



# SLOVENSKI STANDARD

## SIST EN 14535-2:2011

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**Železniške naprave - Kolutne zavore za železniška vozila - 2. del: Kolutne zavore, nameščene na kolo, mere in zahteve za kakovost**

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

Bahnanwendungen - Bremsscheiben für Schienenfahrzeuge - Teil 2: Bremsscheiben, die an einem Rad befestigt werden, Abmessungen und Qualitätsanforderungen

Applications ferroviaires - Disques de frein pour matériel roulant ferroviaire - Partie 2: Disques de frein montés sur la roue, dimensions et exigences de qualité

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**ICS:**

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

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 14535-2**

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ICS 45.060.01

English Version

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

Applications ferroviaires - Disques de frein pour matériel roulant ferroviaire - Partie 2: Disques de frein montés sur la roue, dimensions et exigences de qualité

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This European Standard was approved by CEN on 4 May 2011.

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-CENELEC Management Centre or to any CEN member.

This European Standard exists 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



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

Management Centre: Avenue Marnix 17, B-1000 Brussels

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## Foreword

This document (EN 14535-2:2011) 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 December 2011 and conflicting national standards shall be withdrawn at the latest by December 2011.

This document has been prepared under a mandate given to CEN/CENELEC/ETSI by the European Commission and the European Free Trade Association, and supports Essential Requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

This series of European Standards *Railway applications — Brake discs for railway rolling stock* consists of:

- *Part 1: Brake discs pressed or shrunk onto the axle or drive-shaft, dimensions and quality requirements [1]*
- *Part 2: Brake discs mounted onto the wheel, dimensions and quality requirements*
- *Part 3: Brake discs, performance of the disc and of the pad and disc friction couple, classification<sup>1)</sup>*

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

Until Part 3 is made publicly available, the existing relevant national standards or other suitable regulations should be used as an interim solution where prEN 14535-3 is referenced in this document.

NOTE On publication of Part 3, Part 2 may be reviewed to take into account any necessary changes.

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, 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.

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<sup>1)</sup> To be published.

## Introduction

This European Standard gives the requirements to be met for the design, dimensions, performance and testing of the brake disc, hereafter called "disc". These requirements cannot be written in sufficient detail to ensure good workmanship or proper construction. Each manufacturer is therefore responsible for taking every necessary step to make sure that the quality of design, workmanship and construction is such as to ensure accordance with good engineering practice.

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## 1 Scope

This European Standard specifies requirements to be met for the design, dimensions, performance and testing of the brake disc.

This European Standard applies to brake discs mounted onto the wheel, including the wheel web or wheel hub of railway rolling stock.

For each discrete unit so fitted, one or more disc brake rings, each having one friction face, may be deployed.

This European Standard applies to discs designed to be fitted to rail vehicles used on the main national networks, urban networks, underground railways, trams, private networks (regional railways, company railways, etc.).

In addition to the common requirements, this European Standard also requires the items detailed in Clause 5 to be documented. For compliance with this European Standard, both the common requirements and the documented items need to be met.

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

prEN 15328<sup>2)</sup>, *Railway applications — Braking — Brake pads*

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## 3 Terms and definitions

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

### 3.1

#### **brake disc**

rotor having one or more co-planar annular friction faces for the engagement of brake pads and means of transmitting rotation between itself and the associated web or hub

NOTE 1 It may absorb and dissipate at least part of the brake energy.

NOTE 2 This definition is identical to 4.9.7.10 in EN 14478:2005.

### 3.2

#### **friction face**

radially and circumferentially extending planar surface of the disc available for frictional engagement of the brake pad(s)

### 3.3

#### **brake ring**

portion of the disc having the friction face

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<sup>2)</sup> To be published.

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NOTE 1 Brake rings having a continuity of material allowing in that volume no flow of air are "non-ventilated". Otherwise they are "ventilated".

NOTE 2 Brake rings being of homogenous material construction behind the friction face are "homogenous" or otherwise "non-homogenous".

NOTE 3 Brake rings may consist of one or more sectors and may have continuous or non-continuous friction faces.

NOTE 4 Split brake rings are those which are separated into two halves. Segmented brake rings are those which are separated into more than two parts.

### 3.4 fastening area

portion of the disc having means for the fastening on the wheel

NOTE The fastening area may be constructed integral with the brake ring or connected to it by a separate linking arrangement.

### 3.5 non-ventilated disc (solid disc)

disc having a continuity of material or materials extending from the friction face axially to the rear face so preventing the flow of air through the body of the disc

### 3.6 ventilated disc

disc in which passages to conduct a flow of cooling air are located between the friction ring and the web of the wheel

NOTE The airflow is usually occasioned by the rotation of the disc.

### 3.7 maximum permissible disc temperature

highest operating temperature related to the application

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NOTE This may be expressed as an absolute peak value or as a nominal value over a defined period of time.

### 3.8 split disc

disc in which the brake ring is separated in two halves

### 3.9 segmented disc

disc in which the brake ring is separated in more than two parts

### 3.10 maximal permissible rotational speed

highest rotational speed related to the application

### 3.11 direct actuation

brake in which the brake pad normal force is applied directly (as in the case of an "automobile" type of brake caliper)

### 3.12 indirect actuation

brake in which the brake pad normal force is applied via a lever system

### 3.13 part

uniquely identified pattern of a detail in an assembly or a component



**3.14****identification number**

number for identification of the part, item or article

**3.15****performance class**

set of the values of brake energy, braking power and brake torque, related to the outer diameter, width and type of the disc, at which it is type tested to demonstrate its capability to withstand these conditions without exceeding the defined limits of structural degradation

NOTE Discs are categorized into the performance classes according to the tests to be covered in prEN 14535-3<sup>3)</sup>: Brake discs, performance of the disc and of the pad and disc friction couple, classification.

**3.16****braking energy**

energy dissipated per disc

**3.17****braking torque**

torque per disc generated by the brake calliper and the pad friction value

**3.18****braking power**

braking energy per unit time

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**4 Symbols**

For the purpose of this European Standard, the following symbols apply.

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**Table 1 — Symbols and units**

Symbol	Description	Unit
$d$	Diametrical dimension	mm
$R_a$	Surface roughness (arithmetical mean deviation of the assessed profile)	$\mu\text{m}$
$R_z$	Surface roughness (maximum height of profile)	$\mu\text{m}$
$U$	Imbalance	$\text{g} \cdot \text{m}$
$x$	Axial dimension	mm

**5 Items to be agreed between contracting parties and documented****5.1 Information to be supplied**

The following information to be supplied shall be fully documented. For compliance with the standard both the common requirements specified throughout the standard and the following documented items shall be satisfied:

- any special conditions for manufacture and any special characteristics for the materials used (6.2, Note 1);

<sup>3)</sup> To be published.

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- access to the wheel for testing and checking without dismantling the disc, including envelope dimensions (6.3.2, note);
- any requirement for surface roughness other than that specified in this standard (6.3.4, note);
- values for imbalance class 3, if appropriate (6.3.5, note);
- approved test method for crack detection (6.4.2);
- whether a declaration of the constant brake moment is required (6.4.3, note);
- whether a declaration of the ventilation losses is required (6.4.4, note);
- environmental conditions, which the disc is required to be able to withstand (6.4.7);
- identification and traceability of the manufacturing process of the discs and their component parts at all stages of production, inspection and delivery (7.3.3);
- format, storage medium and retrieval system for records if other than the normal practice of the supplier (7.3.5, Notes 1 and 2);
- method of marking if other than those specified in this European Standard (9.1.3).

NOTE Usually these items of information are supplied by the purchaser.

**5.2 Items for agreement**

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The following items to be agreed between the contracting parties are specified in the clauses referred to and shall be fully documented. For compliance with the standard both the common requirements specified throughout the standard and the following documented items shall be satisfied:

- form of the disc fastening areas features (6.3.1, note);
- indication of disc wear limits (6.3.3);
- process used to achieve the imbalance requirement other than that specified in this European Standard (6.3.5);
- dimensional tolerances for discs having a maximal permissible rotational speed greater than 2 200 rpm (6.3.6);
- maximum values for corrugation, swashing and buckling for disc designs other than those in which the fastening points are centred (6.4.2);
- corresponding values after a category C2 test (6.4.2, 7.2 and Annex A);
- performance test (category B, C1) (6.4.6 and 7.2);
- in-service limit (6.4.7);
- method of calculation for verification of requirements for wheel and brake disc (6.5);
- any additional marking (9.1.2);
- packing and protection (9.2);
- time duration or number of kilometres for test (Annex A);

- number of discs and vehicles used for the checking of the operating requirement (Annex A);
- any controls to be realized and prescriptions to be met before and/or after the checking test of operating requirement (Annex A);
- pass-fail criteria (Annex A).

## 6 Requirements

### 6.1 Purpose

The discs are intended to be used as part of a friction brake and shall fulfil the following purposes:

- permit a braking moment or torque to be generated, supported and transmitted to the rail vehicle wheel;
- permit, by frictional engagement of a brake pad or pads, the conversion into heat of the kinetic and potential energy involved in retarding the vehicle or vehicles which is attributed to the use of the disc brake;
- absorb part or all of the kinetic and potential energy arising from the process described previously;
- dissipate the absorbed energy by radiation, convection and conduction.

In achieving these requirements, the disc shall not suffer damage or degradation other than wear, surface cracks and deformations of the friction face beyond permissible limits.

### 6.2 Materials, design and manufacture

The materials, design and manufacture of the disc shall, for all intended operating conditions, take into account:

- in the case of discs mounted on the wheel, the vehicle gauge when the road wheels are at their minimum permitted diameter and width;
- the rotational speed;
- the magnitude of the braking torque;
- the quantity of brake energy to be converted and dissipated and its rate of conversion and dissipation;
- the frictional working conditions, especially with the interaction with the brake pad;
- self-ventilating fan driving losses;
- noise;
- mass of disc;
- imbalance of the disc;
- environmental influence, e.g.: storage, climatic, shock and vibration conditions;
- the integrity, life and maintenance requirements of the disc, associated brake components, and brake and vehicle systems;