

SVENSK STANDARD

SS-EN 13146-9:2020

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

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



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Standarden är framtagen av kommittén för Järnvägar, SIS/TK 254.

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Europastandarden EN 13146-9:2020 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN 13146-9:2020.

Denna standard ersätter SS-EN 13146-9:2009+A1:2011, utgåva 1.

The European Standard EN 13146-9:2020 has the status of a Swedish Standard. This document contains the official version of EN 13146-9:2020.

This standard supersedes the SS-EN 13146-9:2009+A1:2011, edition 1.

EUROPEAN STANDARD

EN 13146-9

NORME EUROPÉENNE

EUROPÄISCHE NORM

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English Version

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

Applications ferroviaires - Voie - 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 24 February 2020.

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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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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SS-EN 13146-9:2020 (E)

Contents	Page
European foreword.....	4
Introduction	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	6
4 Symbols and abbreviated terms	7
5 Verification of calibration.....	9
6 Test procedures for pads.....	9
6.1 Static test procedure for pads.....	9
6.1.1 Principle	9
6.1.2 Apparatus.....	9
6.1.3 Procedure.....	10
6.1.4 Test report.....	11
6.2 Dynamic low-frequency test procedure for pads	12
6.2.1 General.....	12
6.2.2 Principle	12
6.2.3 Apparatus.....	12
6.2.4 Procedure.....	13
6.2.5 Test report.....	13
6.3 Dynamic high-frequency test procedure for pads.....	14
7 Test procedures for complete rail fastening assemblies.....	14
7.1 Static test procedure for fastening assemblies	14
7.1.1 Principle	14
7.1.2 Apparatus.....	14
7.1.3 Test specimens.....	15
7.1.4 Procedure.....	15
7.1.5 Test report.....	16
7.2 Dynamic low-frequency test procedure for fastening assemblies.....	17
7.2.1 General.....	17
7.2.2 Principle	17
7.2.3 Apparatus.....	17
7.2.4 Procedure.....	17
7.2.5 Test report.....	18
7.3 Dynamic high-frequency test procedure for assemblies.....	18
Annex A (informative) Determination of the dynamic high-frequency stiffness for pads	19
A.1 General.....	19
A.2 Principle	19
Annex B (informative) Determination of the dynamic high-frequency stiffness of fastening assemblies	20
B.1 Principle	20
B.2 Apparatus.....	20

B.2.1	General	20
B.2.2	Direct method	20
B.2.3	Indirect method.....	21
B.2.4	Corrected driving point method.....	22
B.3	Test specimen	23
B.4	Test procedure	23
B.4.1	Test temperature.....	23
B.4.2	Test vibration velocity	23
B.4.3	Direct method	24
B.4.4	Indirect method.....	25
B.4.5	Corrected driving point method.....	25
B.4.6	Nonlinear fastening systems	26
B.5	Test report	27
	Bibliography	28

SS-EN 13146-9:2020 (E)

European foreword

This document (EN 13146-9:2020) 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 2020, and conflicting national standards shall be withdrawn at the latest by October 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13146-9:2009+A1:2011.

In this revision of EN 13146-9:2009+A1:2011 the procedures for setting up and calibrating instruments have been brought into line with the requirements in EN 13146-4 and the procedure for high-frequency stiffness testing has been moved into an informative annex.

This document is one of the series EN 13146 *Railway applications — Track — Test methods for fastenings 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;*
- *Part 5: Determination of electrical resistance;*
- *Part 6: Effect of severe environmental conditions;*
- *Part 7: Determination of clamping force and uplift stiffness;*
- *Part 8: In-service testing;*
- *Part 9: Determination of stiffness;*
- *Part 10: Proof load test for pull-out resistance.*

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

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

Earlier versions of this document included test methods applicable to higher frequencies. These methods are still included in an informative annex.

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, is recommended.

SS-EN 13146-9:2020 (E)

1 Scope

This document specifies laboratory test procedures to determine the static and dynamic stiffness of rail pads, baseplate pads and complete rail fastening assemblies.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 13481-1:2012, *Railway applications — Track — Performance requirements for fastening systems - Part 1: Definitions*

EN ISO 7500-1:2018, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines – Calibration and verification of the force-measuring system (ISO 7500-1:2018)*

EN ISO 9513:2012, *Metallic materials — Calibration of extensometer systems used in uniaxial testing (ISO 9513:2012)*

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)*

ISO 21948, *Coated abrasives — Plain sheets*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13481-1:2012 and EN ISO 10846-1:2008 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp/ui>

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 clamping 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;	6.2.3.1
F_{LFP1}	notional fastening clamping 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 = $0,8 F_{SAmax}$, 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