SLOVENSKI STANDARD
oSIST prEN 16843:2020

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Železniške naprave - Infrastruktura - Mehanske zahteve za spoje v voznih tirnicah

Railway applications - Infrastructure - Mechanical requirements for joints in running rails

Bahnanwendungen - Infrastruktur - Mechanische Anforderungen an Fahrschienenstöße

Applications ferroviaires - Infrastructures - Exigences mécaniques des joints dans les rails de roulement

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ICS:

45.080	Tračnice in železniški deli	Rails and railway components

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ICS

English Version

Railway applications - Infrastructure - Mechanical requirements for joints in running rails

Applications ferroviaires - Infrastructures - Exigences mécaniques des joints dans les rails de roulement

Bahnanwendungen - Infrastruktur - Mechanische Anforderungen an Fahrschienenstöße

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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European foreword

This document (prEN 16843:2019) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

The following terms are used within to define the parties involved in using the EN as the technical basis for a transaction:

— Customer: the Operator or User of the equipment, or the Purchaser of the equipment on the User's behalf;

— Supplier: the body responsible for the use of the EN in response to the Customer's requirements.

1 Scope

This document deals with mechanical rail joints for permanent use with flat bottom rails 46 kg/m and above.

The scope of this document is:

— to establish requirements for insulated and non-insulated rail joints, for stressed rail (continuous welded rail, CWR) and unstressed rail (jointed track);

— to define mechanical and electrical requirements for type approval and for acceptance of insulated rail joints which are manufactured in a factory (prefab construction) as well as assembled on-site (site construction).

This document specifies the minimum requirements. Special applications as for instance tram systems may require different demands in certain paragraphs and should be agreed between customer and supplier.

The scope of this document excludes all types of mechanical joints for temporary use in track, used for example during track construction or for securing broken rails and welds before final repair. The scope also excludes expansion devices (covered in EN 13232-8), and special joints in switch constructions.

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 10025-2:2019, *Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels*

EN 10204, *Metallic products - Types of inspection documents*

EN 13674 (series), *Railway applications - Track - Rail*

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:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
mechanical rail joint
mechanical assembly, for example with fishplates to join two rail ends

3.2
standard mechanical rail joint
mechanical rail joint that connects two rails of the same profile

3.3
transition mechanical rail joint
mechanical rail joint that connects two rail profiles which are different or which compensate for railhead wear

3.4
non-insulated rail joint
mechanical rail joint which does not separate the rail ends electrically

3.5
insulated rail joint
mechanical rail joint with the additional function to separate the rail ends electrically

3.6
insulated rail joint for jointed track with expansion
insulated rail joint with expansion capacity which can accommodate longitudinal displacement of the jointed rail length

3.7
insulated rail joint for jointed track without expansion
insulated rail joint without expansion capacity which can only resist the longitudinal forces of a jointed track

3.8
insulated rail joint for CWR
insulated rail joint without expansion capacity which can resist the forces in CWR

3.9
prefab construction
manufactured in a factory

3.10
site construction
manufactured in track (on-site) by an assembler

3.11
continuous welded rail
CWR
joint-free rail
rails welded together to form a single rail length longer than a defined length

3.12
rail with joints
rail in jointed track installed at lengths less than a defined length, with expansion gaps provided at mechanical joints

3.13
fishplate
component applied in mechanical rail joints on each side of the rail on the fishing surfaces

3.14
fishplate bolts
bolts used in mechanical rail joints with special design to fit the fishplates

3.15
end post
insulating component between the two rail ends

3.16
joint clearance
functionally required distance between the two rail ends of a jointed track

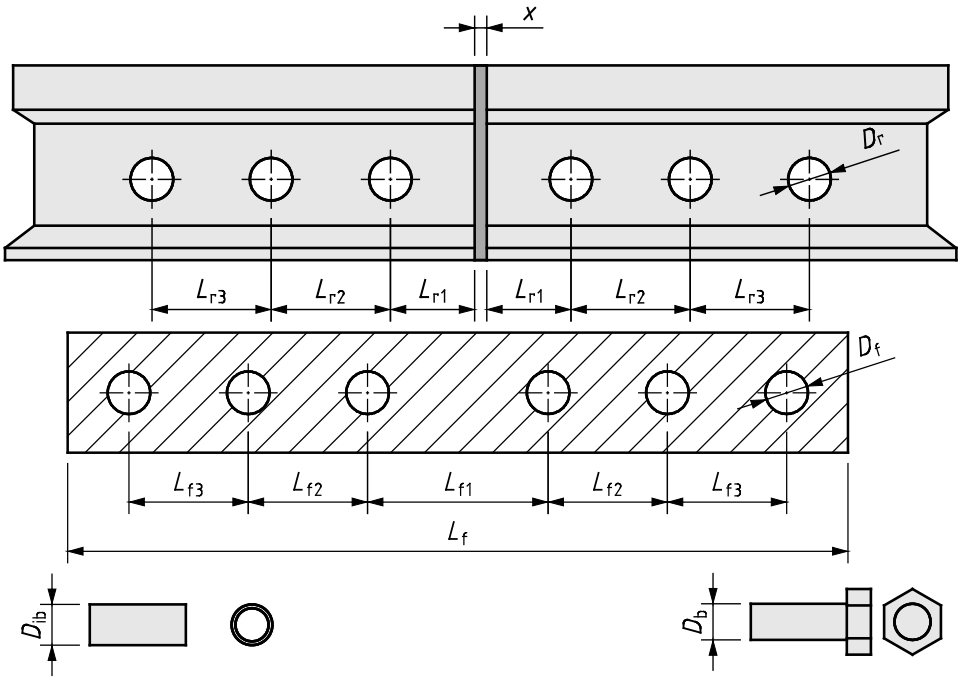
3.17
suspended joint
unsupported joint situated between two supports with regular spacing

3.18
supported joint
joint situated on top of one support, one sleeper or a double sleeper

3.19
rail bond
electrical connection for traction currents in jointed track

3.20
rail bolt for earthing
bolt connected to the rail for earth bond

3.21
insulating bush
insulating component between bolt and rail or fishplate



Key

Top: rail ends

Middle: fishplate

Bottom left: insulating bush

Bottom right: fishplate bolt

For insulated joint without expansion: $x = e$

For mechanical rail joints and insulated rail joints with expansion: $x = J_n$

Figure 1 – Definition of parts and design parameters of mechanical rail joints

4 Symbols and abbreviations

Table 1 – Overview of symbols

Symbol	Description	Unit
A_{rail}	Cross-section area of rail	m^2
D_b	Diameter of fishplate bolt	m
D_f	Diameter of holes in fishplate	m
D_{ib}	External diameter of insulating bush	m
D_r	Diameter of holes in rail end	m
E	Young's modulus of rail steel	N/m^2
F	Force in repeated bending test	N
F_{min}	Minimum force in repeated bending test	N
F_{max}	Maximum force in repeated bending test	N
$F_{s,min}$	Minimum tension strength in tension strength test	N

Symbol	Description	Unit
$F_{s,t}$	Tension strength in tension strength test	N
H	Height of rail section	m
I_{rail}	Rail moment of inertia	m^4
J_c	Joint clearance capacity	m
J_{min}	Minimum joint clearance	m
J_{max}	Maximum joint clearance	m
J_n	Nominal joint clearance with rails, fishplates and fishplate bolts at nominal position	m
J_t	Instantaneous joint clearance	m
k	Track index	N/m
L	Length of test specimen	m
L_{char}	Characteristic length	m
$L_{jt,max}$	Maximum rail length for jointed track	m
L_f	Total length of fishplate	m
L_{f1}	Longitudinal distance between axes of centre holes of the fishplate	m
L_{f2}	Longitudinal distance between axes of fishplate holes 1 and 2	m
L_{f3}	Longitudinal distance between axes of fishplate holes 2 and 3 (optional)	m
L_h	Longitudinal distance between clamps	m
L_{r1}	Longitudinal distance between rail end and axis of the nearest rail hole 1	m
L_{r2}	Longitudinal distance between axes of rail holes 1 and 2	m
L_{r3}	Longitudinal distance between axes of rail holes 2 and 3 (optional)	m
L_s	Longitudinal distance between vertical supports	m
L_w	Longitudinal distance between load insertion points	m
M_{max}	Maximum bending moment	Nm
M_r	Required bending moment in repeated bending test	Nm
M_s	Bending moment in static bending test	Nm
N_{max}	Maximum tension force in the rail due to temperature difference	N
Q	Nominal wheel load	N
d	Average deflection of mechanical rail joint in static bending test	m
d_1, d_2, d_3, d_4	Deflections of mechanical rail joint in static bending test	m
d_{max}	Maximum average deflection of mechanical rail joint in static bending test	m
e	Thickness of end post (e = 0 if no end post is used)	m
s, s_1, s_2	Tolerances of fishplate in vertical deflection	m
t, t_1, t_2	Tolerances of fishplate in transverse deflection	m

Symbol	Description	Unit
w_s	Residual gap in residual gap test	m
$w_{s,max}$	Maximum residual gap in residual gap test	m
w_{max}	Maximum rail deflection in adjoining track structure	m
ΔT	Rail temperature variation in jointed track (difference between minimum and maximum rail temperature)	K
ΔT_1	Temperature difference between neutral (stress-free) and minimum rail temperature	K
α	Linear thermal expansion coefficient of rail steel	K^{-1}
γ_c	Safety and correction factor	-
γ_s	Safety factor for variable loads	-

5 Requirements

5.1 General

5.1.1 Design requirements for mechanical rail joints

The general design shall satisfy the following requirements:

— to connect rail ends in such a way that the assembly may behave as a continuous beam in any direction;

— to limit relative displacements (vertical and lateral) of the rail ends while permitting longitudinal displacement, if required, for thermal behaviour;

— to be compatible with the rail fastening system.

5.1.2 Joint clearance capacity for jointed track

The joint clearance capacity J_c is calculated as follows:

The nominal joint clearance J_n is:

$$J_n = L_{f1} - 2L_{r1} \quad (1)$$

Assuming that $L_{r2} = L_{f2}$ (4 bolts assembly) and that $L_{r3} = L_{f3}$ (6 bolts assembly only), the maximum joint clearance J_{max} is:

$$J_{max} = J_n + 2.(D_r - D_b) \quad (2)$$

with $D_r \geq D_b$ and $D_f \geq D_b$.

If insulating bushes are used then D_{ib} shall be used instead of D_b.

The maximum joint clearance J_{max} shall be equal to the value defined by the customer.

The minimum joint clearance J_{min} is:

$$J_{min} = J_n - (D_r - D_b) + (D_f - D_b) \quad (3)$$

with $D_r \geq D_b$ and $D_f \geq D_b$.

If insulating bushes are used then D_{ib} shall be used instead of D_b.