
Železniške naprave - Infrastruktura - Zahtevane lastnosti sistemov za pritrdjevanje tirnic za tramvaje - Komplementarni element

Railway applications - Infrastructure - Performance requirements of rail fastening systems for tramways - Complementary element

Bahnanwendungen - Infrastruktur - Leistungsanforderungen für Schienenbefestigungssysteme für Straßenbahnen

Applications ferroviaires - Infrastructure - Exigences de performance relatives aux systèmes de fixation de rail pour tramways

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**Railway applications - Infrastructure - Performance
requirements of rail fastening systems for tramways -
Complementary element**

Applications ferroviaires - Infrastructure - Exigences
de performance relatives aux systèmes de fixation de
rail pour tramways

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Leistungsanforderungen für
Schienenbefestigungssysteme für Straßenbahnen

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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prEN 17319:2018 (E)**European foreword**

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This European Standard is supported by the test methods in the series EN13146 “*Railway applications – Track – Test methods for fastening systems*”.

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1 Scope

This document is applicable to rail fastening systems used with grooved rails for tram, urban rail and industrial tracks, with maximum axle loads and minimum curve radii in accordance with Table 1.

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

Table 1 — Fastening category criteria

Fastening category	Maximum design axle load kN	Minimum curve radius m
A+	130	20
A	130	40
B	180	80
NOTE The maximum axle load limit does not apply to maintenance vehicles		

The requirements apply to fastening systems for the grooved rail profiles in EN 14811 which act on the foot and/or web of the rail.

This standard is not applicable to fastening systems for other rail sections or special fastening systems used at bolted joints or glued joints or in switches and crossings for grooved rails.

NOTE Requirements for fastening for use with Vignole rails are included in the EN13481 series of standards.

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 13146-1:2017, *Railway applications – Track – Test methods for fastening systems – Part 1: Determination of longitudinal restraint*

EN 13146-4:2012+A1:2014, *Railway applications - Track - Test methods for fastening systems - Part 4: Effect of repeated loading*

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

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

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

EN 13146-10:2017, *Railway applications - Track - Test methods for fastening systems - Part 10: Proof load test for pull-out resistance*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 <http://www.iso.org/obp>

3.1

grooved rail

rail which has a grooved head that provides the space for the wheel flange

Note 1 to entry: For examples and further information see EN 14811

3.2

embedded track

track which is under a closed surface (e.g. a road surface, so that other vehicles can be driven across it), with no more than the head of the rails exposed

3.3

grass track

track which has a surface that is covered with vegetation in such a way that it doesn't impair rail traffic operation. The underlying track structure can be ballasted track or slab track

3.4

category A+ fastening system

fastening system designed for tramways, urban rail or industrial tracks with a typical axle load of 100 kN, a typical curve radius of 30 m and, in applications with discrete supports, a typical support spacing of 800 mm

3.5

category A fastening system

fastening system designed for tramways, urban rail or industrial tracks with a typical axle load of 100 kN, a typical curve radius of 80 m and, in applications with discrete supports, a typical support spacing of 800 mm

Note 1 to entry: This definition is consistent with the definition which appears in EN 13481-1:2012.

3.6

category B fastening system

fastening system designed for tramways, urban rail or industrial tracks with a typical axle load of 160 kN, a typical curve radius of 100 m and, in applications with discrete supports, a typical support spacing of 600 mm

Note 1 to entry: This definition is consistent with the definition which appears in EN 13481-1:2012.

3.7**embedded rails**

rails, usually applied in embedded track, which are continuously supported with elastic and/or rigid elements under the rail foot as well as on both sides of the rail web, so that the embedment provides lateral support to the rail

Note 1 to entry: Rail fastening systems for embedded track with elements on both sides of the rail web that do not provide lateral support shall be considered – for the purpose of this standard – as rail fastening systems for slab track with rails on the surface.

Note 2 to entry: Embedded rails may be laid in a constructed channel (thus with rigid sides and a base) separating the rail fastening system from the surrounding road surface or structure. Alternatively embedded rails may be laid directly in roads such that the rail fastening system is in direct contact with the road surface construction materials.

3.8**adhesive fastening system for embedded rails**

system used to fasten embedded rails in which the principle means is an adhesive bond between the rail and the channel or the road surface construction materials

3.9**mechanical fastening system for embedded rails**

system used to fasten embedded rails in which the principle means is a mechanical connection between the rail and the channel or the road surface construction materials

Note 1 to entry: A waterproof seal, often applied between the rail and the channel or the road surface construction materials in mechanical fastening systems for embedded rails, shall not be taken into consideration for the definition whether a fastening system for embedded rails is either adhesive or mechanical.

3.10**purchaser**

operator, owner or user of the rail fastening system

3.11**supplier**

body responsible for the use of this European Standard

Note 1 to entry: Sometimes the manufacturer is the supplier too.

4 Symbols and abbreviations

F_{LFA1}	minimum force applied in measurement of dynamic low frequency stiffness of assembly, in kN
F_{LFAmax}	minimum force applied in measurement of dynamic low frequency stiffness of assembly, in kN
F_{max}	Maximum force applied in longitudinal restraint test defined in EN 13146-1
F_{SA1}	minimum force applied in measurement of static stiffness of assembly, in kN
F_{SAmax}	maximum force applied in measurement of static stiffness of assembly, in kN
k_{LFA}	low frequency dynamic stiffness of assembly, in MN/m
P_v	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
X	distance between the line of application of P_L and the centre of the gauge corner radius of the rail head
α	angle between the load line and a line normal to the running surface of the rails

5 Requirements for rail fastening systems for embedded track

5.1 Longitudinal rail restraint or longitudinal stiffness

Longitudinal rail restraint or longitudinal stiffness measurements are required within the repeated load test procedures in 5.3.

Tests shall be carried out on a specimen with an embedded rail with a supported length of 0,8 m for category A+ or category A fastenings or with an embedded rail with a supported length of 0,6 m for category B fastenings.

For the mechanical fastening system for embedded rails, the requirement for the longitudinal rail restraint of the system shall be minimum 7 kN, determined using the method set out in EN 13146-1.

For the adhesive fastening system for embedded rails, the longitudinal stiffness k_L shall be measured in accordance with EN 13146-1, between 0 mm and D_r mm relative displacement per equivalent length of support without visible damage. The requirement for D_r shall be 2,0 mm and the minimum longitudinal force shall be 7 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 EN 13146-1 may be used in the calculation. In such cases and subject to agreement between the purchaser and supplier, the minimum requirement for longitudinal rail restraint may be reduced.

If the rail fastening system is claimed to be designed to provide a waterproof seal between the rail and the road surface or channel, there shall be no visible fracture or deformation of that element which indicates a failure of the waterproof sealing function.

5.2 Vertical assembly stiffness

Vertical stiffness measurements are required within the repeated load test procedures in 5.3.

When required by the purchaser, any further vertical stiffness measurements shall be made using the appropriate procedure in EN 13146-9. Values of test loads for measurement of stiffness are given in Table 2.

Table 2 — Loads for measurement of stiffness

Fastening category	F_{SA1} and F_{LFA1} kN	F_{SAmax} and F_{LFmax} kN
A and A+	1	32
B	1	43

Tests shall be carried out on a specimen with an embedded rail with a supported length of 0,8 m for category A+ or category A fastenings or with an embedded rail with a supported length of 0,6 m for category B fastenings. Measured stiffnesses shall be reported as stiffness per unit length l [MN/m/m]. Fixtures shall be used to ensure that the applied load acts through the centre line of the rail web.

5.3 Effect of repeated loading

The effect of repeated loading for embedded rails shall be determined by the procedure in EN 13146-4, except that no clamping force measurements shall be carried out either before or after the repeated load test.

The test loads and angles 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.

- Longitudinal rail restraint change ≤ 20 %; or
- Longitudinal stiffness change ≤ 20 %;
- Vertical static stiffness change ≤ 25 %.

The requirements for change in vertical static stiffness are not applicable to fastening systems with static stiffness ≥ 300 MN/m.

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

If the rail fastening system is claimed to be designed to provide a waterproof seal between the rail and the road surface or channel, there shall be no visible fracture or deformation of that element which indicates a failure of the waterproof sealing function.

Table 3 — Test loads and angles

k_{LFA}	< 75 MN/m/m		$\geq 75 < 150$ MN/m/m		≥ 150 MN/m/m	
Fastening category	α deg	$P_V/\cos \alpha$ kN	α deg	$P_V/\cos \alpha$ kN	α deg	$P_V/\cos \alpha$ kN
A+	38,6	36	38,6	40	38,6	50
A	38,6	33	38,6	36	38,6	45
B	33	35	33	38	33	48
NOTE These test loads apply to a specimen with the rail embedded for 0,8 m in Category A+ and A, and 0,6 m in Category B. In case of a shorter specimen, the test load and the load speed shall be reduced proportionally.						

5.4 Electrical insulation

Requirements for electrical insulation in the rail fastening system are specific to the signalling and power supply configurations for each project. Guidance is given in Annex A.