SLOVENSKI STANDARD
SIST EN 17682:2023

01-marec-2023

Železniške naprave - Infrastruktura - Elastični element za sistem plavajočih plošč

Railway applications - Infrastructure - Resilient element for floating slab system

Bahnanwendungen - Infrastruktur - Elastisches Element für Unterbodenmattensystem

Applications ferroviaires - Infrastructure - Elément élastique pour système de dalles flottantes

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Ta slovenski standard je istoveten z: **EN 17682:2022**

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ICS:

93.100	Gradnja železnic	Construction of railways

SIST EN 17682:2023 **en,fr,de**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 17682

December 2022

ICS 93.100

English Version

Railway applications - Infrastructure - Resilient element for floating slab system

Applications ferroviaires - Infrastructure - Élément élastique pour système de dalle flottante (REFS)

Bahnanwendungen - Infrastruktur - Elastisches Element für Unterbodenmattensystem

This European Standard was approved by CEN on 30 October 2022.

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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 foreword

This document (EN 17682:2022) 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of an identical text or by endorsement, at the latest by June 2023 and conflicting national standards shall be withdrawn at the latest by June 2023.

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.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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Introduction

In a track for railway vehicles, the Resilient Element for Floating Slab (REFS) is a product which is placed between the substructure and the ballastless track. This document applies to the performance-related properties of this element.

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1 Scope

This document is applicable to resilient elements for floating slab system (REFS) – elements used in floating slab and defines the test procedures and their acceptance criteria.

The document covers not only those parameters related to the effectiveness of a track structure in mitigating vibrations, that is, to reduce the emission of vibrations and structure-borne noise, but also the parameters that are needed for the static analysis and for the verification of track safety.

Floating slab track systems in the form of track base plates and track troughs are individual solutions in which there is considerable variation in the engineering design and the types of resilient elements used. For this reason, a floating slab track system is always an individual engineering solution and therefore, it is not possible to define all specific conditions for the resilient elements in this document.

The most typical types of resilient elements are:

— full surface bearings;

— strip bearings;

— discrete bearings (including the helical steel spring element);

— vertical bearings.

This document provides particular information in the following areas:

— test methods, test arrangements and acceptance criteria;

— data supplied by the purchaser and by the supplier;

— definition of general process of design approval tests;

— definition of routine tests.

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This document defines the specific test procedures for REFS:

— stiffness tests;

— fatigue tests;

— severe environmental condition test.

This document also sets out procedures for testing fitness for purpose and provides information on quality monitoring as part of quality assurance procedures. This document does not, however, contain requirements pertaining to the functions of Resilient Element for Floating Slab system. It is the responsibility of the purchaser to define these requirements and to choose the optional tests.

This document is not applicable for fastening system and for booted concrete block and sleeper completed with boots covered by EN 13481-5.

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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 ISO 527 (all parts), *Plastics - Determination of tensile properties (ISO 527 (all parts))*

EN ISO 1798, *Flexible cellular polymeric materials - Determination of tensile strength and elongation at break (ISO 1798)*

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)*

ISO 37, *Rubber, vulcanized or thermoplastic - Determination of tensile stress-strain properties*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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3.1
floating slab system
track system where a designed elasticity by a resilient element is introduced between the ballastless track system or trough slab and its substructure

3.2
resilient element for floating slab system
REFS
product of resilient material installed in the floating slab system including all integral parts of the product in order to mitigate vibrations

3.3
full surface bearing
resilient element arranged as a mat in between the floating slab and its substructure to provide continuous elastic support of the floating slab

3.4
strip bearing
resilient element arranged as a strip in between the floating slab and its substructure to provide continuous longitudinal elastic support of the floating slab. Continuous means any longitudinal gap between 2 strips is less than 10 % of one strip length, and not larger than strip width, except where larger gaps are needed for construction requirements such as drainage

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3.5
discrete bearing
resilient element arranged as a point support in between floating slab and its substructure to provide discontinuous elastic support of the floating slab (including helical steel spring element), with designed spacing between them over 10 % of their length

Note 1 to entry: Helical steel spring element, consisting of a helical steel spring according to EN 13906-1 and a viscous or a solid damping system assembled in one device.

3.6
vertical bearing
resilient element placed vertically for floating slab system in order to constrain the horizontal movements

3.7
stiffness
force per unit deflection measured under a uniaxial force

[SOURCE: EN 16730:2016, 3.9]

3.8
bedding modulus
compressive stress (force per unit area) per unit deflection, measured under a uniaxial force

[SOURCE: EN 16730:2016, 3.10, modified]

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3.9
static stiffness
static bedding modulus
force or stress per unit deflection measured under a uniaxial static load

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[SOURCE: EN 16730:2016, 3.12, modified]

3.10
dynamic stiffness
dynamic bedding modulus
force or stress per unit deflection measured under a uniaxial force which acts periodically at a given frequency of (5 to 20) Hz around specific force or stress levels

Note 1 to entry: This value is determined mainly for calculation of dynamic deformation of tracks.

[SOURCE: EN 16730:2016, 3.13, modified]

3.11
acoustic stiffness
acoustic bedding modulus
dynamic stiffness or bedding modulus that is measured under a static preload and at small amplitudes of displacement or velocity applied in the frequency range relevant to noise or vibration perception

3.12
mitigation of ground-borne noise and vibration
reduction of mechanical vibration and/or ground-borne noise transmitted into the surroundings

Note 1 to entry: REFS has no influence on airborne noise-mitigation except in some indirect cases, e.g. mitigate the reradiated sound from bridge-structures.

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3.13
general design approval tests
tests performed to demonstrate the compliance of the product properties with the requirements, for standard dimensions

3.14
project design approval tests
tests performed to demonstrate the compliance of the product properties with the requirements for a specific project, set by the purchaser

3.15
routine tests
tests performed to demonstrate the compliance of the product properties to the quality plan, set by the supplier

3.16
purchaser
operator or user of the equipment, or the customer of the material on the user's behalf

[SOURCE: EN 17319:2020, 3.12, modified]

3.17
supplier
company /body responsible for the execution of purchaser's requirements

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Note 1 to entry: This can be the manufacturer or his designated representative, stockist, distributer, or agent.

[SOURCE: EN 15427-1-1:2022, 3.7, modified]

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3.18
manufacturer
organization responsible for blending and processing material constituents, integrating them in the manufacturing process and subsequently cutting, stamping or moulding to final dimensions

4 Symbols and abbreviations

For the purposes of this document, the symbols and indices in Tables 1 and 2 apply.

Table 1 — Symbols

Symbols	Characterization	Units
A	area	mm^2
C	bedding modulus	N/mm^3
d	displacement	mm
Δ	variation	-
F	load	N
f	frequency	Hz
k	stiffness	N/mm
m	mass	kg

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Symbols	Characterization	Units
η	loss factor	-
κ	stiffening ratio between dynamic bedding modulus and static bedding modulus or dynamic stiffness and static stiffness	-
σ	stress (compressive or tensile)	N/mm^2
Φ	dynamic coefficient	-
R	roughness	mm

Table 2 — Indices of the symbols

Indices	Characterization
0	minimum load
1	service load
2	evaluation load
3	maximum load
PH	applicable horizontal live load
PHB	applicable horizontal load exerted by the reference vehicle
PV	applicable vertical live load
PVB	applicable vertical load exerted by the reference vehicle
i Hz	value of frequency in measurement
af	after
be	before
dyn	dynamic
A	acoustic (bedding modulus)
h	horizontal
max	maximum
min	minimum
i	sequential number in order to differentiate types of measurements
stat	static
test	test load
v	vertical
a	arithmetic mean value
c	cycles
M	million

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5 Loads applied to the REFS

As a floating slab track system is always an individual engineering solution for a particular application, it is not possible to specify generally applicable load ranges for the resilient elements.

The purchaser shall define the different loads (force or pressure) acting on REFS:

F_0 or σ_0 (minimum load):	Dead load of the slab including rails, rail fastenings, without safety factor.
F_1 or σ_1 (service load):	Minimum load (F_0 or σ_0) plus the product of the dynamic coefficient (vibration coefficient) Φ and the applicable vertical live load (F_{PV} or σ_{PV}) on curved or straight track.
F_2 or σ_2 (evaluation load for slab design):	Minimum load (F_0 or σ_0) plus the product of the dynamic coefficient Φ and the applicable vertical live load (F_{PVB} or σ_{PVB}) exerted by the reference vehicle, or plus the product of the dynamic coefficient Φ and the load model used for the verification of slab safety.
F_3 or σ_3 (maximum load for slab design):	1,35 σ_0 plus 1,5 times the product of the dynamic coefficient Φ and the applicable vertical live load (F_{PVB} or σ_{PVB}) exerted by the reference vehicle, or plus 1,45 times the product of the dynamic coefficient Φ and the load model used for the verification of track safety.
F_{h0} or σ_{h0} (minimum load):	Horizontal load resulting from the longitudinal or lateral force component acting parallel to the lateral or longitudinal inclination in the concrete base and from the superelevation of the curve of the track slab support layer.
F_{h1} or σ_{h1} (service load):	Minimum load σ_{h0} plus the horizontal live load σ_{PH} generated by the vehicles used for regular scheduled services.
F_{h2} or σ_{h2} (evaluation load):	Minimum load σ_{h0} plus the horizontal live load σ_{PHB} of the reference vehicle or the horizontal live load of the load model used in the verification of track safety.
F_{h3} or σ_{h3} (maximum load):	1,35 σ_{h0} plus 1,5 times the horizontal live load σ_{PHB} of the reference vehicle, or plus 1,45 times the horizontal live load of the load model used in the verification of track safety.

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The dynamic coefficient Φ incorporates the additional dynamic effects associated with the passage of the vehicle. Currently, a dynamic coefficient of Φ = 1,3 is used for running speeds up to 200 km/h. For higher speeds, the dynamic coefficient should be provided by the purchaser.

NOTE 1 The applicable vertical live load *PV* is determined by the axle loads of the vehicles used for regular scheduled services.

NOTE 2 In the case of tramways, urban light rail systems and underground railways, the live load *PVB* of the reference vehicle is assumed to be the most unfavourable loading scenario generated by the regular scheduled services or by any special-purpose vehicles. For suburban rapid transit systems and main-line railways, the load model LM 71 as defined in EN 1991-2 is generally assumed for verifications of track safety.