



**SLOVENSKI STANDARD**  
**oSIST prEN 17976:2023**  
**01-julij-2023**

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**Železniške naprave - Vijačenje železniških vozil in komponent**

Railway applications - Bolting of railway vehicles and components

Bahnanwendungen - Verschrauben von Schienenfahrzeugen und -fahrzeugteilen

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**ICS:**

21.060.01	Vezni elementi na splošno	Fasteners in general
45.040	Materiali in deli za železniško tehniko	Materials and components for railway engineering

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**en,fr,de**



EUROPEAN STANDARD  
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EUROPÄISCHE NORM

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ICS

English Version

## Railway applications - Bolting of railway vehicles and components

Bahnanwendungen - Verschrauben von Schienenfahrzeugen und -fahrzeugteilen

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**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

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**prEN 17976:2023 (E)**

## **European foreword**

This document (prEN 17976:2023) 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.

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## Introduction

Screwed and bolted joints are often used to assemble safety-critical components on rail vehicles. This document sets out key considerations for design and assembly of such joints, based on an assessment of their criticality.

The application of this document results in an appropriate safety level for bolted joints in railway applications considering design, assembling and service phase.

This document applies to the selection and application of bolted joints for rail vehicles with mechanical and electrical applications.

The function of a bolted joint is to connect two or more parts in a sufficient and safe manner over the intended service life under the conditions of the railway environment. The bolted joint is designed to transmit forces between the connected components safely and without separation or relative movement. For this purpose, the parts are held together by the preload of the bolt.

This document specifies the safety levels of bolted joints and gives an overview of the resulting requirements.

It specifies standards for the design and verification of bolted joints. Design includes aspects such as joint dimensions, layout, securing of bolted joints and corrosion protection.

It is intended to support the designer in the basic selection of bolted joints for familiarisation with the necessary systematics and terms.

Furthermore, this document specifies requirements for assembly, quality and maintenance.

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**prEN 17976:2023 (E)****1 Scope**

This document specifies the requirements for designing, strength assessment, assembly and servicing of mechanical and electrical bolted joints made from metallic components and bolts.

This document is not intended for rivets, lock bolts, self-tapping screws, wood screws, thread-rolling screws, thread-forming and chipboards.

This document is applicable to all rail vehicles.

**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 50153:2014,<sup>1</sup> *Railway applications — Rolling stock — Protective provisions relating to electrical hazards*

EN 50343, *Railway applications - Rolling stock - Rules for installation of cabling*

EN 20273, *Fasteners - Clearance holes for bolts and screws (ISO 273)*

EN 13858, *Corrosion protection of metals - Non-electrolytically applied zinc flake coatings on iron or steel components*

EN 12683, *Biotechnology - Modified organisms for application in the environment - Guidance for the characterization of the genetically modified organism by analysis of the molecular stability of the genomic modification*

EN 15865, *Adhesives - Determination of torque strength of anaerobic adhesives on threaded fasteners (ISO 10964)*

EN ISO 3506-1, *Fasteners - Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs with specified grades and property classes (ISO 3506-1)*

EN ISO 3506-2, *Fasteners - Mechanical properties of corrosion-resistant stainless steel fasteners - Part 2: Nuts with specified grades and property classes (ISO 3506-2)*

EN ISO 4032, *Hexagon regular nuts (style 1) - Product grades A and B (ISO 4032)*

EN ISO 4014, *Fasteners - Hexagon head bolts - Product grades A and B (ISO 4014)*

EN ISO 4017, *Fasteners - Hexagon head screws - Product grades A and B (ISO 4017)*

EN ISO 10683:2018, *Fasteners - Non-electrolytically applied zinc flake coating systems (ISO 10683)*

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<sup>1</sup> This document is impacted by EN 50153:2014/A1:2017 and EN 50153:2014/A2:2020.

EN ISO 4042:2022, *Fasteners - Electroplated coating systems (ISO 4042)*

EN ISO 7040, *Prevailing torque type hexagon regular nuts (with non-metallic insert) - Property classes 5, 8 and 10 (ISO 7040)*

EN ISO 7042, *Prevailing torque type all-metal hexagon high nuts - Property classes 5, 8, 10 and 12 (ISO 7042)*

EN ISO 4762, *Hexagon socket head cap screws (ISO 4762)*

EN ISO 10664, *Hexalobular internal driving feature for bolts and screws (ISO 10664)*

EN ISO 2081, *Metallic and other inorganic coatings - Electroplated coatings of zinc with supplementary treatments on iron or steel (ISO 2081)*

EN ISO 19598, *Metallic coatings - Electroplated coatings of zinc and zinc alloys on iron or steel with supplementary Cr(VI)-free treatment (ISO 19598)*

ISO 261, *ISO general purpose metric screw threads — General plan*

ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread*

ISO 898-2, *Fasteners — Mechanical properties of fasteners made of carbon steel and alloy steel — Part 2: Nuts with specified property classes*

ISO 965-1, *ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data*

ISO 2725-2, *Assembly tools for screws and nuts — Square drive sockets — Part 2: Machine-operated sockets ("impact")*

ISO 2306, *Drills for use prior to tapping screw threads*

ISO 16269-6:2014, *Statistical interpretation of data — Part 6: Determination of statistical tolerance intervals*

ISO 5479, *Statistical interpretation of data — Tests for departure from the normal distribution*

DIN 1319-3:1996-05, *Fundamentals of metrology — Part 3: Evaluation of measurements of a single measurand, measurement uncertainty*

DIN 1461, *Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods*

DIN 78, *Protrusions of bolt ends*

**prEN 17976:2023 (E)****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:

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

**3.1****bolted joint**

assembly of two or more components held together by the preload of the bolts

Note 1 to entry The bolted joint contains the clamped components, the bolt, nut and washers. In this document the bolted joint includes the screwed joint.

**3.2****screwed joint**

assembly of two or more components held together by the preload of the screw

Note 1 to entry The screw is placed in one tapped component. The screwed joints contain the clamped components, the screw and washers.

**3.3****separation**

opening of clamped parts

Note 1 to entry The surface pressure between two clamped components falls partially or completely to zero due to external loads pulling these parts apart.

**3.4****load factor**

ratio of resilience of the bolt and the clamped components

**3.5****loosening**

slackening and self-acting loosening by rotation, which includes loss of preload

**3.6****slackening**

loss of preload due to embedding, creep or exceeding surface pressure limits

**3.7****embedding**

flattening of joint surfaces, within the thread, under the head or the nut or the interface surfaces

**3.8****creep**

time-dependent plastic deformation under load which leads to the loss of preload in bolted joints

Note 1 to entry In metallic materials, this usually occurs at elevated temperatures (at least 30 % - 40 % of the melting temperature in Kelvin).

**3.9****self-acting loosening by rotation**

loss of preload due to relative rotational movement between the nut and bolt or screw and threaded part, often associated with external shear forces overcoming the joint friction

**3.10****normal service load**

service or cyclic load being sustained for the specified life without detriment to the structural safety

Note 1 to entry The normal service load is considered in accordance with specific standards, e.g. EN 12663-1 and EN 13749.

**3.11****exceptional load**

extreme load representing the maximum load under which full serviceability is to be maintained and used for assessment against static material properties

Note 1 to entry The normal service load is considered in accordance with specific standards, e.g. EN 12663-1 and EN 13749

**3.12****ultimate load**

load due to crash, derailment, vandalism under which load capacity is to be maintained

**3.13****failure**

defect which leads to the bolted joint ceasing to fulfil its functional requirement

Note 1 to entry Functional requirements are e.g. structural strength or current transfer. Depending on design and function this can be an unacceptable loss of preload or total loss of joint.

Note 2 to entry Failure can arise from overload ultimate loads or normal service and exceptional loads in combination with corrosion or degradation.

**3.14****slip resistant**

no relative transverse or radial movement between the clamped components

**3.15****tightening factor**

ratio between maximum and minimum assembly preload of a bolted joint due to the scatter of the tightening process and scatter of friction coefficients

Note 1 to entry Reduction of preload due to embedding is not taken into account.

**prEN 17976:2023 (E)****3.16****mechanical connection**

bolted joint transferring loads between two or more components

**3.17****electrical connection**

bolted joint connecting two or more components to transfer current in service

Note 1 to entry The electrical connection may be maintained permanently or as securing line (Earthing connection).

**3.18****severity level**

severity of the consequences in case of failure of a bolted joint

**3.19****safety class**

resistance of a design against the feared consequences in case of failure of the bolt

**3.20****safety level**

combination of the severity level and the safety class

Note 1 to entry Depending on the safety level several measures are defined.

**3.21****load-transmitting equipment**

component or assembly which transfers equipment loads including attachment brackets and housings

Note 1 to entry Examples for equipment loads are traction, braking and damper forces.

**3.22****protective earthing**

current-carrying electrical connection only in the event of a fault

**3.23****low voltage**

voltage not exceeding 25 V (AC) or 60 V (DC)

Note 1 to entry According to EN 50153, extra-low voltages shall not exceed the voltage limits of 25 V for AC voltages (related to the effective value) and 60 V for DC voltages (voltage range I according to EN 50153).

**3.24****TN-C**

neutral conductor and protective earthing conductor combined in one unique line inside whole system

**3.25****PEN-conductor**

conductor combining the functions of both a protective earthing conductor and a neutral conductor

**3.26****equipotential bonding system**

provision of electric connections between conductive parts intended to achieve equipotentiality

**3.27****control parameter**

control parameter by which the tightening process is terminated

**3.28****monitoring parameter**

measured parameter used for supervision purposes

**3.29****directly measured parameter**

measured variable without additional physical transformation

Note 1 to entry The control/monitoring variable is measured using a traceable calibratable sensor integrated into the fastening tool or fastening system and which supplies measurement signals independently of the fastening process

**3.30****indirectly measured parameter**

control or control variable that is not directly measured

Note 1 to entry E. g., current or pressure shutdown without measurement until the spindle stops.

**3.31****manually actuated fastening tool**

fastening tool which is unpowered

Note 1 to entry An example for a manually actuated fastening tool is a manual torque wrench.

**3.32****hand-held tightening system**

motor-driven tightening system, in which the operator supports the reaction torque

Note 1 to entry Permanent confirmation is achieved through tactile feedback to the user.

**3.33****hand-guided tightening system**

motor-driven tightening system, in which the operator does not support the reaction torque

Note 1 to entry This definition also includes fully automatic robotic systems.

**3.34****performance class**

classified scatter of control parameter