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del: Pritrdilni sistemi za betonske prage

Railway applications - Track - Performance requirements for fastening systems - Part 2:
Fastening systems for concrete sleepers

Bahnanwendungen - Oberbau - Leistungsanforderungen für
Schienenbefestigungssysteme - Teil 2: Befestigungssysteme für Betonschwellen

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Bahnanwendungen - Oberbau - Leistungsanforderungen für Schienenbefestigungssysteme - Teil 2: Befestigungssysteme für Betonschwellen

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.

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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.

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Foreword

This document (prEN 13481-2:2010) has been prepared by Technical Committee CEN/TC 256 "Railway applications", the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13481-2:2002.

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 European Standard is one of the series EN 13481 "*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 are supported by the test methods in the series EN 13146 "*Railway applications – Track – Test methods for fastening systems*".

Introduction

A requirement for longitudinal rail restraint is included to control rail creep and pull apart in the event of a broken rail.

Measurement of torsional resistance is included for use in assessing the risk of track buckling.

Classes for attenuation of dynamic loading are included for use when it is necessary to protect sleepers from vehicle induced impacts.

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

The test for clamping force is only suitable for laboratory use.

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1 Scope

This European Standard is applicable to fastening systems, in categories A – E (prEN 13481-1:2010, 3.1), for use on concrete sleepers in ballasted track with maximum axle loads and minimum curve radii in accordance with Table 1.

Table 1 — Fastening category criteria

Category	Maximum design axle load kN	Minimum curve radius m
A	130	40
B	180	80
C	260	150
D	260	400
E	350	150

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

The requirements apply to:

- fastening systems which act on the foot and/or web of the rail including direct fastening systems and systems which incorporate a baseplate;
- fastening systems for the rail sections in EN 13674-1 and EN 13674-4.

This standard is not applicable to fastening systems for other rail sections, rigid fastening systems or special fastening systems used at bolted joints.

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

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.

prEN 13146-1:2009, *Railway applications – Track – Test methods for fastening systems – Part 1: Determination of longitudinal rail restraint*

prEN 13146-2:2009, *Railway applications – Track – Test methods for fastening systems – Part 2: Determination of torsional resistance*

prEN 13146-3:2009, *Railway applications – Track – Test methods for fastening systems – Part 3: Determination of attenuation of impact loads*

prEN 13146-4:2009, *Railway applications – Track – Test methods for fastening systems – Part 4: Effect of repeated loading*

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prEN 13146-5:2009, *Railway applications – Track – Test methods for fastening systems – Part 5: Determination of electrical resistance*

prEN 13146-6:2009, *Railway applications – Track – Test methods for fastening systems – Part 6: Effect of severe environmental conditions*

prEN 13146-7:2009, *Railway applications – Track – Test methods for fastening systems – Part 7: Determination of clamping force*

prEN 13146-8:2009, *Railway applications – Track – Test methods for fastening systems – Part 8: In service testing*

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

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

prEN 13481-1:2010, *Railway applications – Track – Performance requirements for fastening systems – Part 1: Definitions*

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

EN 13674-4, *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 definitions given in prEN 13481-1:2010 apply.

4 Symbols

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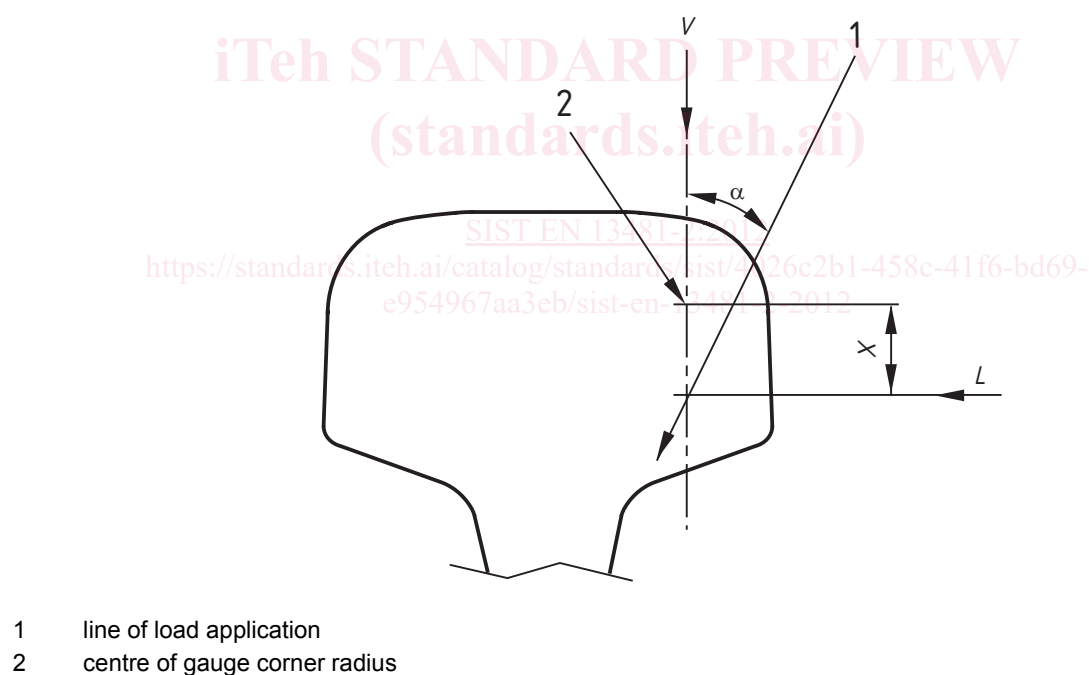
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For the purposes of this document the following symbols apply.

F_{HFAmax}	force applied in measurement of dynamic high frequency stiffness, in kN
F_{LFA}	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_{LFP}	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 (prEN 13481-1:2010), 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_{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
P_L	component of load parallel to the base of the sleeper, in kN
P_V	component of load normal to the base of the sleeper, in kN
V	vertical component of force transmitted by the wheel to 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, in degrees

NOTE $\frac{L}{V} = \frac{P_L}{P_V} = \tan \alpha$



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

Figure 1 — Load application position

5 Requirements

5.1 Longitudinal rail restraint

The longitudinal rail restraint shall be not less than 7 kN when measured by the procedure in prEN 13146-1:2009. For use in category D fastening systems (> 250 km/h) the longitudinal rail restraint shall be not less than 9 kN.

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 prEN 13146-1:2009 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 Torsional resistance

When required by the purchaser the torsional resistance shall be measured by the procedure in prEN 13146-2:2009 and the result reported.

5.3 Attenuation of impact loads

For fastening systems described as having medium or high attenuation of dynamic loads this shall be measured by the procedure in prEN 13146-3:2009 using the type of sleeper (monoblock or two block) on which the fastening is to be used. The result shall comply with the following limits:

- medium attenuation $\geq 15\% \leq 30\%$;
- high attenuation $> 30\%$.

5.4 Pad and assembly stiffness

As required by prEN 13146-4:2009 the assembly static stiffness and assembly low frequency dynamic stiffness shall be measured in accordance with EN 13146-9. Measurement of the rail pad static stiffness is required at the purchaser's discretion in accordance with prEN 13146-8:2009. If the purchaser requires any of the following it shall be measured in accordance with EN 13146-9:

- 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 dynamic stiffness is given in EN 13146-9, Annex A. For the measurement of assembly properties at acoustic frequency see EN 15461.

Table 2 — Loads for measurement of stiffness

Fastening category	F_{SP1} and F_{LFP}	F_{SPmax} and F_{LFPmax}	F_{LFA}	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
E	20	119	1	95

5.5 Effect of repeated loading

The effect of repeated loading shall be determined by the procedure in prEN 13146-4:2009 using the test loads and positions in Table 3.

Table 3 — Test loads and positions

Fastening category	α^0	X mm	$P_V/\cos \alpha$ kN ^{a,b}	
			$K_{LFA} < 200^c$	$K_{LFA} \geq 200^c$
			MN/m	MN/m
A	38,6	25 ^d	55	55
B	38,6	25 ^d	62	65
C	33	15 ^d	75	83
D	26	15 ^d	70	76
E	40	75 ^d	100	108

^a The test loads apply only to rail sections included in EN 13674-1 and EN 13674-4 excluding 49 E4.
^b The test loads reflect the typical axle loads and curve radii in prEN 13481-1:2010, 3.1.
^c Low frequency dynamic stiffness of assembly measured, at 5 Hz, in accordance with EN 13146-9.
^d For web supported rail the rail section shall be unmodified (i.e. $X = 0$).

As required by prEN 13146-4:2009 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, the change in clamping force does not apply.

- Longitudinal rail restraint change $\leq 20\%$;
- Vertical static stiffness change $\leq 25\%$;
- Clamping force change $\leq 20\%$.

Compliance with Category E implies compliance with Categories A – E.

Compliance with Category C implies compliance with Categories C and D.

Compliance with Category B implies compliance with Categories A and B.