SLOVENSKI STANDARD
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Železniške naprave - Železniška vozila - Digitalna tovorna avtomatska spenjača - Zahteve za izdelavo posebne geometrije vmesnika in preskusna metoda

Railway applications - Railway Rolling stock - Digital Freight Automatic Coupler - Performance requirements specific interface geometry and test method

Bahnanwendungen - Schienenfahrzeuge - Digitale automatische Kupplung für Güterwagen - Spezifische Schnittstellengeometrie und Prüfverfahren

Applications ferroviaires - Matériel roulant ferroviaire - Coupleur automatique numérique pour le fret - Exigences de performance, géométrie spécifique de l'interface et méthode d'essai

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45.040	Materiali in deli za železniško tehniko	Materials and components for railway engineering
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European foreword

This document (prEN 18171:2025) 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.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annex ZA, which is an integral part of this document.

This standardization request is based on the Technical Specification relating to the subsystem ‘rolling stock — freight wagons’ of the rail system in the European Union Commission Regulation (EU) No 321/2013 of 13 March 2013 and repealing Decision 2006/861/EC and EU regulation 2019/776.

Introduction

This document is presented to the public with the intention of obtaining validated knowledge and data during the CEN enquiry. With the knowledge gained, among other things, Annex H will be moved to Section 9 and a second CEN enquiry is planned.

1 Scope

This document specifies the requirements for the digital automatic coupler (DAC) for freight compliant with the Technical Specification relating to the subsystem 'rolling stock — freight wagons' of the rail system in the European Union Commission Regulation (EU) No 321/2013 of 13 March 2013 and repealing Decision 2006/861/EC and EU regulation 2019/776.

This document specifies the minimum interface requirements to allow automatic coupling (mechanical and pneumatic) of two digital automatic couplers. This document further specifies the mechanical interfaces needed for the interoperability of electrical couplers, it does not cover the electrical contacts needed.

This document covers the requirements for DACs integrated into locomotives.

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 1005-3:2002+A1:2008, *Safety of machinery — Human physical performance — Part 3: Recommended force limits for machinery operation*

EN 10204:2004, *Metallic products - Types of inspection documents*

EN 10228-1:2016, *Non-destructive testing of steel forgings - Part 1: Magnetic particle inspection*

EN 10228-2:2016, *Non-destructive testing of steel forgings - Part 2: Penetrant testing*

EN 12663-2:2024, *Railway applications — Structural requirements of railway vehicle bodies — Part 2: Freight wagons*

prEN 14198:2023, *Railway applications — Braking — Requirements for the brake system of trains hauled by locomotives*

EN 14601:2024, *Railway applications — Straight and angled end cocks for brake pipe and main reservoir pipe*

EN 15227:2020+A1:2024, *Railway applications — Crashworthiness requirements for rail vehicles*

EN 15085-1:2023, *Railway applications - Welding of railway vehicles and components - Part 1: General*

EN 15085-2:2020+A1:2023, *Railway applications — Welding of railway vehicles and components — Part 2: Requirements for welding manufacturer*

EN 15085-3:2022+A1:2023, *Railway applications — Welding of railway vehicles and components — Part 3: Design requirements*

EN 15085-4:2023, *Railway applications - Welding of railway vehicles and components - Part 4: Production requirements*

EN 15085-5:2023, *Railway applications - Welding of railway vehicles and components - Part 5: Inspection, testing and documentation*

EN 15551:2022, *Railway applications - Railway rolling stock - Buffers*

EN 15566:2022, *Railway applications - Railway Rolling stock - Draw gear and screw coupling*

EN 15839:2024, *Railway applications - Testing and simulation for the acceptance of running characteristics of railway vehicles - Running safety under longitudinal compressive force*

EN 16019:2014, *Railway applications - Automatic coupler - Performance requirements, specific interface geometry and test method*

EN 16839:2022, *Railway applications - Rolling stock - Head stock layout*

EN 17976:2024, *Railway applications - Bolting of rail vehicles and components*

EN 50125-1:2014, *Railway applications — Environmental conditions for equipment — Part 1: Rolling stock and on-board equipment*

EN 50124-1:2017, *Railway applications — Insulation coordination — Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment*

EN 60529:1991,[1] *Degrees of protection provided by enclosures (IPCode) (IEC 60529:1989/A2:2013/ COR1:2019)*

EN ISO 228-1:2003, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1:2003)*

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 https://www.electropedia.org/

3.1 General terms

3.1.1
Digital Automatic Coupler
DAC
central buffer end coupling system for freight applications that couples automatically

Note 1 to entry: The degree of automation is defined in functional levels 1 to 5 see 3.2.

Note 2 to entry: The requirements described in this standard are valid for digital automatic couplers for use in freight trains. For digital automatic couplers for use in passenger trains there exist different or additional requirements.

Note 3 to entry: The mechanical housing for the electrical coupler will be covered in this standard.

[1] Document impacted by EN 60529:2019/A1:2000, /A2:2013 and /AC:2019.

3.1.2
electrical coupler
system that is used for connecting or disconnecting the electrical lines automatically which transfer control signals or power supply / current from one railway vehicle to another within a train

Note 1 to entry: If relevant the Electrical coupler will also house data connections and lines. The electrical components of the electrical coupler are defined in prEN 50746 and prEN 50747.

Note 2 to entry: For clarity, the mechanical interfaces but not the transmission conduits (pins) and their configuration of the electrical coupler are covered in this standard.

3.1.3
horizontal and vertical support
system that moves or aids - in the uncoupled condition - the complete coupler back into the central position after being deflected

3.1.4
split collar
fastening element consisting of two metal half-shells that are joined by fasteners

Note 1 to entry this is not a standardized interface covered by this standard.

3.1.5
draft gear
element of the coupler that can transfer compressive and tensile forces into freight wagon or locomotive

Note 1 to entry the draft gear can handle regenerative and non-regenerative energy

3.1.6
crash element
non-regenerative energy absorption devices that absorb energy in the event of a collision

Note 1 to entry These devices are used to protect the main structure of the wagon, load or other rail device it is attached to. These elements may be sacrificial.

3.1.7
coupler shank
connection between the coupler head and the draft gear

3.1.8
pivot pin
pin used to connect the coupler shank to the draft gear

3.1.9
manual uncoupling mechanism
device which provides manual rotation of the locking mechanism from the coupled position in to the ready to couple position

Note 1 to entry It can be a lever, handle, rope or other tool which is connected to the coupling mechanism and is pulled until the ready to couple position is attained.

3.1.10
uncoupling actuator
device which provides automatic rotation of the locking mechanism from the coupled position in to the ready to couple position

3.1.11
prevent coupling
state when the mechanical mechanism of the coupler is retained in an uncoupled state preventing coupling of the couplers even if two couplers are put in contact (buffed) with each other – which normally would result in coupling

Note 1 to entry this enables buffing in hump and yard operations.

3.1.12
Berne or Berner rectangle
area between the vehicles ends defined in EN 16839:2022, 3.1 and 4.2

3.2 Functional Levels (FL)

3.2.1
functional level 1
FL1
automated coupling of the mechanical connection; manual uncoupling possible

3.2.2
functional level 2
FL2
FL 1 plus automatic coupling of air pipe(s)

3.2.3
functional level 3
FL3
FL 2 plus automatic coupling of electrical power line(s)

3.2.4
functional level 4
FL4
FL 3 plus automatic coupling of data line(s)

3.2.5
functional level 5
FL5
FL 4 plus full automated uncoupling

Note 1 to entry The full automated can be by means of remote access

4 Product requirements

4.1 General

This document specifies the product requirements of a digital freight automatic coupler intended to be equipped into freight wagons and locomotives.

For the components of the digital freight automatic coupler which transfer forces in the draw and buff line (for example coupler head, shank, pin and draft gear) the:

— inspection documents of materials used for the manufacture shall be according to 3.1 or 3.2 in EN 10204:2004,

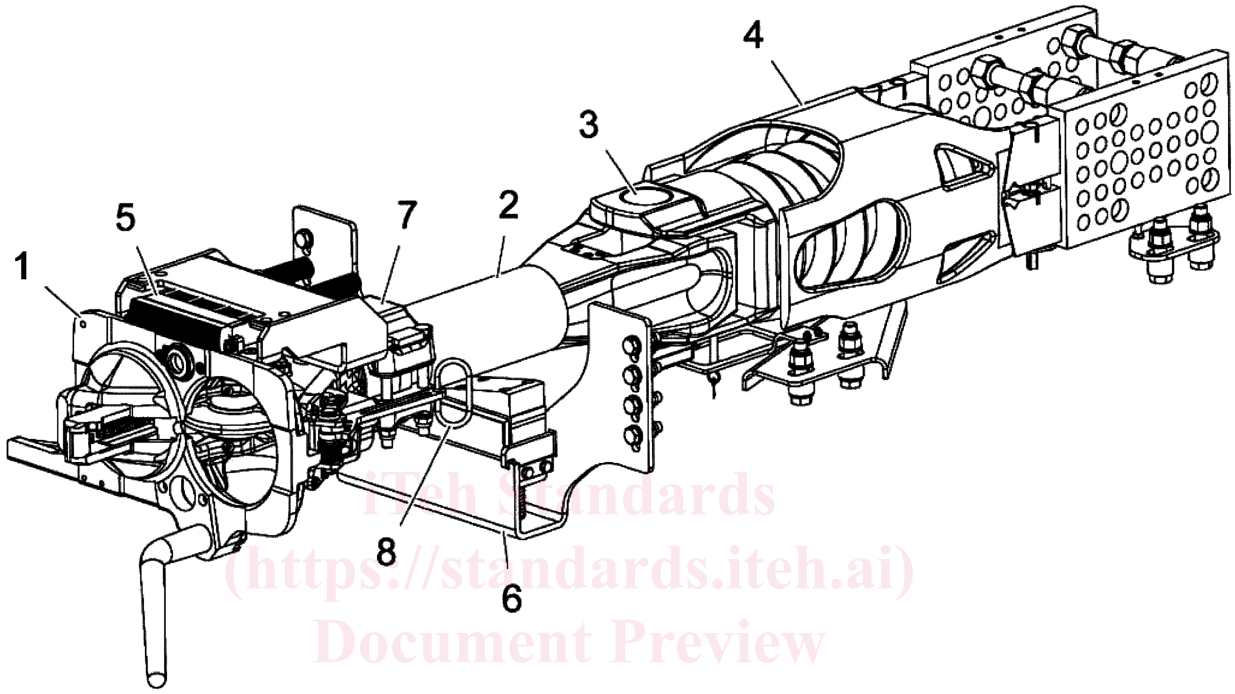
— bolted connections shall be in accordance to EN 17976:2024,

— welded parts shall be in accordance with EN 15085-1:2023, EN 15085-2:2020+A1:2023, EN 15085-3:2022+A1:2023, EN 15085-4:2023 and EN 15085-5:2023.

The couplers shall be prepared for upgradability from a lower functional level to a higher functional level.

NOTE For example, from FL2 to FL4 without major reworks.

For the main components of a Digital Freight Automatic Coupler see Figure 1.



Key

1	Mechanical coupler	5	Electrical coupler
2	Coupler shank	6	Horizontal and Vertical Support
3	Pivot pin	7	Split Collar
4	Draft gear	8	Manual uncoupling

Figure 1 — Main components of a Digital Freight Automatic Coupler

4.2 Digital automatic coupler main characteristics

The digital automatic coupler shall be able to withstand the following static loads without any plastic deformations ($Rp_{0,2}$):

NOTE 1 see also EN 12663-1:2010+A2:2023 or EN 12663-2:2024.

— tensile load = 1 000 kN

— compressive load = 2 000 kN

A nominal breaking point for tensile loads of 1 500 kN $\begin{pmatrix}+10\ \% \\ -15\ \%\end{pmatrix}$ shall be located in the draw line, located in the tensile chain between the pivot pin and the front plate of the coupler head.

NOTE 2 The couplers are not designed to withstand continues use at high forces (2 000 kN).

NOTE 3 Recommended max operational force in day use 850 kN.

For new designs the proof of the fatigue loading shall be carried out.

NOTE 4 The dynamic test procedures can be supported by the methods described in EN 15566:2022, Annex A, for tensile loads and in EN 15551:2022 for compressive loads.

The DAC shall fulfil a fatigue loading of at least ± 300 kN, with view to a lifetime of 30 years.

The proof of the fatigue loading shall be carried out by a dynamic test.

The load collective shall cover a damage equivalent load of at least 300 kN.

For an unwelded steel structure following load collective *F* shall be applied:

— $\Delta F1 = \pm 300$ kN

— $F = 0$ kN ± 300 kN and N1 = 1 500 000 cycles

NOTE 5 In case of welding connections in the load path, adjustments of the load collective are required with regard to appropriate S-N diagrams (see EN 17149-3 or FKM Guideline) depending on the weld type, in order to cover a damage equivalent load of at least 300 kN.

NOTE 6 The declared service life of the coupler is defined by an assumed distribution of loads. Real service life may be affected depending on real distribution of loads. Please see UIC B 51 RP 21 (ERRI B 51 RP 21) for an assumed load spectrum.

For evolved designs the proof of the fatigue load can alternatively be carried out by simulation with a validated FE-model.

The whole air connection system of the digital freight automatic coupler shall be suitable for a nominal 5 bar pressure on the brake pipe (BP).

For an optional main reservoir pipe (MRP) the air connection system of the digital automatic coupler shall be suitable for a nominal 10 bar pressure. If no mating MRP exists the valve of the MRP shall remain closed.

The digital automatic coupler shall work reliably under normal European operational conditions, e.g. rain, pollution, washing water, snow, ice and particularly in hot summers as well as in cold winters. The coupler shall follow the requirements set out EN 50125-1:2014. The temperature shall at least match the temperature range of the vehicle.

Coupler (excluding the regenerative energy absorption components) should be designed to commensurate with the service life of a vehicle.

The service life of the digital freight automatic coupler is defined as 30 years under the premises that all necessary maintenance and overhaul have been carried out. Based on 70 000 km per years, three coupling cycles per day, 250 operation days per year.

The service life of digital Automatic hybrid couples or digital automatic couplers for mainline locomotives is based on 150 000 km per year, five coupling cycles per day, and 360 days per year .

The service life of digital Automatic hybrid couples or digital automatic couplers for shunting locomotives is based on 50 000 km per year, 80 coupling cycles per day, and 320 days per year .

The height of the coupler shall not lead to restrictions on the ability to drive over end boards on wagons. The distance between the centre line of the coupler and the top of the coupler shall not exceed 200 mm from the centre line of the coupler.

NOTE 7 The height of the coupler is including additional components (such as e-coupler, valves levers, etc).