



SLOVENSKI STANDARD

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Železniške naprave - Zgornji ustroj - Zahteve za izdelavo pritrdilnih sistemov - 5. del: Pritrdilni sistemi za tir s tirnico na površini plošče ali s tirnico, vgrajeno v ploščo

Railway applications - Track - Performance requirements for fastening systems - Part 5: Fastening systems for slab track with rail on the surface or rail embedded in a channel

Bahnanwendungen - Oberbau - Leistungsanforderungen für Schienenbefestigungssysteme - Teil 5: Befestigungssysteme für feste Fahrbahn mit aufgesetzten oder in Kanälen eingebetteten Schienen

Applications ferroviaires - Voies - Exigences de performance pour les systèmes de fixation - Partie 5: Systèmes de fixations des voies sans ballast ou voies avec rails enrobés

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93.100 Gradnja železnic Construction of railways

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

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ICS 93.100

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English Version

**Railway applications - Track - Performance requirements for
fastening systems - Part 5: Fastening systems for slab track with
rail on the surface or rail embedded in a channel**

Applications ferroviaires - Voie - Exigences de performance
pour les systèmes de fixation - Partie 5: Systèmes de
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Schienenbefestigungssysteme - Teil 5:
Befestigungssysteme für feste Fahrbahn mit aufgesetzten
oder in Kanälen eingebetteten Schienen

This European Standard was approved by CEN on 27 April 2012.

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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.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 13481-5:2012) has been prepared by Technical Committee CEN/TC 256 "Railway applications", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2012, and conflicting national standards shall be withdrawn at the latest by November 2012.

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.

This document supersedes EN 13481-5:2002.

The main changes in this revision of EN 13481-5:2002 are as follows:

- a) the scope has been extended to include fastening systems for embedded rail (Clause 1);
- b) new categories of fastening systems have been introduced (Clause 1, Table 1);
- c) the ranges of test loads have been extended to cover the new categories of fastening systems (5.2, Table 2 and 5.3, Table 3);
- d) advice on attenuation of noise and vibration has been added in a new annex (Annex A).

This European Standard is one of the series "EN 13481-5:2012 Railway applications – Track – Performance requirements for fastening systems" which consists of the following parts:

- Part 1: Definitions
- Part 2: Fastening systems for concrete sleepers
- Part 3: Fastening systems for wood sleepers
- Part 4: Fastening systems for steel sleepers
- Part 5: Fastening systems for slab track with rail on the surface or rail embedded in a channel
- Part 7: Special fastening systems for switches and crossings and check rails

NOTE Part 6 does not exist in this series.

These European Standards are supported by the test methods in the series EN 13146 "Railway applications – Track – Test methods for fastening systems".

This document has been prepared under a mandate given to CEN 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.

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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, Turkey and the United Kingdom.

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Introduction

Various tests are necessary to assess the performance of fastening systems of railway tracks. In this European Standard, a requirement for longitudinal rail restraint is included to control rail creep and pull apart in the event of a broken rail. The relationship between longitudinal rail restraint and the overall design of the track slab requires consideration.

No satisfactory test is available to determine the attenuation of impact loads on slab track. The relative performance may be assessed by the procedure in EN 13146-3:2012 with the fastening system on a concrete sleeper.

The laboratory test for the effect of repeated loading is the means of assessing potential long term performance of the fastening in track.

For systems in which the rail is continuously supported, test procedures are modified to take account of the change from discrete support.

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EN 13481-5:2012 (E)**1 Scope**

This European Standard is applicable to fastening systems, in categories A – D as specified in EN 13481-1:2012, 3.1, for attaching rails to the uppermost surface of concrete or asphalt slabs and for embedded rails in non-ballasted tracks, with maximum axle loads and minimum curve radii in accordance with Table 1.

Table 1 — Fastening category criteria

Category	Maximum design axle load	Minimum curve radius
	kN	m
A	130	40
B	180	80
C	260	150
D	260	400

NOTE The maximum axle load for categories A and B does not apply to maintenance vehicles.

The requirements apply to:

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- a) fastening systems which act on the foot and/or web of the rail including direct and indirect systems;
- b) fastening systems which incorporate concrete elements and which each have not more than one supporting element per rail, including booted concrete blocks and sleepers complete with boots;
- c) adhesive and mechanical fastening systems for embedded rail but excluding rail cast into road pavements.

In the case of (b), the concrete element is considered to be part of the fastening system. If the system includes concrete elements which each have more than one supporting location per rail, those concrete elements are considered to be part of the slab and not part of the fastening system.

This standard is only applicable to fastening systems for rail sections in EN 13674-1 (except 49E4) and EN 13674-4+A1; it is not applicable to special fastening systems for use at bolted joints or glued joints.

This standard is for type approval of a complete fastening assembly only.

2 Normative references

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

EN 13146-1:2012, *Railway applications – Track – Test methods for fastening systems – Part 1: Determination of longitudinal restraint*

EN 13146-4:2012, *Railway applications – Track – Test methods for fastening systems – Part 4: Effect of repeated loading*

EN 13146-5:2012, *Railway applications – Track – Test methods for fastening systems – Part 5: Determination of electrical resistance*

EN 13146-6:2012, *Railway applications – Track – Test methods for fastening systems – Part 6: Effect of severe environmental conditions*

EN 13146-8:2012, *Railway applications – Track – Test methods for fastening systems – Part 8: In service testing*

EN 13146-9:2009+A1:2011, *Railway applications – Track – Test methods for fastening systems – Part 9: Determination of stiffness*

EN 13230-1:2009, *Railway applications – Track – Concrete sleepers and bearers – Part 1: General requirements*

EN 13481-1:2012, *Railway applications – Track – Performance requirements for fastening systems – Part 1: Definitions*

EN 13481-2:2012, *Railway applications – Track – Performance requirements for fastening systems – Part 2: Fastening systems for concrete sleepers*

EN 13674-1:2011, *Railway applications – Track – Rail – Part 1: Vignole railway rails 46 kg/m and above*

EN 13674-4+A1, *Railway applications – Track – Rail – Part 4: Vignole railway rails from 27 kg/m to, but excluding 46 kg/m*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13481-1:2012 apply.

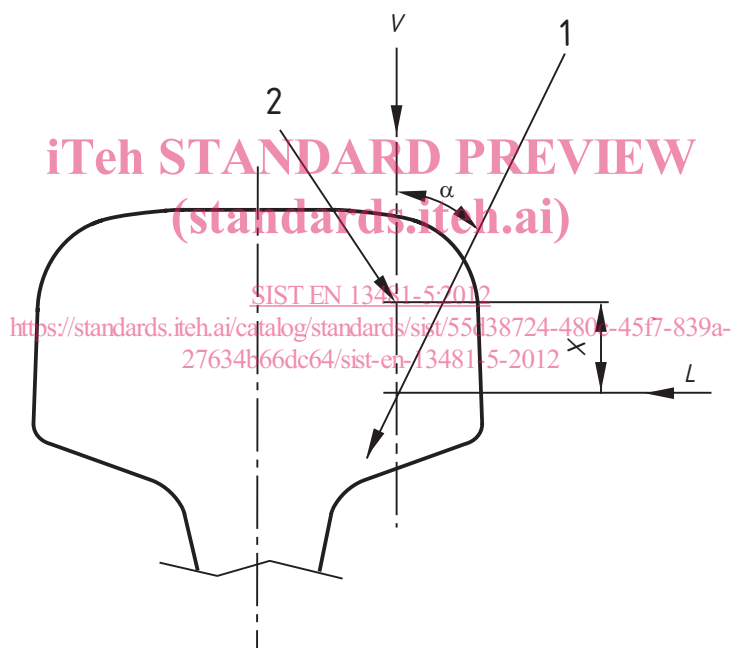
4 Symbols

For the purposes of this document, the following symbols apply.

D_r	maximum longitudinal displacement of rail prior to slip, in mm (EN 13146-1:2012);
F_{HFAmax}	static preload applied in measurement of high frequency stiffness of assembly, in kN;
F_{LFA1}	minimum force applied in measurement of dynamic low frequency stiffness of assembly, in kN;
F_{LFAmax}	reference force for measurement of dynamic low frequency stiffness of assembly, in kN;
F_{LFP1}	notional fastening clip force assumed for measurement of dynamic low frequency stiffness of pad, in kN;
F_{LFPmax}	reference force for measurement of dynamic low frequency stiffness of pad, in kN;
F_{max}	axial load at which gross slip occurs in the longitudinal rail restraint test (EN 13146-1:2012), in kN;
F_{SA1}	minimum force applied in measurement of static stiffness of assembly, in kN;
F_{SAmax}	force applied to assembly in measurement of static stiffness of assembly, in kN;
F_{SP1}	notional fastening clip force assumed for measurement of static stiffness of pad, in kN;
F_{SPmax}	force applied to pad in measurement of static stiffness of pad, in kN;
k_L	longitudinal stiffness in accordance with EN 13146-1:2012, in MN/m;

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k_{HFAD}	transfer stiffness in measurement of high frequency stiffness of assembly, in N/m;
k_{LFA}	low frequency dynamic stiffness of assembly, in MN/m;
L	lateral component of force transmitted by the wheel to the rail head as shown in Figure 1, in kN;
L_{T}	Sample length of embedded rail, in m;
P_{L}	component of load parallel to the running surface of the rails, in kN;
P_{V}	component of load normal to the running surface of the rails, in kN;
V	vertical component of load transmitted by the wheels to the running surface at the rail head as shown in Figure 1, in kN;
X	distance between the line of application of P_{L} and the centre of the gauge corner radius of the rail head as shown in Figure 1, in mm;
α	angle between the load line and a line normal to the running surface of the rails as shown in Figure 1, in °.
NOTE	$\frac{L}{V} = \frac{P_{\text{L}}}{P_{\text{V}}} = \tan \alpha$



Key

- 1 line of load application
- 2 centre of gauge corner radius

Figure 1 — Load application position

5 Requirements

5.1 Longitudinal rail restraint or longitudinal stiffness

For discrete fastening systems, the longitudinal rail restraint shall be not less than 7 kN when measured by the procedure in EN 13146-1. For use in category D tracks (> 250 km/h), the longitudinal rail restraint shall be not less than 9 kN.

For embedded rail with an adhesive fastening system, the longitudinal stiffness k_L shall be measured in accordance with EN 13146-1, between 0 mm and 7 mm (i.e. $D_r = 7$) relative displacement per equivalent length of support without visible damage.

On structures such as long bridges, the longitudinal force transmitted between the track and the structure may be calculated by the method in EN 1991-2. The value of F_{max} measured in accordance with EN 13146-1 may be used in the calculation. In such cases and subject to agreement between the purchaser and manufacturer, the minimum requirement for longitudinal restraint may be reduced.

5.2 Assembly and pad stiffness

As required by EN 13146-4, the assembly static stiffness and assembly low frequency dynamic stiffness shall be measured in accordance with EN 13146-9+A1. Measurement of the rail pad static stiffness is required at the purchaser's discretion in accordance with EN 13146-8. If the purchaser requires any of the following it shall be measured in accordance with EN 13146-9+A1:

- pad low frequency dynamic stiffness;
- assembly high frequency dynamic stiffness.

Test loads are given in Table 2.

NOTE Guidance on the measurement of pad high frequency stiffness is given in EN 13146-9:2009+A1:2011, Annex A. For the measurement of assembly properties at acoustic frequency see EN 15461+A1.

Table 2 — Loads for measurement of stiffness

Fastening category	F_{SP1} and F_{LFP}	F_{SPmax} and F_{LFPmax}	F_{SA1} and F_{LFA1}	F_{SAmax} and F_{LFAmax}
	kN	kN	kN	kN
A	16	51	1	32
B	18	64	1	43
C	18	85	1	64
D	18	85	1	64

NOTE 1 For continuously supported rail, the test lengths for category A should be (800 ± 10) mm. The test lengths for categories B to D should be (600 ± 10) mm.

NOTE 2 For embedded rail, the stiffness should be expressed per unit length.

5.3 Effect of repeated loading

This shall be determined by the procedure in EN 13146-4. In the case of twin block, booted concrete sleepers, the whole sleeper shall be subject to testing using the procedure for two rail seats.

The test loads and positions shall be as shown in Table 3.

As required by EN 13146-4, the following measurements shall be performed before and after repeated loading. The change in performance shall not exceed the values shown below. For fastening systems which support the web of the rail and adhesive fastening systems for embedded rail, the change in clamping force does not apply.

- Longitudinal rail restraint change ≤ 20 %; or
- Longitudinal stiffness change ≤ 20 %;