SLOVENSKI STANDARD
oSIST prEN 16843:2015

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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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45.080	Tračnice in železniški deli	Rails and railway components
93.100	Gradnja železnic	Construction of railways

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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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (prEN 16843:2015) 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.

Note: Due to fact that the EC has not yet been able to confirm the financial commitment for the New Approach Consultants’ work in 2015, there are currently no New Approach Consultants in place for 2015. Therefore the provisions of CEN-CENELEC Guide 15 cannot be met.

This shall not prevent the processing of draft standards nor the offering of harmonized standards to the European Commission. In particular, draft standards can be sent to vote without Consultant assessment.

This note will be removed from the Foreword of the finalized publication.

1 Scope

This European Standard deals with mechanical rail joints for flat bottom rails 46 kg/m and over.

The scope of this standard 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 standard 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 also excludes expansion joints (it is covered in EN 13232-8), and special joints in switch constructions.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10025-2:2004, *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 13674-1, *Railway applications - Track - Rail - Part 1: Vignole railway rails 46 kg/m and above*

3 Terms and definitions

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

3.1
mechanical rail joint
mechanical assembly with e.g. fishplates to join two rail ends; the assembly is designed to get the best continuity of the running edge and to reduce additional vertical or lateral displacements due to interruption of the rail inertias. See Table 1.

Table 1 – Overview of mechanical rail joints

Mechanical rail joint			
For jointed track			For continuous welded rail (CWR)
Non-insulated	Insulated with expansion	Insulated without expansion	Insulated
Type approval: see 6.1	Type approval: see 6.3		Type approval: see 6.2

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

3.3
transitional mechanical rail joint
mechanical rail joint that connects two different rail profiles

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

3.5
insulated rail joint
mechanical rail joint with the additional function to separate both 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
stressed rail
continuous welded rail (CWR)

3.12
unstressed rail
jointed track

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

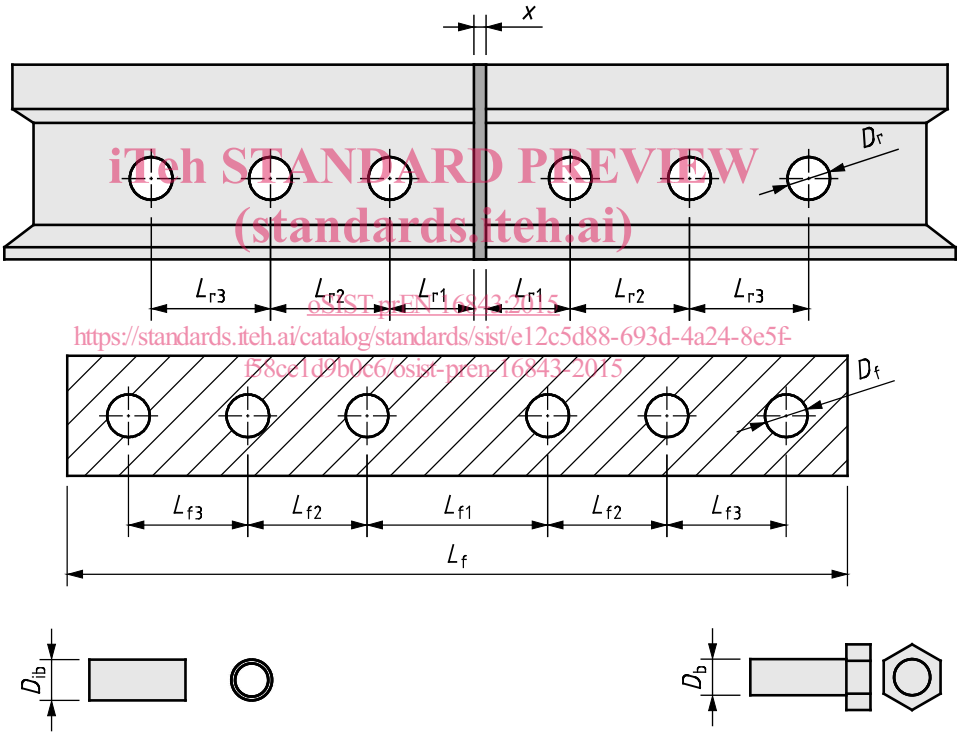
3.17
suspended joint
unsupported joint situated between two supports with regular spacing

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 2 – Overview of symbols

Symbol	Description	Unit
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
$F_{s,t}$	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
L	Length of test specimen	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_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

Symbol	Description	Unit
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
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)	°C
ΔT_1	Temperature difference between neutral (stress-free) and minimum rail temperature	°C
α	Linear thermal expansion coefficient of rail steel	/°C
γ_c	Safety and correction factor	-
γ_s	Safety factor for variable loads	-

5 Requirements

5.1 Quality systems

5.1.1 General

The supplier responsible for the parts or the whole mechanical rail joints shall be certified and have an audited quality system approved by the customer.

5.1.2 Design requirements for mechanical rail joints – General

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 both rail ends while permitting longitudinal displacement, if required, for thermal behaviour;

— to fulfil the compatibility with the rail fastening system;

— to be simple;

— to be carried out with the minimum elements required.

5.1.3 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:

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

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

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:

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

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

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

However, if this formula reveals that $J_{min} < e$ then $J_{min} = e$, with e equal to the thickness of the end post, and $e = 0$ if no end post is used.

Finally the joint clearance capacity J_c is calculated as follows:

$$J_c = J_{max} - J_{min} \quad (4)$$

5.1.4 Maximum rail length for jointed track

As a consequence of the joint clearance capacity J_c of a typical design of a mechanical rail joint for jointed track, the rail length for jointed track is limited. The maximum rail length for jointed track $L_{jt,max}$ is depending on the variation of rail temperature ΔT, which shall be defined by the customer.

For mechanical rail joint for jointed track, the customer, or the supplier with the approval of the customer, shall define:

— a table of values for:

  — the longitudinal distances between the axes of the holes in the rail ends L_{r1-3} and in the fishplates L_{f1-3};

  — the diameters of the holes in the rail ends D_r and the fishplates D_f;

  — the diameters of the fishplate bolts D_b;

  — the diameters of the insulating bushes D_{ib}, if used;

  — J_n, J_{max}, J_{min} and J_c;

— a rule to give the maximum rail length for jointed track $L_{jt,max}$ depending on J_c, on the rail temperature variation ΔT and on the lateral and longitudinal resistance of the track.

NOTE See Annex A for an example for the design of a track with mechanical rail joints.

5.1.5 Design approval

The general design of a mechanical rail joint shall be described by a technical documentation agreed between the customer and the supplier including:

— the reference of the rail section according to EN 13674 series standards;