressure rising and *b* = 95 % of the maximum brake cylinder pressure

3.11
release time
period of time related to the brake cylinder pressure after emergency or full service brake application on a single vehicle in accordance with EN ISO 24478 where *c* is the beginning of the pressure drop and *d* = 0,4 bar

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4 Symbols and abbreviated terms

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

λ braked weight percentage

AC alternating current

BP brake pipe

CCS Control Command and Signalling System

CSM common safety methods

CW marking for freight wagons depending on compliance with TSI WAG requirements, for application refer to Commission Regulation (EU) No 321/2013, Annex C, Clause 5 “Marking of units”

DC direct current (“Berlin DC-Network” means network of the S-Bahn Berlin, Germany, which runs on DC)

EMC electromagnetic compatibility

ETCS European Train Control System

GB Great Britain

GE marking for freight wagons depending on compliance with TSI WAG requirements, for application refer to Commission Regulation (EU) No 321/2013, Annex C, Clause 5 “Marking of units”

MRP main reservoir pipe

MTB magnetic track brake

UIC International Union of Railways (*Union internationale des chemins de fer*)

WSP wheel slide protection system

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5 Requirements

5.1 General requirements of the train brake system

The purpose of the train brake system is to ensure that the train’s speed can be reduced or maintained on a slope, or that the train can be stopped within the maximum allowable braking distance.

Braking also provides the immobilization of a train either for a certain period of time or permanently.

Units designed and assessed to be operated in general operation (various formations of vehicles from different origins; train formation not specified at the design stage) shall be fitted with a technically compatible brake system to ensure the brake function in all vehicles of the train.

5.2 General safety requirements

5.2.1 Design principles

The design, construction or assembly, maintenance and monitoring of safety-critical components, and more particularly of the components involved in train movements, shall ensure safety at the level corresponding to the aims laid down for the respective railway network. The braking techniques and the stresses exerted shall be compatible with the design of the tracks, engineering structures and signalling systems. Brake systems shall conform to the following:

— the design principles listed in the standards on brake systems referred to in Clause 2;

— the brake performances specified in Clause 6;

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— the design principles in accordance with the requirements of this document;

— keeping within the specified effects on the environment, particularly regarding EMC and noise emissions.

In the course of the system design, risks shall be considered and mitigated. As a minimum, the following hazards shall be taken into account:

a) the braking force applied is greater than the maximum design level:

   1) impact on track shifting forces;

   2) excessive jerk (impact on standing passengers);

   3) damage to the contact surface of the wheels or friction partners;

   4) impact on the fatigue life of the components generating the braking force;

b) the brake performance is lower than the level of brake demanded:

   1) keeping traction effort on the train while emergency brake is requested;

   2) required emergency brake performance not achieved;

   3) required parking brake performance not achieved;

   4) immobilization brake performance not achieved during the required period of time;

c) there is no braking force when demanded:

   1) no emergency brake on the whole train when requested;

   2) automatic (emergency) brake not initiated in the case of an unintended train separation (loss of train integrity);

   3) parking brake: loss of performance over the time;

d) there is a braking force when a brake demand has not been made:

   1) undue local brake application (pneumatic or parking);

e) brake component failures that could cause death or injury or damage to the train or infrastructure, e.g. derailment.

After activation of an application signal on the trainwide control line(s) for emergency brake or parking brake or immobilisation brake, no single failure shall result in the critical hazard “loss of more than 50 % of the total braking force of the train”. A single failure of the traction system leading to application of an accelerating traction force while braking shall be considered.

The hazards in the previous list shall be assessed in accordance with CSM.

Concluding from the hazards listed above the emergency brake shall have a high level of integrity. The service brake, whilst it may share subsystems and components, etc. with the emergency brake, does not need to achieve the same level of integrity. Nevertheless, the service brake shall be designed in accordance with the following requirements:

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— it shall be activated on the whole train when requested;

— it shall cut off traction effort on the whole train while service brake is requested;

— it shall provide service brake effort as high as requested.

Independently from the service brake:

— it shall be possible for the driver to immediately initiate the emergency brake by using the same lever which is used for service braking or by using another independent device;

— the train protection systems shall be capable of initiating the emergency brake.

The components shall be of a proven design and withstand any duties expected to occur during their period in service. The safety implication of any failures shall be limited by appropriate means as described in this document. For more guidance on proven design see Annex C.

Proper functionality of the brake system is also affected by the design of the piping and component design as specified in 5.4.5.

5.2.2 Fire protection

The brake system shall be protected against the effects of fire and shall not emit toxic fumes. This shall be achieved by selecting appropriate materials, by an appropriate system architecture and installation arrangement.

The brake system shall be consistent with the train fire protection requirements as set out in the EN 45545 series.

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The running capability shall be in accordance with EN 50553:2012[2].

5.2.3 Environmental condition

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The rolling stock and the equipment on board shall work properly in those climatic zones, for which they have been designed. The environmental conditions shall be in accordance with EN 50125-1:2014.

For certain lines further requirements may be specified, e.g. for the Nordic countries.

CEN/TR 16251 covers this subject and it may be considered.

5.3 Requirements of the main brake system

5.3.1 General requirements

Trains for general operation shall be equipped with a main brake system providing the following functions:

— emergency braking;

— service braking;

— functions to keep the train stationary.

The functions shall incorporate the features listed below:

— trainwide brake control (driver's cab equipment, CCS, etc.);

— command distribution;

— local brake control;

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— braking force generation;

— indication of brake status;

— energy supply for braking force generation and command control of the main brake system.

The structure of the document is considering general functions on a train wide level and particular functions for the different vehicles on a local vehicle level. The local vehicle level is considering different functions for locomotives, coaches and wagons.

Figure 1 shows the basic structure of a brake system (with train and vehicle levels) and transmission paths for brake control signals and energy for braking force generation, including their conversion into braking force.

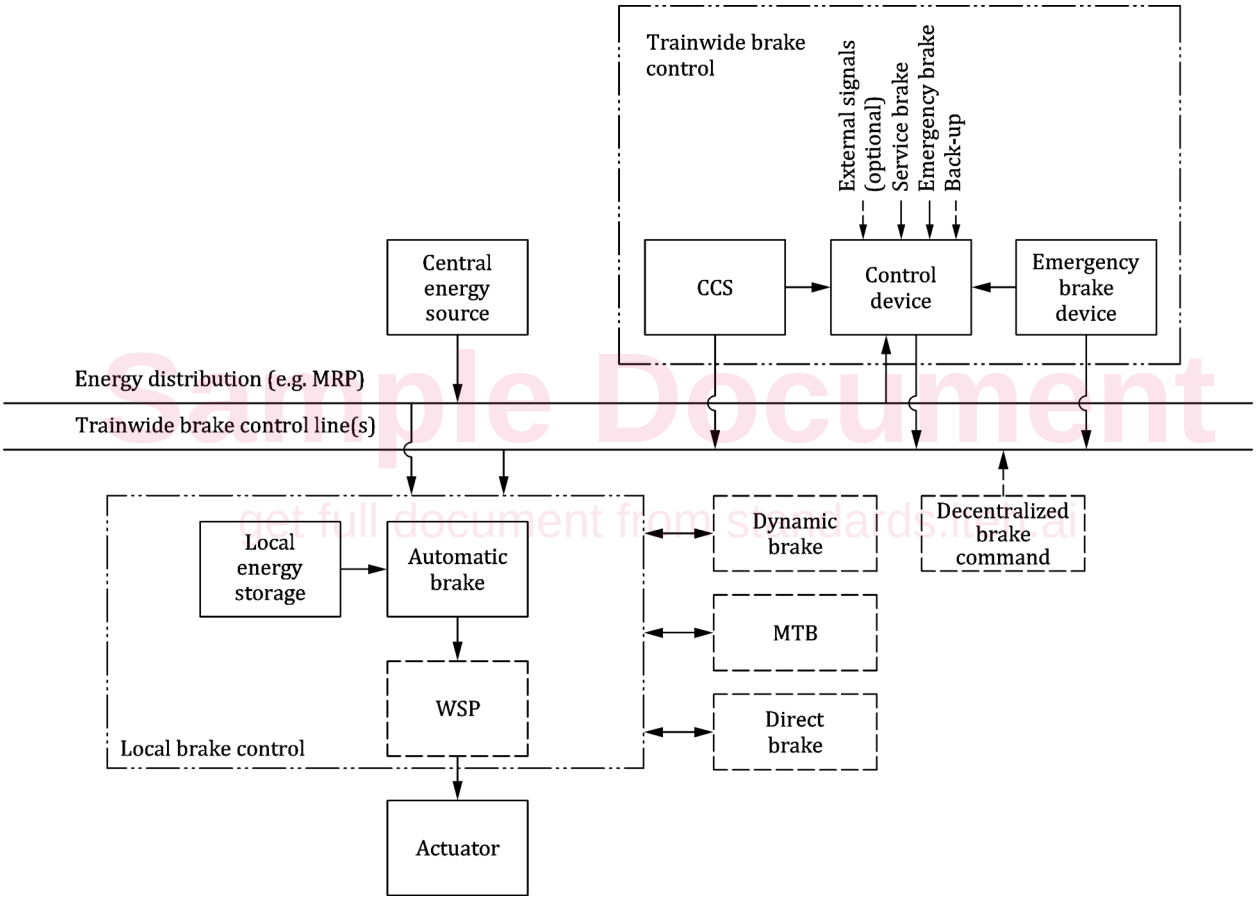

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Figure 1 — Basic structure of the main brake system (functions in dotted lines are optional)

5.3.2 General functions on train level

5.3.2.1 Brake control functions

a) Each unit shall be equipped with a trainwide brake control line which is intended to transmit the brake command from the active driver's cab to all other units in the train in a dedicated manner.

b) The trainwide brake control, the continuous trainwide brake control line and the local control unit in each single vehicle of the train shall cooperate in a compatible way by using appropriate command signals.

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c) The trainwide brake control line shall be capable

1) to receive a brake apply/release command from a trainwide brake control initiated from the active driver's cab of the leading vehicle,

2) to receive an emergency brake application command from a trainwide brake control initiated from decentralized brake command devices if fitted.

d) The trainwide brake control line shall be capable of transmitting the brake command information:

1) full release of the brakes;

2) emergency brake application;

3) gradual application and gradual release for service braking.

e) Each unit shall be equipped with a local brake control which is connected to the trainwide brake control line for the purpose of receiving the brake command information and to control the local brakes accordingly.

f) The level of brake application may be adjusted locally in proportion to the mass of the vehicle.

g) If additional brake systems are intended to be used for emergency braking they shall be controlled by the trainwide brake control line. In case they are intended for use in service braking these additional brake systems should be capable of being controlled by the trainwide brake control line and also independently.

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h) When more than one trainwide brake control line is used (for example pneumatic and emergency brake loop) they shall act continuously and automatically.

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i) For the purpose of service braking only it is permitted to establish an additional trainwide brake control line which does not need to act automatically.

5.3.2.2 Automatic brake application

Any loss of integrity of the trainwide brake control line (for example: an unintended train separation caused by a mechanical failure) shall lead to an immediate emergency brake application on all vehicles of the train.

A release command shall not be capable to override a brake application command except as set out in 5.3.2.6.

The principle to achieve this requirement is the energizing of the trainwide brake control line to release the brake and by de-energizing the trainwide brake control line causing an automatic emergency brake application.

5.3.2.3 Inexhaustibility on train level

There shall be sufficient brake energy available on board the train (= stored energy), distributed along the train consistent with the design of the brake system. Repeated brake application and release cycles followed by a subsequent emergency brake application shall achieve at least 85 % of the nominal train braking force, that is achieved by an emergency brake application when the local energy storage is in its operational range (e.g. range of pressure in auxiliary reservoir).

The system shall indicate to the driver in the event of the brake energy supply being disrupted, the power supply failing or other energy source failure at train level. If the inexhaustibility will no longer be achieved

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