



# SLOVENSKI STANDARD

## SIST EN 13146-4:2012

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**Železniške naprave - Zgornji ustroj - Preskušanje pritrtilnih sistemov - 4. del:  
Učinek ponavljajoče se obremenitve**

Railway applications - Track - Test methods for fastening systems - Part 4: Effect of repeated loading

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Bahnanwendungen - Oberbau - Prüfverfahren für Schienenbefestigungssysteme - Teil 4:  
Dauerschwingversuch

SIST EN 13146-4:2012

Applications ferroviaires - Voie - Méthodes d'essai pour les systèmes de fixation - Partie  
4 : Effets produits par des charges répétitives

**Ta slovenski standard je istoveten z: EN 13146-4:2012**

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**ICS:**

93.100

Gradnja železnic

Construction of railways

**SIST EN 13146-4:2012**

en,de

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
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English Version

## Railway applications - Track - Test methods for fastening systems - Part 4: Effect of repeated loading

Applications ferroviaires - Voie - Méthodes d'essai pour les systèmes de fixation - Partie 4: Effets produits par des charges répétitives

Bahnanwendungen - Oberbau - Prüfverfahren für Schienenbefestigungssysteme - Teil 4: Dauerschwingversuch

This European Standard was approved by CEN on 26 November 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.

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## Foreword

This document (EN 13146-4:2012) 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 October 2012, and conflicting national standards shall be withdrawn at the latest by October 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 13146-4:2002.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

In this revision of EN 13146-4:2002 the procedure has been modified for application to embedded rail.

This European Standard is one of the series EN 13146 "*Railway applications — Track — Test methods for fastening systems*" which consists of the following parts:

- *Part 1: Determination of longitudinal rail restraint;*
- *Part 2: Determination of torsional resistance;*
- *Part 3: Determination of attenuation of impact loads;*
- *Part 4: Effect of repeated loading;* [SIST EN 13146-4:2012](https://standards.iteh.ai/catalog/standards/sist/55bc6e0f-a687-4bf5-af51-128c323b2b07/sist-en-13146-4-2012)
- *Part 5: Determination of electrical resistance;*
- *Part 6: Effect of severe environmental conditions;*
- *Part 7: Determination of clamping force;*
- *Part 8: In service testing;*
- *Part 9: Determination of stiffness.*

These support the requirements in the series EN 13481 "*Railway applications — Track — Performance requirements for fastening systems*".

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.

**EN 13146-4:2012 (E)****1 Scope**

This European Standard specifies a laboratory test procedure for applying repeated displacement cycles representative of the displacements caused by traffic on railway track. It is used for assessing the long term performance of direct fastening systems.

The procedure is applicable to surface mounted rail on sleepers, bearers and slab track, and embedded rail.

This test procedure applies to a complete fastening assembly.

**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 rail restraint*

EN 13146-7:2012, *Railway applications — Track — Test methods for fastening systems — Part 7: Determination of clamping force*

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

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 13481-3:2012, *Railway applications — Track — Performance requirements for fastening systems — Part 3: Fastening systems for wood sleepers*

EN 13481-4:2012, *Railway applications — Track — Performance requirements for fastening systems — Part 4: Fastening systems for steel sleepers*

EN 13481-5:2012, *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*

EN 13481-7:2012, *Railway applications — Track — Performance requirements for fastening systems — Part 7: Special fastening systems for switches and crossings and check rails*

EN ISO 7500-1:2004, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system (ISO 7500-1:2004)*

EN ISO 9513:2002, *Metallic materials — Calibration of extensometers used in uniaxial testing (ISO 9513:1999)*

### 3 Terms and definitions, symbols and abbreviations

#### 3.1 Terms and definitions

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

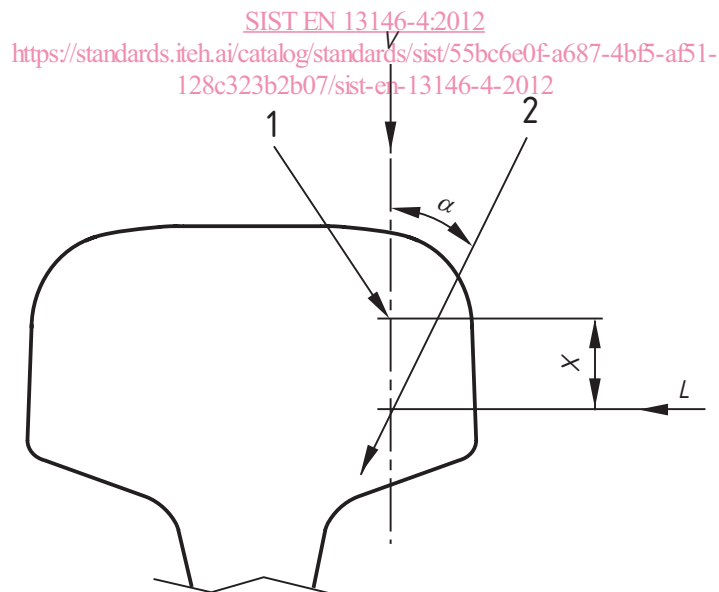
#### 3.2 Symbols and abbreviations

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

- $\alpha$  angle between the load line and a line normal to the running surface of the rails, in degrees;
- $F$  maximum axial longitudinal load on the rail without non-elastic displacement occurring, in kN;
- $F_{SAmax}$  force applied to assembly in measurement of static stiffness of assembly, in kN;
- $L$  lateral component of force transmitted by the wheel to the rail head as shown in Figure 1, in kN;
- $P_L$  component of force parallel to the running surface of the rails in kN;
- $P_V$  component of force 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;
- $X$  position of the line of application of  $P_L$  below the centre of curvature of the gauge corner of the rail head as shown in Figure 1, in mm.

NOTE 1  $\frac{L}{V} = \frac{P_L}{P_V} = \tan \alpha$

NOTE 2 Running surface is defined in EN 13481-1:2012.



#### Key

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

Figure 1 — Position of load application

**EN 13146-4:2012 (E)****4 Principle**

A constant amplitude, cyclic force is applied by a single actuator at a predetermined load line and position on the rail head. The load, position and line of application to be used are determined from the vertical stiffness of the fastening assembly, axle loads and curve conditions of the track for which the fastening assembly is being tested.

Performance is determined by the change in clamping force, longitudinal rail restraint, vertical stiffness and rail position, and visual inspection of the components during test.

**5 Apparatus****5.1 Rail**

Short lengths of rail (approximately 0,5 m per rail seat or longer if required), of the section for which the fastening assembly under test is designed. The rail shall be unlaminated and have neither loose rust on the surface nor be polished on the foot by repeated testing.

The head of the rail may be modified to accommodate the load application head except when testing fastenings which support the web of the rail. In this case, the dimension *X*, as shown in Figure 1, refers to the design rail section for the fastening assembly.

For embedded rail, the rail is part of the test specimen.

**5.2 Actuator**

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Actuator capable of applying a force of up to 150 kN in a cyclic manner at a frequency of  $(4 \pm 1)$  Hz.

NOTE For simultaneous loading of two and four rail seats the required capacity will be correspondingly greater.

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**5.3 Load application head**

A head in contact with the rail which is capable of transmitting the applied force to a rail at the required position relative to the rail head.

**5.4 Displacement measuring instruments**

Instruments conforming to EN ISO 9513:2002, Table 2, Class 2. The instruments shall be capable of measuring displacement of the rail, relative to the support, within  $\pm 0,01$  mm. Non-contact instruments may be used providing a procedure for verifying their calibration is used and recorded.

NOTE Non-contact instruments are outside the scope of EN ISO 9513.

**5.5 Force measuring instruments**

Instruments conforming to EN ISO 7500-1:2004 and EN ISO 7500-1:2004/AC:2009, Class 1 and over the required range of force.

**5.6 Verification of calibration**

The calibration of actuators shall be verified periodically in accordance with EN ISO 7500-1 using equipment having traceability to European or International Standards using the International System of Units (SI).



## 6 Test specimens

### 6.1 Sleeper or other rail support

A sleeper, half sleeper, concrete block or other rail support with cast-in fastening components or holes, and rail seats, as made without modification for this test. It is recommended that two sleepers or half sleepers are used if the cast-in fastening components or holes are non-symmetrical about the longitudinal centre line of the sleeper.

For surface mounted rail on slab track, the fastening system shall be mounted in the centre of the top of a reinforced concrete block. The length of the block, normal to the rail, shall be  $\geq 500$  mm and the width  $\geq 300$  mm. If, for stability, it is necessary to test two rail seats, the width of the block shall be  $\geq 2 \times$  the design fastening spacing in the track. The depth of the block shall be the depth of the slab or  $(200 \pm 10)$  mm, whichever is the smaller.

For surface mounted fastening systems on slab track, with continuous support of the rail, the test shall be performed using a length of pad equal in length to the design spacing of the fastening along the rail. The piece of rail used for the test shall be at least as long as the piece of pad and the size of the concrete block shall be sufficient to provide support to the full length of the piece of pad.

For embedded rail using adhesive fastening systems, the test length shall be (0,5 to 0,75) m and the channel containing the rail shall be contained in a concrete block similar to that for surface mounted rail.

For mechanically fastened embedded rail, the test length shall be equal to the typical sleeper spacing, for the category of fastening in EN 13481-1:2012, 3.1 and the channel containing the rail shall be contained in a concrete block of similar dimensions to that for surface mounted rail.

### 6.2 Fastening

All fastening components as used in track and assembled in accordance with the manufacturer's instructions.

## 7 Procedure for one rail

### 7.1 General

The following procedure is for the test when a rail is fixed to one end of the sleeper or half sleeper. When two rails are used the procedure in Clause 8 shall be used.

The sequence of tests shall be 7.3, 7.4, 7.5, 7.6, 7.5, 7.4, 7.3 performed on test specimens assembled in accordance with 7.2.1 or 7.2.2. At no time during the test sequence shall any part of the fastening assembly be adjusted, retightened or modified.

### 7.2 Preparation for test

#### 7.2.1 In line fastening

If the fastenings are in line fix a short length of rail to one rail seat using the fastening components as assembled in track.

#### 7.2.2 Offset fastening

If the fastenings are non-symmetrical, the test set up may become unstable during test. In such cases fix a short length of rail to one rail seat on each of two adjacent sleepers or half sleepers as shown in