



SLOVENSKI STANDARD

oSIST prEN 15328:2026

01-december-2026

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: prEN 15328

ICS:

45.040	Materiali in deli za železniško tehniko	Materials and components for railway engineering
--------	---	--

oSIST prEN 15328:2026

en,fr,de

Sample Document

get full document from standards.iteh.ai

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 15328

October 2026

ICS

Will supersede EN 15328:2020+A1:2024

English Version

Railway applications - Braking - Brake pads

Applications ferroviaires - Freinage - Garniture de frein

Bahnanwendungen - Bremsen - Bremsbeläge

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 256.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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 United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

© 2026 CEN All rights of exploitation in any form and by any means reserved
worldwide for CEN national Members.

Ref. No. prEN 15328:2026 E

Contents

Page

European foreword	4
Introduction	5
5.1 Classification of brake pads	9
5.2 Range of validity for vehicle implementation	9
5.3 Coefficient of friction	10
5.4 Environmental impact, health and safety	10
5.5 Usage requirements.....	10
5.6 Frictional requirements for brake pads.....	11
5.7 Requirements and optional test programs for brake pads for coaches.....	13
5.8 Geometrical features of the brake pads.....	14
5.9 Mechanical, physical and chemical characteristics.....	14
5.10 Thermal and mechanical requirements.....	15
5.11 In-service assessment	16
5.12 Marking of brake pads	16
5.13 Dynamometer test.....	16
5.14 Conditions for classification test.....	16
5.15 Guidelines for interchangeability of brake pads.....	19
Annex A (informative) Generic conditions for the execution of test programs	20
A.1 General.....	20
A.2 Response time.....	20
A.3 Weighing	20
A.4 Interruption of test sequence.....	20
A.5 Temperatures.....	20
A.6 Brake applications under wet conditions.....	20
A.7 Condition of break discs	21
A.8 Bedding-in of brake pads.....	22
A.9 Methods of temperature measurements.....	22
A.10 Mean friction radius.....	23
A.11 Rotation and ventilation conditions	23
A.12 Wheel diameter	23
Annex B (normative) Test programs for classes A1 to G1.....	24
B.1 Test program: brake pads for class A1.....	24
B.2 Test program: brake pads of class B1 and C1.....	27
B.3 Test Program: brake pads of classes B2 and C2.....	31
B.4 Test program: brake pads of class C0	36
B.5 Test program: brake pads of class C3	39
B.6 Test program: brake pads of class D1	41

B.7	Test program: brake pads of class D2	44
B.8	Test program: brake pads of class E1.....	48
B.9	Test program: brake pads of class F1.....	50
B.10	Test program: brake pads of classes F2 and G1.....	53
B.11	Test program: brake pads of class F3.....	56
B.12	Assessment of static friction coefficient.....	58
Annex C (normative) Test programs for coaches.....		59
C.1	Test program S1.1 ($v_{\max} = 200$ km/h – organic brake pads)	59
C.2	Test program S2.1 (wet test)	61
C.3	Instantaneous coefficient of friction for test program S1, S2, T1 and T2	62
C.4	Mean coefficient of friction for test programs S1.1, S2.1, T1 and T2	63
C.5	Test program T1 ($v_{\max} = 200$ km/h – sintered brake pads).....	64
C.6	Test program T2 wet test (sintered brake pads)	66
Annex D (normative) Documentation of brake tests		68
Annex E (normative) Generic test programs		70
E.1	Use of the generic test programs.....	70
E.2	Locomotives and Vehicles other than high-speed vehicles.....	70
E.3	High-speed vehicles	76
Annex F (normative) Brake pads shapes and envelopes.....		80
F.1	General	80
F.2	Preferred space envelope for SBP 200 cm ²	80
F.3	Preferred space envelope for SBP 175 cm ²	81
F.4	Space envelope for SBP 200 cm ²	81
F.5	Maximum Space envelope for SBP 175 cm ²	82
Annex G (normative) Drawings for dove tails		83
Annex H (informative) In-service test.....		88
H.1	Test requirements.....	88
H.2	Mechanical requirements.....	88
H.3	Thermal requirements.....	89
Annex I (informative) Example of the declaration of conformity		90
Bibliography		91

prEN 15328:2026 (E)**European foreword**

This document (prEN 15328:2026) has been prepared by Technical Committee CEN/TC 256 “Railway application”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 15328:2020+A1:2024.

prEN 15328:2026 includes the following significant technical changes with respect to EN 15328:2020+A1:2024:

- new terms 3.9 “braked mass per disc” and 3.10 “braking energy per disc” and 3.11 “braking power per disc” have been added;
- Table 1, Symbols and abbreviations has been updated;
- 5.2 “Range of validity for vehicle implementation” has been added;
- 5.14.1 “Conditions for classification tests” has been revised;
- 5.15 “Guideline for interchangeability of brake pads” has been revised;
- Annexes have been aligned accordingly;
- Annex G “Drawings for dove tails” has been revised.

get full document from standards.iteh.ai

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.

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.

Sample Document

get full document from standards.iteh.ai

prEN 15328:2026 (E)**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 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 16451, *Railway applications – Braking - Brake pad holder*

EN ISO 13715, *Technical product documentation — Edges of undefined shape — Indication and dimensioning (ISO 13715)*

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)*

EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025)*

EN ISO 8015, *Geometrical product specifications (GPS) - Fundamentals - Concepts, principles and rules (ISO 8015)*

EN ISO 24478, *Railway applications - Braking - General vocabulary (ISO 24478)*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 24478, EN 14535-1, EN 14535-2 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp/>
- IEC Electropedia: available at <https://www.electropedia.org/>

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.

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)

prEN 15328:2026 (E)

3.9

braked mass per brake disc

proportionate mass of the vehicle including rotational mass to be braked per disc

3.10

braking energy per brake disc

braking energy calculated using maximum operating speed of the vehicle and the braked mass per brake disc

3.11

braking power per brake disc

product of brake force per disc at maximum operating speed and the maximum operating speed

Note 1 to entry: For high-speed vehicles with two- or more step braking, it is possible that the braking power for speeds at the stepping point is higher than for the maximum operating speed. Here the braking power at the maximum operating speed is used

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
F_{br}	Braking force per brake disc	kN
E_{br}	Braking energy per brake disc	MJ
P_{br}	Maximum braking power per brake disc	kW
m	Mass to be braked per brake disc (inclusive of the rotational masses)	t
Q	Water flow rate	l/h
R_a	Refer to EN ISO 21920-2	μm
R_z	Refer to EN ISO 21920-2	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:	—

Symbol	Designation	Unit
	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	
$\mu_{m,nom}$	Nominal friction coefficient (brake pad)	—
θ_0	Mean initial temperature at the beginning of the brake application	°C
AMD	Axle mounted disc	
CI	Cast iron	
MU	Multiple unit (EMU/DMU)	
SBP	Standard brake pad	
WMD	Wheel mounted disc	

5 Characteristics and test method of the brake

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 8.

Classification tests for brake pads shall be carried out with the test program corresponding to the performance class to which it is sought (see Table 6). If a performance class covers other performance classes, the declaration of conformity includes those performance classes (see Table 7).

The specific parameters in the test program of Annex B and Annex C are specified in order to assess the basic friction performance and to get comparable results.

Brake pads that have a valid UIC certification according to UIC 541-3, 8th Ed (preliminary or full) comply with EN 15328:2020+A1:2024 for the corresponding vehicle and energy performance class.

Brake pads which comply with EN 15328:2020+A1:2024 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.

For the vehicles not covered by Table 7 project specific test program in accordance with Annex E shall be applied.

5.2 Range of validity for vehicle implementation

The classification of the brake pads may be used for:

- any brake disc type (wheel or axle mounted brake disc);
- any outer diameter of the brake disc;
- any material of the brake disc.

prEN 15328:2026 (E)

The references are the braking energy (see Formula (1)) and the maximum braking power (see Formula (2)) per stop per brake disc of any project specific brake application with the highest application force as well as the maximum braked mass. Further restrictions shall be considered which are determined in 5.14.4.

$$E_{br} = \frac{1}{2} \times m \times v_{max}^2 \quad (1)$$

$$P_{br} = F_{br} \times v_{max} \quad (2)$$

In principle, the scope of classification is defined by the performance class for which tests were conducted.

The usage of the classification in a specific project, as outlined in the program of the performance class X, may be permitted under the following conditions:

- a) The project-specific braking energy and power per stop do not exceed the performance class X level.
- b) The project-specific braking energy and power per stop is higher than defined for performance class X. Up to 10 % higher braking energy and power per stop the conformity shall be shown in vehicle implementation test or in generic test program in accordance with Annex E.

5.3 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.

5.4 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.

5.5 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.

5.6 Frictional requirements for brake pads

5.6.1 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.

5.6.2 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.

5.6.3 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.

prEN 15328:2026 (E)

5.6.4 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.

Table 3 — Tolerance bands for the mean coefficients of friction vs, priority levels

Priority level of brake application	1	2	3	4
Tolerance band 1	±10 %	±15 %	±20 %	±25 %
Tolerance band 2	±15 %	±20 %	±25 %	±30 %

The mean coefficient of friction for each brake application shall lie within the bounds of the tolerance band 1 in accordance with its priority, while the following exceptions are tolerated:

- a total of 6 % of all brake applications (rounded to the closest integer) of priority 1 may deviate from tolerance band 1 towards the negative side;
- a total of 12 % of all brake applications (rounded to the closest integer) of priority 1 may deviate from tolerance band 1;
- a total of 5 % of all brake applications (rounded to the closest integer) of priorities 2 to 4 may deviate from tolerance band 1 towards the negative side;
- a total of 10 % of all brake applications (rounded to the closest integer) of priorities 2 to 4 may deviate from tolerance band 1.

No mean coefficient of friction shall lie outside of tolerance band 2.

5.6.5 Criteria for continuous brake applications

During continuous brake applications, after 10 s the instantaneous coefficient of friction shall stay inside the band defined by $\mu_{\min} = 0,250$ and $\mu_{\max} = 0,500$.

After 2 minutes the instantaneous coefficient of friction shall not vary more than 0,05 during any minute and the coefficient of friction shall stay inside the band defined by $\mu_{\min} = 0,250$ and $\mu_{\max} = 0,500$.

The brake pad wear during any continuous brake application, including the stop brake application, thereafter, shall not exceed 1 mm. The wear in mm can be calculated from the weight differences before and after the continuous brake application.

5.6.6 Criteria for bedding brake applications

The nominal coefficient of friction of the bedded state shall be defined as the average of measured mean coefficients of friction μ_m of the last 5 braking stops carried out during the bedding section.

During the bedding-in phase, the mean coefficients of friction shall not exceed the following variations from the nominal value of the bedded state:

- ± 30 % from the 11th bedding-in brake application until 30 % of number of the bedding-in applications are finished;
- ± 15 % during the rest of the bedding-in process.

5.7 Requirements and optional test programs for brake pads for coaches

5.7.1 General

The frictional requirements for brake pads in coaches used in generic operation are described in 5.6.2 to 5.6.6. The optional test programs are defined in S1 and S2 for organic material and T1 and T2 for sintered material and may be used instead of performance class C0 (see Annex C).

5.7.2 Tolerance ranges

The tolerance ranges for the instantaneous and mean coefficients of friction on a dry brake disc are given for the respective applications in the figures of the corresponding annexes. The instantaneous and the mean coefficients of friction measured in the test bench tests shall be documented in the appropriate tolerance diagrams. For the highest nominal application forces of the test program the mean coefficients of friction are summarized in a separate tolerance diagram and documented in tabular form. The average value of these mean coefficients of friction at a speed of 120 km/h at the highest nominal application force (excluding brake application with high initial temperatures) should not vary more than 10 % upwards or 5 % downwards from the nominal coefficient of friction given in the tolerance diagram of the respective test program. At speeds above 120 km/h, the average values of these mean coefficients of friction shall not vary more than 10 % upwards or 10 % downwards from the nominal coefficients of friction.

5.7.3 Criteria for continuous brake applications

During continuous brake applications, after 10 seconds the instantaneous coefficient of friction shall stay inside the band defined by $\mu_{\min} = 0,250$ and $\mu_{\max} = 0,500$.

After 2 minutes the instantaneous coefficient of friction shall not vary more than 0,05 during any minute and the coefficient of friction shall stay inside the band defined by $\mu_{\min} = 0,250$ and $\mu_{\max} = 0,500$.

5.7.4 Criteria for bedding brake applications

The mean coefficient of friction of the bedded state shall be defined as the average of measured mean coefficient of friction of the last 5 braking stops carried out during the bedding section.

During the bedding-in phase, the mean coefficients of friction shall not exceed the following variations from the nominal value of the bedded state:

- ± 30 % from the 11th bedding-in brake application until 30 % of number of the bedding-in applications are finished;
- ± 15 % during the rest of the bedding-in process.

5.7.5 Coefficient for friction under high thermal load

For brake applications to a stand, which are done from a high initial temperature (approximately 140 °C, excluding brake application after continuous brake applications and for two consecutive emergency brake without cooling time), the mean coefficient of friction under otherwise similar conditions shall not vary by more than ± 15 % from the average of the mean coefficients of friction of brake applications initiated from the cold and dry condition.

5.7.6 Coefficient of friction under wet conditions

In wet conditions, with the highest nominal application force of test programs S2 and T2 the mean coefficient of friction shall not vary – all other things being equal – by more than ± 15 % compared with the average of mean coefficients of friction obtained during braking under dry conditions. The mean