

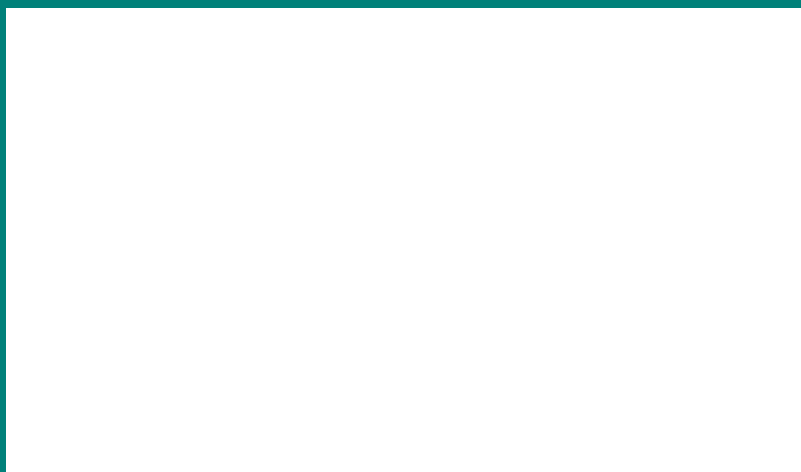
SVENSK STANDARD

SS-EN 13146-9:2009

Fastställt/Approved: 2009-11-23
Publicerad/Published: 2009-12-14
Utgåva/Edition: 1
Språk/Language: engelska/English
ICS: 93.100

Järnvägar – Spår – Provningsmetoder för befästningssystem – Del 9: Bestämning av styvhet

Railway applications – Track – Test methods for fastening systems – Part 9: Determination of stiffness



Hitta rätt produkt och ett leveranssätt som passar dig

Standarder

Genom att följa gällande standard både effektiviserar och säkrar du ditt arbete. Många standarder ingår dessutom ofta i paket.

Tjänster

Abonnemang är tjänsten där vi uppdaterar dig med aktuella standarder när förändringar sker på dem du valt att abonnera på.

På så sätt är du säker på att du alltid arbetar efter rätt utgåva.

e-nav är vår online-tjänst som ger dig och dina kollegor tillgång till standarder ni valt att abonnera på dygnet runt. Med e-nav kan samma standard användas av flera personer samtidigt.

Leveranssätt

Du väljer hur du vill ha dina standarder levererade. Vi kan erbjuda dig dem på papper och som pdf.

Andra produkter

Vi har böcker som underlättar arbetet att följa en standard. Med våra böcker får du ökad förståelse för hur standarder ska följas och vilka fördelar den ger dig i ditt arbete. Vi tar fram många egna publikationer och fungerar även som återförsäljare. Det gör att du hos oss kan hitta över 500 unika titlar. Vi har även tekniska rapporter, specifikationer och "workshop agreement".

Matriser är en översikt på standarder och handböcker som bör läsas tillsammans. De finns på sis.se och ger dig en bra bild över hur olika produkter hör ihop.

Standardiseringsprojekt

Du kan påverka innehållet i framtida standarder genom att delta i någon av SIS ca 400 Tekniska Kommittéer.

Find the right product and the type of delivery that suits you

Standards

By complying with current standards, you can make your work more efficient and ensure reliability. Also, several of the standards are often supplied in packages.

Services

Subscription is the service that keeps you up to date with current standards when changes occur in the ones you have chosen to subscribe to. This ensures that you are always working with the right edition.

e-nav is our online service that gives you and your colleagues access to the standards you subscribe to 24 hours a day. With e-nav, the same standards can be used by several people at once.

Type of delivery

You choose how you want your standards delivered. We can supply them both on paper and as PDF files.

Other products

We have books that facilitate standards compliance. They make it easier to understand how compliance works and how this benefits you in your operation. We produce many publications of our own, and also act as retailers. This means that we have more than 500 unique titles for you to choose from. We also have technical reports, specifications and workshop agreements.

Matrices, listed at sis.se, provide an overview of which publications belong together.

Standardisation project

You can influence the content of future standards by taking part in one or other of SIS's 400 or so Technical Committees.

Europastandarden EN 13146-9:2009 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN 13146-9:2009.

The European Standard EN 13146-9:2009 has the status of a Swedish Standard. This document contains the official English version of EN 13146-9:2009.

! © Copyright/Upphovsrätten till denna produkt tillhör SIS, Swedish Standards Institute, Stockholm, Sverige. Användningen av denna produkt regleras av slutanvändarlicensen som återfinns i denna produkt, se standardens sista sidor.

! © Copyright SIS, Swedish Standards Institute, Stockholm, Sweden. All rights reserved. The use of this product is governed by the end-user licence for this product. You will find the licence in the end of this document.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00.

Standarder kan beställas hos SIS Förlag AB som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), tel +46 8 555 520 00.

Standards may be ordered from SIS Förlag AB, who can also provide general information about Swedish and foreign standards.

SIS Förlag AB, SE 118 80 Stockholm, Sweden. Tel: +46 8 555 523 10. Fax: +46 8 555 523 11.

E-mail: sis.sales@sis.se Internet: www.sis.se

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 13146-9

November 2009

ICS 93.100

English Version

Railway applications - Track - Test methods for fastening systems - Part 9: Determination of stiffness

Applications ferroviaires - Voies - Méthodes d'essai pour les systèmes de fixation - Partie 9 : Détermination de la raideur

Bahnanwendungen - Oberbau - Prüfverfahren für Schienenbefestigungssysteme - Teil 9: Bestimmung der Steifigkeiten

This European Standard was approved by CEN on 3 October 2009.

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 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, 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

Contents	Page
Foreword.....	3
Introduction	4
1 Scope.....	5
2 Normative references	5
3 Terms and definitions.....	5
4 Symbols and abbreviated terms.....	6
5 Verification of calibration.....	8
6 Test procedures for pads.....	8
6.1 Static test procedure for pads	8
6.1.1 Principle	8
6.1.2 Apparatus	8
6.1.3 Procedure	9
6.1.4 Test report	10
6.2 Dynamic low frequency test procedure for pads	11
6.2.1 General.....	11
6.2.2 Principle	11
6.2.3 Apparatus	11
6.2.4 Procedure	12
6.2.5 Test report	12
6.3 Dynamic high frequency test procedure for pads.....	13
7 Test procedures for complete rail fastening assemblies	13
7.1 Static test procedure for fastening assemblies	13
7.1.1 Principle	13
7.1.2 Apparatus	13
7.1.3 Test specimens	14
7.1.4 Procedure	14
7.1.5 Test report	14
7.2 Dynamic low frequency test for fastening assemblies	15
7.2.1 General.....	15
7.2.2 Principle	15
7.2.3 Apparatus	15
7.2.4 Procedure	16
7.2.5 Test report	16
7.3 Dynamic high frequency test for assemblies	17
7.3.1 Principle	17
7.3.2 Apparatus	17
7.3.3 Test specimen	20
7.3.4 Test procedure	20
7.3.5 Test report	24
Annex A (informative) Determination of the dynamic high frequency stiffness of pads.....	25
A.1 General.....	25
A.2 Principle	25
Bibliography	26

Foreword

This document (EN 13146-9:2009) 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 May 2010, and conflicting national standards shall be withdrawn at the latest by May 2010.

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 European Standard is one of the series EN 13146, *Railway applications — Track — Test methods for fastening systems* as listed below:

- *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*
- *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* — Parts 1 to 8.

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, 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.

Introduction

This part of EN 13146 brings together test methods for measuring the stiffness of pads and fastening assemblies under static, low frequency and high frequency dynamic loading.

For measurements at high frequency, the corrected driving point method has been included although it is only valid up to 120 Hz whilst the direct and indirect methods are valid up to 400 Hz. Only a few test laboratories have the equipment and the experience necessary to perform the indirect and direct methods. More laboratories should be able to perform the corrected driving point method and for some purposes, measurements up to 120 Hz are adequate.

No method for testing at acoustic frequencies is included. The procedure in EN 15461, which involves testing a length of track incorporating the fastening assemblies under test can be used.

1 Scope

This European Standard specifies laboratory test procedures to determine the static and dynamic stiffness of rail pads, baseplate pads and complete rail fastening assemblies. The procedures for dynamic stiffness cover low and high frequencies.

2 Normative references

The following 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 13146-4, *Railway applications — Track — Test methods for fastening systems — Part 4: Effect of repeated loading*

EN 13481 (all parts), *Railway applications — Track — Performance requirements for fastening systems*

EN ISO 7500-1, *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)*

EN ISO 10846-1:2008, *Acoustics and vibration — Laboratory measurement of vibro-acoustic transfer properties of resilient elements — Part 1: Principles and guidelines (ISO 10846-1:2008)*

EN ISO 10846-2, *Acoustics and vibration — Laboratory measurement of vibro-acoustic transfer properties of resilient elements — Part 2: Direct method for determination of the dynamic stiffness of resilient supports for translatory motion (ISO 10846-2:2008)*

EN ISO 10846-3, *Acoustics and vibration — Laboratory measurement of vibro-acoustic transfer properties of resilient elements — Part 3: Indirect method for determination of the dynamic stiffness of resilient supports for translatory motion (ISO 10846-3:2002)*

EN ISO 10846-5, *Acoustics and vibration — Laboratory measurement of vibro-acoustic transfer properties of resilient elements — Part 5: Driving point method for determination of the low-frequency transfer stiffness of resilient supports for translatory motion (ISO 10846-5:2008)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13481-1:2002 and EN ISO 10846-1:2008 apply.

4 Symbols and abbreviated terms

		Relevant subclause
F_{SPmax}	force applied to pad in measurement of static stiffness of pad, in kN;	6.1.3
F_{SP1}	notional fastening clip force assumed for measurement of static stiffness of pad, in kN;	6.1.3
F_{SP2}	$0,8 F_{SPmax}$, in kN;	6.1.3
k_{SP}	static stiffness of pad, in MN/m;	6.1.3
d_{SP}	mean vertical displacement of pad, in mm;	6.1.3
F_{LFPmax}	reference force for measurement of dynamic low frequency stiffness of pad, in kN;	6.2.4
F_{LFP1}	notional fastening clip force assumed for measurement of dynamic low frequency stiffness of pad, in kN;	6.2.4
F_{LFP2}	$0,8 F_{LFPmax}$, in kN;	6.2.4
d_{LFP}	displacement of pad in measurement of low frequency dynamic stiffness of pad, in mm;	6.2.4
f_{LFP}	frequency of measurement of low frequency measurement dynamic stiffness of pad, in Hz;	6.2.4
k_{LFPf}	low frequency dynamic stiffness of pad at a specific frequency, in MN/m;	6.2.4
$k_{LFPmean}$	mean of measurements of low frequency dynamic stiffness of pad measured at 5 Hz, 10 Hz and 20 Hz, in MN/m;	6.2.4
F_{SAmax}	force applied to assembly in measurement of static stiffness of assembly, in kN;	7.1.4
k_{SA}	static stiffness of assembly, in MN/m;	7.1.4
d_{SA}	mean displacement of rail in measurement of static stiffness of assembly, in mm;	7.1.4
F_{SA1}	minimum force applied in measurement of static stiffness of assembly, in kN;	7.1.4
F_{SA2}	maximum force applied in measurement of static stiffness of assembly = $0,8 F_{LFAmax}$, in kN;	7.1.4
k_{LFA}	low frequency dynamic stiffness of assembly, in MN/m;	7.2.4
F_{LFA1}	minimum force applied in measurement of dynamic low frequency stiffness of assembly, in kN;	7.2.4
F_{LFA2}	maximum force applied in measurement of dynamic low frequency stiffness of assembly = $0,8 F_{LFAmax}$, in kN;	7.2.4

F_{LFAmax}	reference force for measurement of dynamic low frequency stiffness of assembly, in kN;	7.2.4
d_{LFA1}	displacement of assembly in measurement of dynamic low frequency stiffness of assembly for force F_{LFA1} , in mm;	7.2.4
d_{LFA2}	displacement of assembly in measurement of dynamic low frequency stiffness of assembly for force F_{LFA2} , in mm;	7.2.4
F_{HFAMax}	static preload applied in measurement of high frequency stiffness of assembly, in kN;	7.3.4.3
a_{HFAD1}	excitation acceleration in measurement of high frequency stiffness of assembly, in m/s^2 ;	7.3.4.3
a_{HFAD2}	acceleration of the measuring platform in measurement of high frequency stiffness of assembly, in m/s^2 ;	7.3.4.3
a_{HFAI2}	output acceleration in measurement of high frequency stiffness of assembly by the indirect method, in m/s^2 ;	7.3.4.4
F_{HFAD2}	force on the measuring platform in measurement of high frequency stiffness of assembly, in N;	7.3.4.3
f_{HFAD}	frequency in measurement of high frequency stiffness of assembly, in Hz;	7.3.4.3
j	$\sqrt{-1}$	7.3.4.3
L_{HFADk}	transfer stiffness level in measurement of high frequency stiffness of assembly, in dB re 1 N/m;	7.3.4.3
m_{HFAD}	mass of the measuring platform and any parts of the fastening assembly below the resilient element, in kg;	7.3.4.3
k_{HFAD}	transfer stiffness in measurement of high frequency stiffness of assembly, in N/m;	7.3.4.3
k_{HFADc}	corrected transfer stiffness in measurement of high frequency stiffness of assembly, in N/m;	7.3.4.3
V_{HFAD1}	excitation velocity = $\frac{a_{HFAD1}}{j\omega_{HFAD}}$, in m/s;	7.3.4.3
ω_{HFAD}	angular frequency = $2\pi f_{HFAD}$, in rad/s;	7.3.4.3
F_{HFAI2}	force on the measuring platform of high frequency stiffness of assembly, in N;	7.3.4.4
k_{HFAI}	transfer stiffness in measurement of high frequency stiffness of assembly by the indirect method, in N/m;	7.3.4.4
ω_{HFAI}	angular frequency = $2\pi f_{HFAI}$, in rad/s;	7.3.4.4
a_{HFAI1}	excitation acceleration in measurement of high frequency stiffness of assembly by the indirect method, in m/s^2 ;	7.3.4.4