SLOVENSKI STANDARD
SIST EN 14198:2017+A2:2021

01-julij-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

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

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

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Contents

Page

European foreword

This document (EN 14198:2016+A2:2021) 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of an identical text or by endorsement, at the latest by November 2021, and conflicting national standards shall be withdrawn at the latest by November 2021.

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This document includes Amendment 1 approved by CEN on 2018-08-05.

This document includes Amendment 2 approved by CEN on 2021-04-12.

This document supersedes [A2] EN 14198:2016+A1:2018 [/A2].

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [/A1], [A2] [/A2].

[A2] This document has been prepared under a standardization request addressed to CEN by the European Commission, and it aims to support essential or other requirements of EU Directive(s) or Regulation(s).

For relationship with EU Directive(s) or Regulation(s), see informative Annex ZA, which is an integral part of this document. [/A2]

[A1] *deleted text* [/A1]

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies basic requirements for the braking of trains hauled by locomotives:

— For trains hauled by locomotives and intended for use in general operation each vehicle is fitted with the traditional brake system with a brake pipe compatible with the UIC brake system.

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

— For trains hauled by locomotives and intended for use in fixed or predefined formation, the requirements on the vehicle and the train are necessary. In the case of a UIC brake system, this standard applies; if not, the EN 16185 series or the EN 15734 series applies.

If concerned, the UIC brake architecture described in this standard (see 5.4) can be used for brakes for multiple unit train and high speed trains and urban rail described in the EN 13452 series, the EN 16185 series and the EN 15734 series.

This European Standard 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 on-track machines are set out in EN 14033-1.

This European Standard does not apply to Urban Rail rolling stock braking system, which is specified by EN 13452-1.

2 Normative References

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

EN 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 837-1:1996, *Pressure gauges - Part 1: Bourdon tube pressure gauges - Dimensions, metrology, requirements and testing*

EN 854, *Rubber hoses and hose assemblies - Textile reinforced hydraulic type - Specification*

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*

EN 13749:2011, *Railway applications - Wheelsets and bogies - Method of specifying the structural requirements of bogie frames*

EN 14478, *Railway applications - Braking - Generic vocabulary*

EN 14531-1, *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, *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, *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, *Railway applications - Brake discs for railway rolling stock - Part 2: Brake discs mounted onto the wheel, dimensions and quality requirements*

EN 14535-3, *Railway applications - Brake discs for railway rolling stock - Part 3: Brake discs, performance of the disc and the friction couple, classification*

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

EN 15220, *Railway applications - Brake indicators*

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

EN 15329, *Railway applications - Braking - Brake block holder and brake shoe key for railway vehicles*

EN 15355, *Railway applications — Braking — Distributor valves and distributor-isolating devices*

EN 15595, *Railway applications — Braking — Wheel slide protection*

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

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

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

EN 15734-1, *Railway applications - Braking systems of high speed trains - Part 1: Requirements and definitions*

EN 15807, *Railway applications - Pneumatic half couplings*

EN 16185-1, *Railway applications - Braking systems of multiple unit trains - Part 1: Requirements and definitions*

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

EN 16207, *Railway applications - Braking - Functional and performance criteria of Magnetic Track Brake systems for use in railway rolling stock*

EN 16241, *Railway applications - Slack adjuster*

EN 16334, *Railway applications - Passenger Alarm System - System requirements*

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

EN 16452, *Railway applications - Braking - Brake blocks*

prEN 16834, *Railway applications - Braking - Brake performance*

EN 45545 (all parts), *Railway applications — Fire protection on railway vehicles*

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

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

EN 50553, *Railway applications - Requirements for running capability in case of fire on board of rolling stock*

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

NF F 11-100:1995, *Matériel roulant ferroviaire — Qualité de l'air comprimé destiné aux appareils et circuits pneumatiques*

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

UIC 541-5:2005, *Brakes — Electropneumatic brake (ep brake) — Electropneumatic emergency brake override (EBO)*

UIC 541-6:2010, *Brakes — Electropneumatic brake (ep brake) and Passenger alarm signal (PAS) for vehicles used in hauled consists*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14478 [1)] and the following apply.

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

3.2
brake mode
in the "EN-UIC" design, mode that defines the brake force build up and release timings – namely "G" for Goods timings, i.e. slow-acting, "P" for Passenger timings, i.e. fast timing, typically controlled by the brake distributor in an air brake system

3.3
brake positions G, P, R and others
in the "EN-UIC" design, position that defines the behaviour of the distributor valve in regard of brake application and release timings and brake cylinder forces, combined with additional brake systems

3.4
automatic brake application
automatic application of the brakes when the brake line is interrupted

1) EN 14478 is under revision and the next edition will include several of the definitions currently contained in this document.

3.5
power brake
uses compressed air to apply the brake

3.6
unit
assessable entity which may be a single vehicle/locomotive or a group of vehicles that operate in a fixed formation

3.7
train
operational formation consisting of one or more units

3.8
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

3.9
active driving cab
only cab enabled to generate and transmit train wide command for traction and brake release

3.10
brake command vehicle
vehicle where the active cab is located

3.11
emergency brake performance
result of an emergency brake application in terms of stopping distances, retardation and brake response time

3.12
locomotive
traction vehicle (or combination of several vehicles) that is not intended to carry a payload and has the ability to be uncoupled in normal operation from a train and to operate independently

3.13
braked weight percentage
also known as λ (lambda) brake performance in accordance with prEN 16834

3.14
braked weight
weight which is obtained by multiplying the braked weight percentage by the total mass of the vehicle/train and dividing the result by 100 and is expressed in tonnes

3.15
build up time
time to create an emergency brake application on a single vehicle starting from the beginning of the pressure rising until 95 % of the maximum brake cylinder pressure is reached

3.16
release time
time for reducing the brake cylinder or the pre-control brake cylinder pressure on a single vehicle, starting from the beginning of the pressure drop down to 0,4 bar

Note 1 to entry: The pressure in the brake pipe is increased up to the normal working pressure, starting from 1,5 bar below it, in less than 2 s.

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations 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
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
RER	Le Réseau Express Regional (Network of Express Train Lines in and around Paris, France)
UIC	International Union of Railways (*Union internationale des chemins de fer*)
UK	United Kingdom
WSP	Wheel Slide Protection system

5 Requirements

5.1 General requirements of the train braking system

The purpose of the train braking 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 when it is not in operation or without any energy on board.

Units designed and assessed to be operated in general operation (various formations of vehicles from different origins; train formation not defined 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 – normative references;

— the brake performances defined in Clause 6;

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

— keeping within the specified effects on the infrastructure, 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 brake force applied is greater than the maximum design level:

   1) impact on track shifting forces;

   2) excessive jerk (impact on standing passengers);

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

   4) impact on load assumptions in the fatigue life of the components generating the brake 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) holding brake performance not achieved;

c) there is no brake 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 brake 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.

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 and shall always be available when the brake system is set up for operation, whereas the service brake,

whilst it may share subsystems and components, etc. with the emergency brake, need not achieve the same level of integrity. Nevertheless, the service brake shall be designed to comply with the following requirements:

— 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 standard. For more guidance on proven design see Annex C.

Single point failures shall not cause any relevant malfunctions regarding emergency brake application.

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.

The running capability shall be in accordance with EN 50553.

5.2.3 Environmental condition

The rolling stock and the equipment on board shall perform under the conditions as specified in EN 50125-1. They shall work properly in those climatic zones, for which they have been designed and where they will be operated.

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

The CEN technical report 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;

— brake force generation;

— indication of brake status;

— energy supply for brake 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 brake force generation, including their conversion into brake force.

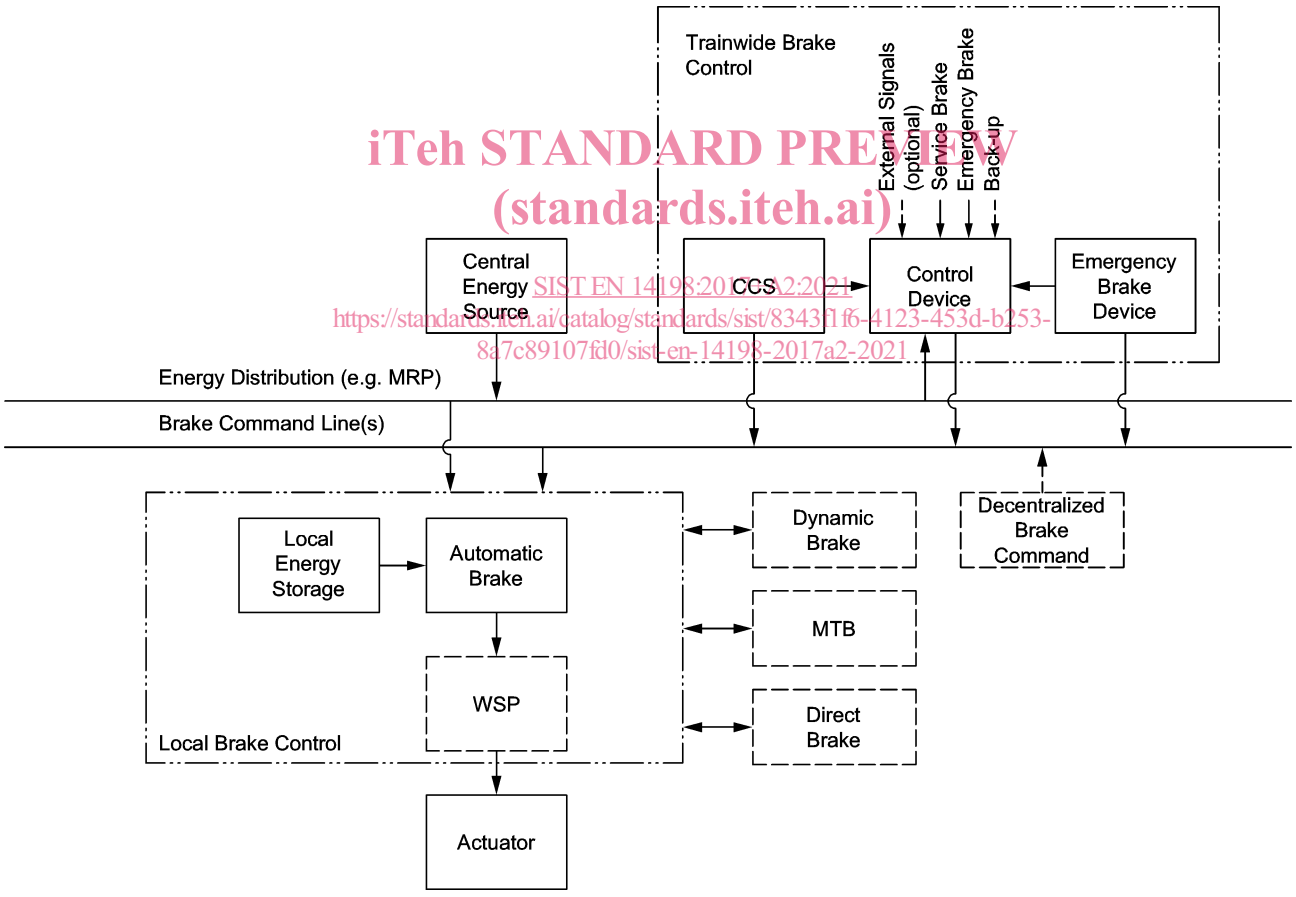

Figure 1 — Basic structure of the main brake system (functions in dotted lines are optional)

5.3.2 General functions on train level

5.3.2.1 Brake control functions

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

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

c) The brake command line shall be capable:

1) to receive a brake apply/release command from a trainwide brake control initiated from the active 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 brake command line shall be capable of transmitting the brake command information:

1) full release of the brakes;

2) emergency brake application;

3) gradual application or release for service braking.

e) Each unit shall be equipped with a local brake control which is connected to the brake command 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 weight of the vehicle.

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

h) It is permitted to use more than one brake command line (for example pneumatic and emergency brake loop) if they act continuously and automatically.

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

5.3.2.2 Automatic brake application

Any loss of integrity of the brake command line (for example: an unintended train separation caused by a mechanical failure) shall lead to an immediate brake activation 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 brake command line to release the brake and by de-energizing the brake command line causing an automatic brake application.

5.3.2.3 Inexhaustibility

There shall be sufficient braking 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 brake force.

The nominal brake force is that achieved by an emergency brake application when the local energy storage devices are fully charged.