BS EN 14535-2:2011

BSI Standards Publication

Railway applications — Brake discs for railway rolling stock

Part 2: Brake discs mounted onto the wheel, dimensions and quality requirements

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National foreword

This British Standard is the UK implementation of EN 14535-2:2011.

The UK participation in its preparation was entrusted to Technical Committee RAE/4, Railway Applications - Braking.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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

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

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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of an identical text or by endorsement, at the latest by December 2011 and conflicting national standards shall be withdrawn at the latest by December 2011.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*[1)]

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.

1) 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.

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[2)], *Railway applications — Braking — Brake pads*

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

2) To be published.

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 permissable disc temperature
highest operating temperature related to the application

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[3)]: 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

4 Symbols

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

Table 1 — Symbols and units

Symbol	Description	Unit
d	Diametrical dimension	mm
R_a	Surface roughness (arithmetical mean deviation of the assessed profile)	µm
R_z	Surface roughness (maximum height of profile)	µm
U	Imbalance	g · 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);

[3)] To be published.

— 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

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;

— where a disc consists of more than one constructional element designed for in-service replacement of the brake ring or part of it, the associated parts of that disc shall be interchangeable while the fastening area or carrier remains installed on the wheel within the vehicle;

— the design shall be such as to prevent the detachment of any part of the disc at any speed up to and including the maximal permissible speed in all degraded conditions (e.g. wear, cracking) up to the limits specified by the supplier.

If any special conditions for manufacture and special characteristics for the materials used are necessary, they shall be specified and documented.

NOTE 1 Generally, the special conditions for manufacture and special characteristics for the materials are stated by the purchaser.

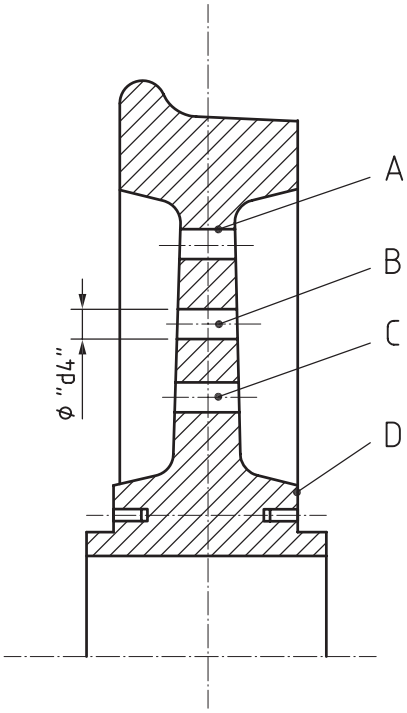
NOTE 2 The manufacturer should operate a quality management system that offers equivalence with EN ISO 9001 [2].

6.3 Dimensions

6.3.1 Characteristics of dimensions and areas for the fastening

Examples of the disc fastening areas are shown in Figure 1. All fastening areas may be used solely or in any combination. The preferred ranges of major fastening and interface dimensions are shown in Table 2. The measures are explained in Figure 2.

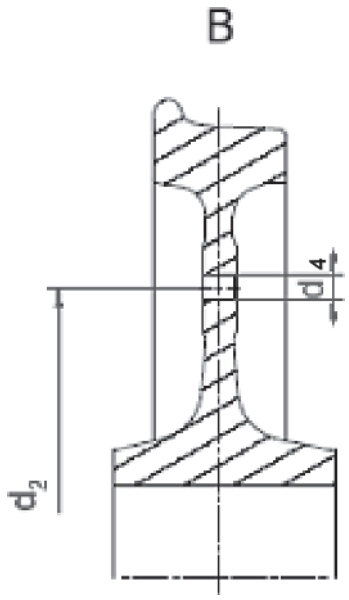
NOTE The form of the disc fastening areas features should be agreed between the contracting parties.



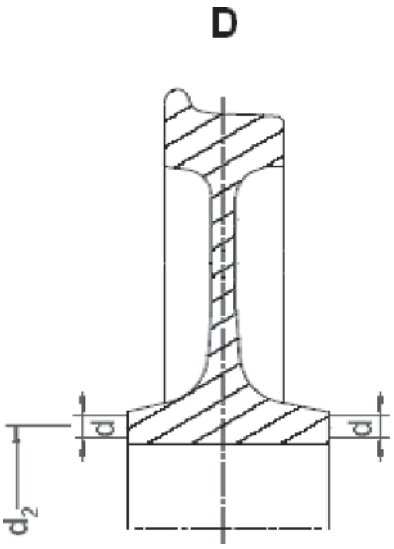
Key

View	Denomination	Fastening area position
A	Outer	Close to wheel rim
B	Central	Middle of the web
C	Inner	Close to wheel hub
D	Hub	Directly to the wheel hub

Figure 1 — Disc, definition of fastening areas



a) Attachment on web of the wheel



b) Attachment on hub of the wheel

Figure 2 — Disc major interface measures

Table 2 — Disc major interface dimensions [a]

Feature	1st preference	2nd preference
d_1 major diameter of brake ring [b]	610 mm, 640 mm, 660 mm, 680 mm, 700 mm, 710 mm, 725 mm, 750 mm, 800 mm, 840 mm, 880 mm, 940 mm, 1 040 mm, 1 085 mm	other diameters from 550 mm to 1 100 mm in any gradation
d_3 minor diameter of brake ring	If d_1 < 660 mm → d_3 ≤ 0,56 × d_1 If d_1 ≥ 660 mm → d_3 = d_1 – 290 mm	any other smaller size
d_2 fastening area pitch diameter		
Fastening on wheel web	to be adapted with the wheel design	to be adapted with the wheel design
Fastening on wheel hub	to be adapted with the wheel design	to be adapted with the wheel design
d_4 fastening area bore diameter	to be adapted with the wheel design [d]	to be adapted with the wheel design [d]
x_1 brake ring width [c]		
– ventilated	(135 – max. wheel web width)/2	any other
– non-ventilated	distance of the mounting faces depending on wheel design	any other wheel web width depending on wheel design

[a] The preferences for dimensions are individually exclusive, e.g.: a particular disc could have a major brake ring diameter of 650 mm (1st preference) combined with a brake ring width of 70 mm (2nd preference), being thereby 2nd preference. Wherever possible, specify 1st preference dimensional combinations.

[b] In some forms of disc construction the friction face major diameter may be less than the brake ring major diameter.

[c] An offset may be employed when the wheel web is not associated symmetrically to the wheel rim.

[d] See EN 13260 [3], EN 13261 [4] and EN 13262 [5]

6.3.2 Access to the wheel

An access to the wheel for testing and checking the wheel web without dismantling of the disc shall be provided if required.

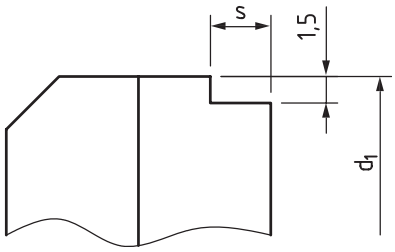
The appropriate envelope dimensions for such access shall be specified.

NOTE Generally, the specification is given by the purchaser.

6.3.3 Indication of disc wear limits

Unless otherwise agreed between the contracting parties, a spigot of the form shown in Figure 3 shall be present on the disc inside and outside circumference to indicate the limit of acceptable wear.

Dimensions in millimetres



Key

s amount of maximum permitted wear

Figure 3 — Wear limit indication spigot

6.3.4 Finishing

The surface roughness shall be such as to avoid unacceptable stress rise. For the friction faces and fastening area bore shall be:

— friction faces: $R_z \leq 16$ µm;

— contact faces to the wheel: $R_z \leq 25$ µm.

NOTE Any other requirement for surface roughness, for example to verify the R_a to facilitate non-destructive testing, should be specified. Generally, the specification is given by the purchaser. The values should be given in the required evaluation method (R_a or R_z).

Corners at friction faces with holes and gaps between wear parts may be chamfered 45° to a depth of at least the calculated wear to the next turning operation.

6.3.5 Balance

The imbalance of new discs and those having a service replacement brake ring, or part of such, shall be within the following values:

Imbalance class 1: $U \leq 10$ gm

Imbalance class 2: $U \leq 16$ gm

Imbalance class 3: Other value.

NOTE The purchaser may define the required value for his application.

The discs may be statically balanced.

The process used, where necessary, to achieve the imbalance requirement shall, unless otherwise agreed between the contracting parties, be through removal of material from an area which is not critical to the disc strength.

The imbalance of a set of two brake rings assembled to a wheel shall not exceed 1,5 times the imbalance of a single brake ring. This can be easily achieved when the brake rings are assembled in a position in which the residual imbalances compensate each other.

6.3.6 Dimensional tolerances

For discs having a maximal permissible rotational speed

— up to and including 1 000 rpm, the tolerances and limit deviations in Table 3 should apply and

— between 1 000 rpm and 2 200 rpm the tolerances and limit deviations in Table 3 shall apply.

Table 3 — Dimensional tolerances

Dimensions in millimetres

Dimensional feature	Tolerance/limit deviation (mm or performance class)	
	Indirect actuation	Direct actuation
Friction face flatness ▱	0,1	0,025
Parallelism of friction faces //	0,3	0,2
Friction face run-out relative to fastening area bore axis ↗	0,25	0,1
Major diameter, d_1	[0, –1]	
Fastening area bore, d, in the wheel	± 0,05	
Minor diameter, d_3	± 2	
Brake ring width x_1	[0; - 0,3]	
Concentricity of major diameter and fastening area bore	0,5	
Friction face to assembly face	0,1	
Required tolerance for parallelism of wheel assembly faces	0,1	

For discs having a maximal permissible rotational speed greater than 2 200 rpm the tolerances may be as otherwise agreed between the contracting parties.

6.4 Performance

6.4.1 Performance classification

Discs of the same size may have different capabilities to convert brake power and absorb and dissipate brake energy due to the disc design, materials and manufacture. The disc shall be classified by performance in order to facilitate selection according to the application in accordance with a standardized test programme. Performance classification is specified in prEN 14535-3[4)].

NOTE It is intended that 6.4.1 will be superseded by EN 14535-3 when issued.

6.4.2 Structural distortion or displacement

On completion of a ”category A” (see 7.1) braking programme as described in the stop braking and power dissipation parts of the type test, the following dimensional and surface degradation criteria, using the fastening area pitch diameter d_2 as a datum, shall be met.

4) To be published.

The imbalance value shall not exceed 1,2 times that measured before the performance test with the disc assembled to the wheel.

For circumferences of diameters

— 10 mm less than the disc major diameter and

— 10 mm greater than the disc minor diameter

the corrugation, swashing and buckling shall not exceed the values given in Table 4, providing the fastening points are centred.

Table 4 — Maximum values for corrugation, swashing and buckling

Dimensions in millimetres

Parameter	Description	Indirect actuation	Direct actuation
Corrugation	undulating deformation of the friction faces	≤ 0,5	0,05
Swashing	helicoidal deformation of the friction faces	≤ 1,0	≤ 1,0
Buckling	cone-shaped deformation of the friction faces	4,0	0,5

These values are only applicable if the fastening points are centred. For other designs the limits should be agreed between the contracting parties.

After one radial cut has been made completely through the disc with a cutter of width 4 mm to 6 mm, the circumferential gap remaining

— for a monobloc disc, between the major diameter and the fastening area bore;

— for all other discs, between the major and minor diameters of the brake ring;

shall be ± 3 mm of the cutter width.

This test is not applicable for segmented brake rings.

No crack longer than 5 mm shall be present on the friction faces. Cracks have to be verified by approved test methods.

The corresponding values after a ”category C2” (see 7.2 and Annex B) test shall be as agreed between the contracting parties.

6.4.3 Thermal power dissipation

If required, the constant brake moments shall be declared which, without enhanced forced air ventilation as described in prEN 14535-3[5)], and at the three speeds comprising 0,6, 0,4 and 0,2 of the maximal permissible rotational speed, cause the brake ring stabilised temperature to be the maximum declared disc temperature and 0,75 and 0,5 of the difference between that temperature and 20 °C.

5) To be published.

NOTE Usually the requirement for the declaration is stated by the purchaser.

6.4.4 Ventilation losses

If a declaration of the ventilation losses is required, it shall be determined as described in prEN 14535-3[6)].

NOTE Usually the requirement for the declaration is stated by the purchaser.

6.4.5 Noise generation

The noise generated by an unbraked rotating ventilated disc where the maximal permissible speed is such that the corresponding circumferential speed exceeds 90 m/s shall not exceed 115 dBA under the conditions defined in prEN 14535-3[7)].

NOTE As measuring conditions of disc noise and TSI train noise are different, the disc noise limit does not guarantee that the train will fulfil TSI noise regulations.

6.4.6 Frictional performance

6.4.6.1 Performance tests at the bench

When performance test (category B, C1) are agreed between the contracting parties, they shall be performed within the framework of an application on a specific vehicle with the couple brake pad and brake disc defined and used in service.

These tests shall be carried out in accordance with prEN 15328[8)] brake pads.

The main prescriptions to be checked are, for example, depending upon the application:

a) for stopping braking:

   1) the average friction coefficient according to the speed and the effort of dry application;

   2) the variation of average friction coefficient between dryness and wet;

   3) the variation of dry average friction coefficient between phase of bedded in and after bedded in;

   4) the variation of dry average friction coefficient between braking at ambient initial temperature and braking at high initial temperature;

   5) the stability of instantaneous friction coefficient;

   6) the average friction coefficient during a stopping braking after a drag braking;

b) for drag braking:

   1) the average friction coefficient;

   2) the stability of instantaneous friction coefficient.

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6) To be published.

7) To be published.

8) To be published.

6.4.6.2 Performance tests on line

Performance tests on line (category C1 tests of 7.2) shall be performed within the framework of an application on a specific vehicle using the brake pad and brake disc friction couple defined and used in service.

These tests shall confirm the performance of the friction couple with regard to stopping distance, deceleration, etc.

6.4.7 Service life

The disc shall be capable of withstanding the environmental conditions until its brake ring wear or cracking degradation has reached the in-service limit, without other life limiting defects occurring.

NOTE Generally, in-service limit is agreed between the contracting parties on the supplier's proposal.

6.5 Installation

The fitting of the disc to wheel is generally achieved by bolting. Other methods of fitting may be used, but shall meet the requirements of this European Standard.

The fit between the fastening area and wheel shall be chosen to provide secure location of the disc under all conditions of operation including consideration of the magnitude of the brake moment or torque, the design and materials used in the disc construction, the installation process, the thermal cycle effects and other environmental effects.

These requirements shall be verified by calculations on both wheel and brake disc. The method of calculation should be agreed between contracting parties.

The position of the residual imbalance of each brake ring of a set shall be in such a position as to minimize the imbalances of the assembly.

7 Test methods

7.1 Type tests (Category A test)

These tests are a fundamental comparative evaluation of the disc using laboratory based test plant and are designated as ”Category A” tests. The tests are standardised in prEN 14535-3[9)]. The principal objective is to enable effective comparisons to be made of the basic performance of discs available from various suppliers so that an analysis can be made to facilitate an informed choice of equipment. The tests are formulated, for the given performance classes, to represent basic dimension data for the design of the brake equipment. In order to meet further requirements, a more extensive test programme may be specified. In normal cases only category B and C1 tests may be carried out.

7.2 Application test

These tests are a check of the braking performances and an assessment of the capability of the use of a specific vehicle with its braking equipment used in service and are designated as follows:

Category B — Bench tests

Performance bench tests shall be carried out in order to validate a brake disc for a specific application. Performance bench tests already made with the same disc-pad couple and for a same vehicle and operating conditions, can be re-used for the new application.

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9) To be published.

Category C1 — Performance run tests

Performance run tests shall be carried out in order to validate a brake disc for a specific application. Performance run tests already made with the same pad-disc couple and for a same vehicle and operating conditions, can be re-used for the new application.

Category C2 — In service tests : validation of the capability for service use (see Annex B)

Testing the capability for service use shall be carried out. In the framework of the validation of a brake disc for a specific application, such tests already made with the same pad-disc couple and for a same vehicle and operating conditions, can be re-used for the new application.

Where an in-service test is requested, the absence of it shall not prevent preliminary approval of the equipment or the vehicle provided the equipment has satisfactorily passed the type test requirement of this specification.

7.3 Routine tests

7.3.1 Verification

It shall be possible to verify that the production operations and the resulting products comply with all the drawings and specifications. There shall be an adequate quality system in place and to qualify suppliers and sub-contractors as having reached and being in a position to maintain that level of capability. It shall be possible to define the operational means by which such capability is to be verified.

7.3.2 Specifications

These may include:

a) an interface ”acceptance” or ”equipment” drawing showing dimensional values and limits, and where applicable, performance, maintenance, life, etc. data;

b) material and process sampling and test procedures and pass/fail criteria;

c) material specifications, which may include:

- chemical composition;
- mechanical properties;
- microstructure and macrostructure;
- defect identification and classification.

7.3.3 Traceability

A system shall be established and maintained to identify and ensure traceability of the manufacturing process of the discs and their component parts at all stages of production, inspection and delivery. The traceability of all the manufacturing processes shall be ensured, including those sub-contracted, of all the components and assemblies correlated in such a way that the data can be attributed with certainty to any chosen disc(s).

Traceability involves in particular the following:

a) the origin of the material, its production process and the contractual arrangements;

b) changes and treatments carried out;

c) dimensional checks;

d) assembly.

It shall be possible to trace all components having undergone the same manufacturing and inspection procedures.

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

7.3.4 Tests and measurements

These, where specified, shall be undertaken to the appropriate EN standard or accepted alternative and the test and measurement results and the associated certification made available.

7.3.5 Records

Records associated with the processes by which the product quality is assured, including, for example, design verification and validation, test results, certificates of conformance, shall be retained for 15 years from the date of product despatch from the manufacturer's premises.

NOTE 1 Usually, the records are retained by the supplier. Retention beyond 15 years is the responsibility of the purchaser.

The format, storage medium and retrieval system shall be suitable to ensure record longevity and shall, except where otherwise specified, be that of the normal practice of the supplier.

NOTE 2 Usually requirements for alternative formats, storage media and retrieval systems are stated by the purchaser.

8 Classification and designation

8.1 Classification

Discs shall be classified as follows:

— for imbalance according to 6.3.5;

— for performance according to 6.4.1.

8.2 Designation

Discs complying with this part of this European Standard shall be designated as follows:

— the number of this European Standard;

— the performance class;

— constructional form of brake ring (C = cast, F = forged, R = rolled, X = any other);

— presence or otherwise of ventilation (V = ventilated, N = non-ventilated);

— axial symmetry (S = symmetrical, A = non-symmetrical);

— brake ring major diameter in mm;

— brake ring minor diameter in mm;

— brake ring width (each) in mm;

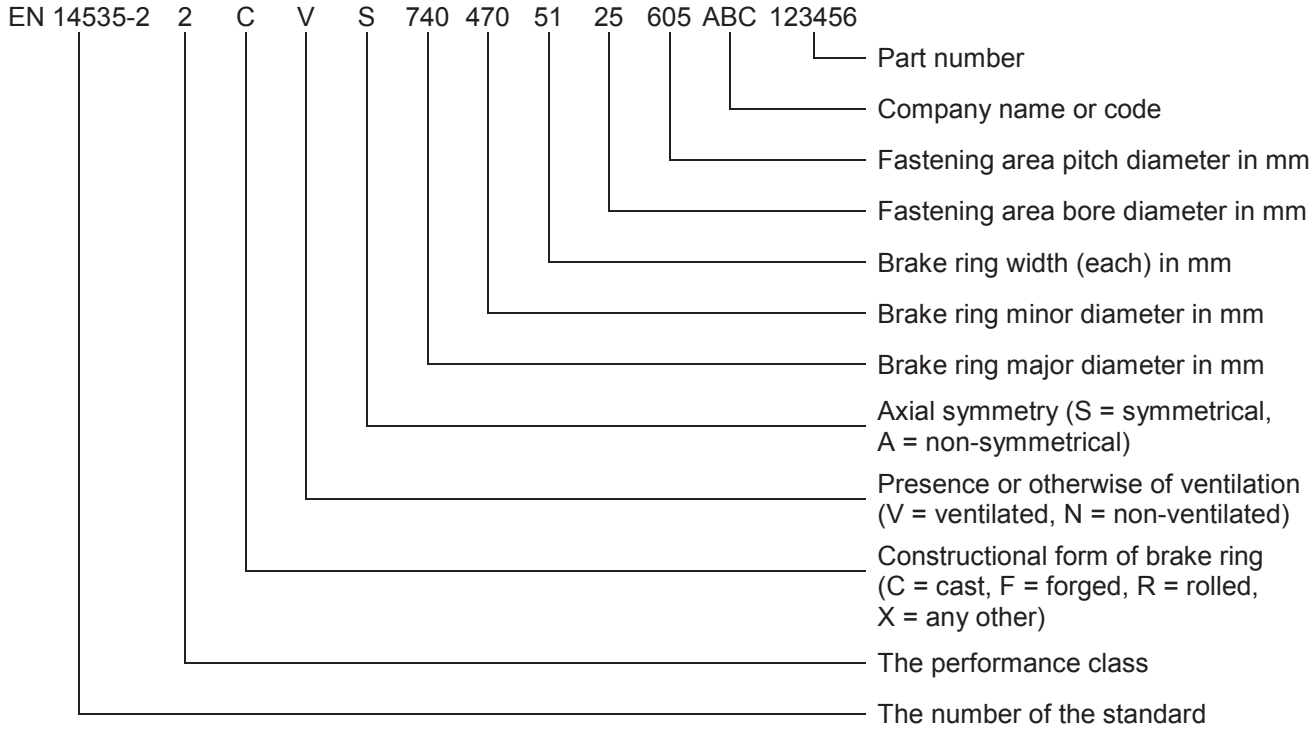
— fastening area bore diameter in mm;

— fastening area pitch diameter mm;

— company name or code;

— part number.

As an example, the designation ”EN 14535-2 2 C V S 740 470 51 25 605 ABC 123456” refers to each brake ring of the wheel-mounted disc of performance class 2 having symmetrical ventilated construction to the dimensions shown, supplied by the ABC Company to part number 123456.



9 Marking and packaging

9.1 Marking

9.1.1 The marking area shall preferably be on the outer circumference, close to the imbalance point. Each disc shall be indelibly marked with the magnitude of imbalance and its position plus a code in an area that is not liable to alteration when in use to enable the following:

a) the supplier to be identified and the origin of all components that have been cast, forged or subject to a critical manufacturing process;

b) the part to be uniquely identified (name or code of manufacturer);

c) the date(s) of manufacture to be established;

d) complete traceability of the materials and manufacturing processes to be achieved;

e) indication of the value of the residual imbalance and identification of its position.

Split discs shall be delivered complete if possible, and marked for assembly.

9.1.2 Any additional marking shall be by agreement between the contracting parties.

9.1.3 The method of marking shall, unless otherwise specified, be by moulded or forged features or made using stamps having no sharp edges.

NOTE Usually the requirement for other methods of marking is stated by the purchaser.

9.2 Packing and protection

This shall be as agreed between the contracting parties.

Annex A
(informative)

Experimentation in service (checking of the operating requirement) category C2 test

Experimentation, for a time duration or number of kilometres for test in service to be agreed between the contracting parties, should be carried out to check the operating requirement of a brake disc associated with a pad defined on a specific vehicle.

The number of discs and vehicles used for the checking of the operating requirement should be agreed between the contracting parties.

For economic reasons, some controls to be realized and prescriptions to be met can be carried out before and/or after the checking test of operating requirement with agreement between the contracting parties.

The main prescriptions to be checked are:

— checking of the dimensional specifications;

— checking of the residual imbalance;

— checking of the chemical composition of materials of the disc, determination of the contents of the various components of the disc;

— checking of the mechanical properties of materials of the disc. Checking of hardness, the tensile strength and Charpy impact test;

— checking of the microstructure of materials of the disc. Characterization of the structure of materials by the measurement of the size of the grain, oxide cleanness, decarburisation, the distribution and the size of graphite;

— checking of the macrostructure of materials of the disc. Characterization of the structure of materials by checking of the organization fibre material Baumann image of macroscopic cleanness of materials;

— identification and classification of the defects of the disc. Visual examination and examination by non destructive testing of internal quality of products by ultrasonic technique, magnetic particles inspection, penetrant testing, and radiography.

Pass-fail-criteria should be agreed between the contracting parties.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC

This European Standard has been prepared under a mandate given to CEN/CENELEC/ETSI by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the Directive 2008/57/EC[10)].

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 for HS Rolling Stock, Table ZA.2 for CR Freight Wagons and Table ZA.3 for CR Locomotives and Passenger Rolling Stock, confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard, the HS TSI RST published in the OJEU dated 26 March 2008 and Directive 2008/57/EC

Clause/ subclauses of this European Standard	Chapter/§/annexes of the TSI	Corresponding text, articles/§/annexes of the Directive 2008/57/EC	Comments
The whole standard is applicable	4. Characteristics of the subsystem 4.2 Functional and technical specification of the subsystem 4.2.4 Braking §4.2.4.7 Braking, Brake performance on steep gradients	Annex III, Essential requirements 1 General requirements 1.1 Safety Clauses 1.1.1, 1.1.2, 1.1.3, 1.1.5 1.2 Reliability and availability 1.5 Technical compatibility 2 Requirements specific to each subsystem 2.4 Rolling stock 2.4.1 Safety §3 2.4.2 Reliability and availability 2.4.3 Technical compatibility §3	The standard cannot be used for acceptance assessment until EN 14535-3 is published. The standard does not support TSI chapter: 4. Characteristics of the subsystem 4.2 Functional and technical specification of the subsystem 4.2.10 Maintenance

[10)] This Directive 2008/57/EC adopted on 17th June 2008 is a recast of the previous Directives 96/48/EC 'Interoperability of the trans-European high-speed rail system' and 2001/16/EC 'Interoperability of the trans-European conventional rail system' and revisions thereof by 2004/50/EC 'Corrigendum to Directive 2004/50/EC of the European Parliament and of the Council of 29 April 2004 amending Council Directive 96/48/EC on the interoperability of the trans-European high-speed rail system and Directive 2001/16/EC of the European Parliament and of the Council on the interoperability of the trans-European conventional rail system'.

Table ZA.2 — Correspondence between this European Standard, the CR TSI RST Freight Wagons dated July 2006, published in the OJEU on 8 December 2006 and its intermediate revision published in the OJEU on 14 February 2009 and Directive 2008/57/EC

Clause/ subclauses of this European Standard	Chapter/§/annexes of the TSI	Corresponding text, articles/§/annexes of the Directive 2008/57/EC	Comments
The whole standard is applicable	4. Characterisation of the subsystem 4.2 Functional and technical specification of the subsystem 4.2.4 Braking §4.2.4.1 Braking, Braking performance 6. Assessment of conformity and/or suitability for use of the constituents and verification of the subsystem 6.2 Subsystem conventional rail rolling stock freight wagons §6.2.3.3.1 Specifications for assessment of the subsystem, Braking, Braking performance Annex S Braking, Braking performance	Annex III, Essential requirements 1 General requirements 1.1 Safety Clauses 1.1.1, 1.1.2, 1.1.3, 1.1.5 1.2 Reliability and availability 1.5 Technical compatibility 2 Requirements specific to each subsystem 2.4 Rolling stock 2.4.1 Safety §3 2.4.2 Reliability and availability 2.4.3 Technical compatibility §3	The standard cannot be used for acceptance assessment until EN 14535-3 is published. The standard does not support Essential Requirement: 2 Requirements specific to each subsystem 2.6 Operation and traffic management 2.6.1 Safety §2 The standard does not support TSI chapter: 4. Characterisation of the subsystem 4.2 Functional and technical specification of the subsystem 4.2.8 Maintenance

Table ZA.3 — Correspondence between this European Standard, the CR LOC and PASS RST TSI (ST05EN05 dated 2010.06.10 accepted by RISC) and Directive 2008/57/EC

Clause/ subclauses of this European Standard	Chapter/§/annexes of the TSI	Corresponding text, articles/§/annexes of the Directive 2008/57/EC	Comments
The whole standard is applicable	4.Characterisation of the Rolling stock subsystem 4.2 Functional and technical specifications of the subsystem 4.2.4 Braking §4.2.4.2.1 Main functional and safety requirements, Functional requirements § 4.2.4.5.4 Braking performance, Calculations relating to thermal capacity	Annex III, Essential requirements 1 General requirements 1.1 Safety Clauses 1.1.1, 1.1.2, 1.1.3, 1.1.5 1.2 Reliability and availability 1.5 Technical compatibility 2 Requirements specific to each subsystem 2.4 Rolling stock 2.4.1 Safety §3 2.4.2 Reliability and availability 2.4.3 Technical compatibility §3	The standard cannot be used for acceptance assessment until EN 14535-3 is published. The standard does not support TSI chapter: 4. Characterisation of the subsystem 4.2 Functional and technical specification of the subsystem 4.2.12 Documentation for operation and maintenance

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 14535-1:2005, *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*

[2] EN ISO 9001, *Quality management systems — Part 1: Requirements (ISO 9001:2008)*

[3] EN 13260, *Railway applications — Wheelsets and bogies — Wheelsets — Products requirements*

[4] EN 13261, *Railway applications — Wheelsets and bogies — Axles — Products requirements*

[5] EN 13262, *Railway applications — Wheelsets and bogies — Wheels — Products requirements*

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