



SLOVENSKI STANDARD
SIST EN 15328:2020+A1:2024

01-junij-2024

Železniške naprave - Zavore - Zavorne obloge

Railway applications - Braking - Brake pads

Bahnanwendungen - Bremsen - Bremsbeläge

Applications ferroviaires - Freinage - Garniture de frein

Ta slovenski standard je istoveten z: EN 15328:2020+A1:2024

ICS:

<https://sist-15328-2020a1-2024.sist-15328-2020a1-2024> 45.040 [SIST EN 15328:2020+A1:2024](https://sist-15328-2020a1-2024.sist-15328-2020a1-2024) Materiali in deli za železniško tehniko [Materials and components for railway engineering](https://sist-15328-2020a1-2024.sist-15328-2020a1-2024)

SIST EN 15328:2020+A1:2024

en,fr,de

EUROPEAN STANDARD

EN 15328:2020+A1

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2024

ICS 45.040

Supersedes EN 15328:2020

English Version

Railway applications - Braking - Brake pads

Applications ferroviaires - Freinage - Garniture de frein

Bahnanwendungen - Bremsen - Bremsbeläge

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European foreword

This document (EN 15328:2020+A1:2024) 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of an identical text or by endorsement, at the latest by October 2024, and conflicting national standards shall be withdrawn at the latest by October 2024.

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 A1 EN 15328:2020.

EN 15328:2020+A1:2024 includes the following significant technical changes with respect to EN 15328:2020:

- the Introduction has been modified;
- new terms 3.7 “continuous brake application 1” and 3.8 “continuous brake application 2” have been added;
- 5.1. “Classification of brake pads” has been modified;
- 5.13.1 “Classification scheme for locomotives, MUs, high-speed trains, freight wagon and coaches”, Table 5 has been modified;
- 5.14 “Interchangeability of brake pads” has been modified;
- Clause A.9 “Methods of temperature measurements” has been modified;
- Annex B “Test programs for classes A1 to G1”, Tables B.2 to B.11 have been modified;
- Annex C “Test programs for coaches”, Table C.1 has been modified;
- Annex E, E.1 “Use of the generic test programs”, Table E.1, E.2.2 “Brake steps”, E.2.4 “Continuous brake applications”, Table E.5 and E.3.5 “Power for continuous brake applications” have been modified;
- new informative Annex I “Example of the declaration of conformity” has been added;
- Annex ZA has been deleted. A1

This document includes Amendment 1 approved by CEN on 2 March 2024.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

A1 *deleted text* A1

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,

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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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Introduction

This document gives the requirements for the design, dimensions, performance and testing of a brake pad which, as part of a disc brake system, acts on one friction face of a brake disc in accordance with EN 14535-1 and EN 14535-2.

A1 *deleted text* **A1**

This document contains the requirements for interfacing the brake pads with the rail vehicle, the testing procedures in order to confirm that it satisfies the basic safety and technical requirements, the material control procedures to ensure product quality, reliability and conformity, as well health and environmental requirements are fulfilled.

A1 *deleted text* **A1**

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1 Scope

This document specifies requirements for pads for disc brakes of railway rolling stock.

The document defines requirements and generic test programs for brake pads on dynamometer. This document does not cover mandatory tests to verify stopping distances in addition to laboratory, bench test and in-service tests. In order to qualify the brake pad performance in accordance with the classification the standard provides fixed parameter figures as categories defined in paragraph classification scheme.

This document is not applicable for urban rail applications.



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 14478:2017, *Railway applications - Braking - Generic vocabulary*



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*

 deleted reference 

EN 16451:2015, *Railway applications - Braking - Brake pad holder*

 EN ISO 21920-2:2022, *Geometrical product specifications (GPS) — Surface texture: Profile — Part 2: Terms, definitions and surface texture parameters (ISO 21920-2: 2021, Corrected version 2022-06)* 

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14478:2017, EN 14535-1:2019, EN 14535-2:2019 ^{A1} *deleted text* ^{A1} 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 <https://www.iso.org/obp/ui>

3.1

instantaneous coefficient of friction

instantaneous value of coefficient of friction of the friction couple brake pad/brake disc at any instant during braking

3.2

static coefficient of friction

coefficient of friction achieved by the friction couple at the point where relative movement between the brake pad friction face and brake disc friction face begins

3.3

brake disc temperature

arithmetic average value of the temperature measurements on the brake disc friction faces

3.4

contact surface area

static contact surface of the brake pad available for frictional engagement with the brake disc friction face

3.5

friction material

consumable portion of the brake pad that acts on the friction face of the brake disc in order to provide the specified brake performance

3.6

brake pad

assembly of friction material and an associated fixing element acting on one friction face of a brake disc

Note 1 to entry: A brake pad can be manufactured in one piece or comprise two separate parts. Where manufactured in two separate halves, the brake pad comprises one left-hand and one right-hand half. For a brake disc four brake pad halves or two brake pads can be used.

^{A1}

3.7

continuous brake application 1

brake application which represents the Gotthard-Ramp with friction brakes only

3.8

continuous brake application 2

brake application which represents the reference case of TSI Loc&Pas to perform a continuous brake application in load condition 'maximum braking load' at speed equal to 90 % of the maximum operating speed on maximum descending gradient of 35 ‰ during 6 km with friction brakes and a train resistance (25 % of the total brake force) ^{A1}

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4 Symbols and abbreviations

For the purposes of this document, the symbols and abbreviations given in Table 1 apply.

Table 1 — Symbols and abbreviations

Symbol	Designation	Unit
F_B	Nominal application force per brake disc	kN
F_b	Instantaneous application force per brake disc	kN
m	Mass to be braked per brake disc (inclusive of the rotational masses)	t
Q	Water flow rate	l/h
R_a	Refer to $\langle A_1 \rangle$ EN ISO 21920-2 $\langle A_1 \rangle$	μm
R_z	Refer to $\langle A_1 \rangle$ EN ISO 21920-2 $\langle A_1 \rangle$	μm
s_2	Stopping distance from the moment on when $F_b = 0,95 F_B$ to rest	m
v_0	Theoretical initial speed at the brake application initiation	km/h
v	Instantaneous speed	km/h
v_{max}	Maximum service speed	km/h
μ_a	Friction coefficient (brake pad): The instantaneous friction coefficient specified at every instant of the braking time	—
$\mu_m = \frac{1}{s_2} \cdot \int_0^{s_2} \mu_a \cdot d_s$	Mean friction coefficient: The mean friction coefficient μ_m integrated over the time from where 95 % of the nominal application force F_B is reached over the stopping distance s_2	—
$\mu_{m,\text{nom}}$	Nominal friction coefficient (brake pad)	—
θ_0	Mean initial temperature at the beginning of the brake application	$^{\circ}\text{C}$
CI	Cast iron	
MU	Multiple unit (EMU/DMU)	
SBP	Standard brake pad	

5 Characteristics and test method of the brake pads

5.1 Classification of brake pads

This document defines the characteristics required for the categories A1 to G1 of brake pads, listed in Table 5. The characteristic requirements for the application in coaches used in general operation are listed in Table 7.

A1 Brake pads that have a valid UIC certification (preliminary or full) comply with EN 15328:2020 for the corresponding vehicle and energy class.

Brake pads which comply with EN 15328:2020 can retain the declaration of conformity to EN 15328 for a period of ten years after the declaration was issued. New declarations of conformity shall relate to the current released version of the standard.

NOTE The declaration of conformity can be issued by the manufacturer on the basis of the test results. An example of the declaration of conformity is given in Annex I.

As an alternative to the vehicle and energy class specific test program, a project specific test program in accordance with Annex E may be applied. **A1**

5.2 Coefficient of friction

The coefficient of friction should be independent of the wear (full thickness of the brake pad), the specific pressure, the temperature and the environmental conditions.

In wet conditions, or when there is snow, the instantaneous coefficient of friction should vary only slightly compared to the coefficient of friction under dry conditions.

These frictional characteristics shall be assessed in accordance with 5.5 to 5.6.

5.3 Environmental impact, health and safety

All raw materials used in the manufacture of the brake pads shall comply with the relevant requirements for environment, health and safety.

NOTE Relevant requirements are given in regulations of environment, health and safety, notably REACH regulations.

In addition, a safety data sheet shall be presented.

5.4 Usage requirements

The composition of the material from which the brake pads are made should be chosen so that the best compromise is obtained between:

- the frictional properties,
- the wear of the brake pads, and
- the aggressiveness against the brake disc.

5.5 Frictional requirements for brake pads

5.5.1 General

This subclause describes the requirements for brake pads used in locomotives, MUs, freight wagons and coaches. Optional test programs and requirements for coaches are defined in 5.6.

EN 15328:2020+A1:2024 (E)**5.5.2 Priority levels of brake applications**

In the test programs A1 to G1, the brake applications are prioritized, in accordance with a decreasing level of importance, as given in Table 2.

Brake applications with highest nominal application force (highest nominal deceleration) under normal conditions representing emergency brake applications are rated with priority 1. All other brake applications are rated according to their safety relevance with priorities 2 to 4. Continuous and parking brake applications are not stopping brake applications and therefore assessed according to different criteria and there is no priority level assigned with these brake applications. Bedding brake applications which are carried out prior to the main stopping brake applications are assessed separately.

Table 2 — Priority levels of brake applications for test programs

Priority level	Type of brake application
1	Dry brake applications with the highest nominal application force for each mass, normal conditions
2	Wet brake applications and hot brake applications with highest nominal application force, for each mass
3	Brake applications with highest nominal application force used for cleaning, drying, regenerating, or after continuous brake applications, for each mass
4	All other brake applications, with the exception of continuous brake applications and bedding brake applications and the examination of static coefficient of friction
—	Continuous brake applications, brake applications used for bedding-in, examination of static coefficient of friction

Normal conditions refer to brake applications under dry conditions with low initial temperature and with the brake disc and the brake pad unaffected by high thermal load or residual wetness.

Brake pads of categories A1 to G1 are characterized by their friction behaviour, expressed as the velocity-dependent nominal line.

The nominal line for the coefficient of friction is calculated for each brake pad and each test program as the linear regression line of the mean coefficients of friction (expressed in a rounding range of 0,001) versus speed of all brake applications with priority 1, extending from the lowest to the highest test speed.

5.5.3 Criteria for the nominal line

The nominal line should lie between 0,300 and 0,450.

It shall lie between 0,280 and 0,470. The difference between the maximum value and the minimum value of the nominal line shall be less or equal to 0,150.

5.5.4 Criteria for the mean coefficient of friction

Allowed deviations of coefficients of friction are expressed by means of tolerance bands centred around the nominal line.

The tolerance bands for the mean coefficients of friction in accordance with their priority level are given in Table 3.