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|  | <p style="text-align: center;"> TECHNICAL STANDARDS DETAILED TECHNICAL CONDITIONS FOR THE CONSTRUCTION OF THE RAILWAY INFRASTRUCTURE OF THE SOLIDARITY TRANSPORT HUB – DESIGN GUIDELINES </p> | <p style="text-align: center;"> CENTRALNY PORT KOMUNIKACYJNY – SOLIDARITY TRANSPORT HUB POLAND </p> |
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TECHNICAL STANDARDS
DETAILED TECHNICAL CONDITIONS FOR THE
CONSTRUCTION OF THE RAILWAY INFRASTRUCTURE OF
THE SOLIDARITY TRANSPORT HUB – DESIGN GUIDELINES

VOLUME XVI
ROLLING STOCK

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The list of volumes constituting the detailed technical conditions for the construction of the railway infrastructure of the Solidarity Transport Hub:

| | |
|---------------|---|
| Volume A | Introduction to the STH railway standards |
| Volume I.1 | Railway track – layout geometry |
| Volume I.2 | Railway – design of civil structures |
| Volume I.3 | Railway track – drainage of track layout |
| Volume I.4 | Railway track – gauge |
| Volume I.5 | Railway track – geotechnical investigations and design |
| Volume II.1 | 2 x 25 kV 50 Hz AC overhead catenary system and traction power supply |
| Volume II.2 | 3 kV DC overhead catenary system and traction power supply |
| Volume III.1 | Engineering structures |
| Volume III.2 | Tunnels |
| Volume IV | Non-OCL power engineering |
| Volume V.1 | Non-public roads |
| Volume V.2 | Public roads |
| Volume VI.1 | Control command and signalling – basic equipment |
| Volume VI.2 | Control command and signalling – European Train Control System (ETCS) |
| Volume VII.1 | Fixed and wireless communication systems and data transmission |
| Volume VII.2 | Telecommunication systems and telematics |
| Volume VII.3 | Detection of rolling stock failure conditions (DSAT) |
| Volume VIII.1 | Station and railway station buildings |
| Volume VIII.2 | Technical buildings |
| Volume VIII.3 | Structures |
| Volume VIII.4 | Structural landscaping |
| Volume IX | Measures to minimise environmental impact |
| Volume X | Conflicts with external networks |
| Volume XI | Electromagnetic compatibility (EMC) |
| Volume XII | Railway line guard |
| Volume XIII | Technical support facilities |
| Volume XIV | Health and safety support systems for people and property |
| Volume XV | Survey control |
| Volume XVI | Railway rolling stock ----- Defines the essential and functional requirements for railway rolling stock |
| Volume XVII | Automatic baggage check-in systems |
| Volume XVIII | Security, protection and cybersecurity integrity requirements |

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1 Introduction

This volume XVI of the Technical Standards – Design Guidelines is one of 30 volumes containing a description of detailed technical conditions for construction of railway lines up to a speed of $V_{max} \leq 350$ km/h. This volume covers technical and functional requirements for the railway rolling stock suitable for traffic on these lines.

1.1 Technical scope

These guidelines apply to all categories of railway lines managed by STH. The guidelines should be used for the railway rolling stock allowed to be operated on all lines managed by STH.

These guidelines define technical and functional requirements as well as requirements for the equipment of railway vehicles.

1.2 Links to other volumes

The links between this volume of Standards with other volumes are presented in Table 1.

Table 1

| Volume No | Volume title | Relation content |
|-----------|---|--|
| I.1 | Railway track – layout geometry | Categories of railway lines for which requirements for railway rolling stock are indicated. |
| I.4 | Railway track – gauge | Railway rolling stock gauge |
| II.1 | 2 x 25 kV 50 Hz AC overhead catenary system and traction power supply | Determination of maximum power of traction vehicles and permissible current. |
| II.2 | 3 kV DC overhead catenary system and traction power supply | Determination of maximum power of traction vehicles and permissible current. |
| III.2 | Tunnels | Impact of the railway rolling stock cross-section on air pressure in a tunnel. Fire protection of railway rolling stock crossing a tunnel |
| VI.2 | Control command and signalling – ETCS | ETCS signalling subsystems |
| VII.1 | Fixed and wireless communication systems and data transmission | General requirements for IT equipment in the railway environment |
| VIII.3 | Structures | Requirements for platform height (connection with the floor height). |
| XI | Electromagnetic compatibility (EMC) | Electromagnetic compatibility requirements for rolling stock. |
| XII | Technical support facilities | Requirements for the support facilities for service and special rolling stock. |
| XVII | Automatic baggage check-in systems | Requirements for a compartment or a baggage car. Adaptation of the rolling stock to the air containers. |

1.3 Definitions of terms used

1) Release for operation

All operations as a result of which the subsystem or vehicle is in the designed state of operation.

[as defined in the Technical Specifications for Interoperability]

2) Railway vehicle

A vehicle adapted to move on its own wheels on railway tracks, with or without a drive.

[as defined in the Railway Transport Act]

3) Special railway vehicle

A railway vehicle intended for maintenance, repair or construction of railway infrastructure or intended for rescue operations.

[as defined in the Railway Transport Act]

4) Infrastructure manager

An entity responsible for managing the railway infrastructure, its operation, maintenance, renewal or participation in the development of the infrastructure, and in the case of construction of new infrastructure, an entity that commenced its construction as the investor.

[as defined in the Railway Transport Act]

NOTE: Definitions derived from acts or legal regulations in a frame, with the source document provided at the bottom.

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2 Essential, basic and general requirements for the STH railway infrastructure

Table 4 defines the link between the detailed technical conditions and the essential, basic and general requirements for the STH infrastructure.

Table 2

| sub-chapter of this volume defining detailed technical conditions | essential requirements (Railway Interoperability Directive) | | | | | | basic requirements | general requirements for the STH railway infrastructure | | | | | | | | | |
|---|--|------------------------------------|-----------------|-------------------------------|---------------------------|--------------------|--------------------|---|------------------|--|--------------------------------------|-------------------------------|--|---|--|--|--|
| | 1.1. security | 1.2. reliability and accessibility | 1.3. health | 1.4. environmental protection | 1.5. technical compliance | 1.6. accessibility | | 2.1. mechanical resistance and stability | 2.2. fire safety | 2.3. hygiene, health and the environment | 2.4. safety and accessibility in use | 2.5. protection against noise | 2.6. energy economy and heat retention | 2.7. sustainable use of natural resources | 3.1. oriented towards the needs of the economy | 3.2. orientation towards the needs of passengers | 3.3. orientation towards the needs of carriers |
| 3.4.1 | | | | | | | n/a | | | | | | | | | 3.3.2 | |
| 3.4.2 | 1.1.2 | | | | 1.5.1 | | n/a | | | | | | | | | | 3.4.1 |
| 3.4.3 | | | | | | | n/a | | | | | | | | | | |
| 3.4.4 | | 1.2.2 | | | | 1.6.1 1.6.3 | n/a | | | | | | 3.2.4 | | | | |
| 3.4.5 | 1.1.1 | | | | | | n/a | | | | | | | | | | |
| 3.4.6 | | | | | | | n/a | | | | | | | | | | |
| 3.4.7 | | | | | 1.5.3 | | n/a | | | | | | | | | | |
| 3.4.8 | | | | | 1.5.4 | | n/a | | | | | | | | | | |
| 3.4.9 | 1.1.4 | | 1.3.1, 1.3.2 | 1.4.2 | | | n/a | | | | | | | | | | |
| 3.4.10 | | 1.2.1 1.2.3 | | | 1.5.5 | | n/a | | | | | | | | | 3.3.1 | |
| 3.4.11 | | | | | | | n/a | | | | | | | | | | |
| 3.5.1 | 1.1.12 | | | | | | n/a | | | | | | | | | | |
| 3.5.2 | | | | | | | n/a | | | | | | | | | | |
| 3.5.3 | 1.1.7 | | | | 1.5.1, 1.5.3 | | n/a | | | | | | | | | | |
| 3.5.4 | 1.1.7 | | | | 1.5.1, 1.5.3 | | n/a | | | | | | | | | | |
| 3.5.5 | 1.1.4 | | 1.3.1 1.3.2 | 1.4.2 | 1.5.1 | | n/a | | | | | | | | | | |
| 3.5.6 | 1.1.1. 1.1.8 | | | | 1.5.1, 1.5.4 | | n/a | | | | | | | | | | |
| 3.5.7 | | | | 1.4.1, 1.4.4 | | | n/a | | | | | | | | | | |
| 3.5.8 | | 1.2.2 | | | 1.5.1 | 1.6.1, 1.6.3 | n/a | | | | | | | | | | |
| 3.5.9 | | | | 1.4.3 | | | n/a | | | | | | | | | | |
| 3.5.10 | | | | | | | n/a | | | | | | | | | | |
| 3.5.11 | | | | | | | n/a | | | | | | | | | | |
| 3.5.12 | | | | | | | n/a | | | | | | | | | | |

Cybersecurity

Technical solutions which collect, store, process, make available or transmit data ensuring the compliance with essential safety requirements (requirements from 1.1.1. to 1.1.11. specified in Volume A of the STH Railway Standards) and general requirements for the STH railway infrastructure concerning security (requirements 1.1.12. and 1.1.13 specified in Volume A of the STH Railway Standards) should be designed taking into account cybersecurity, i.e. “security of network and information systems”, defined in the Directive concerning measures for a high common level of security of network and information systems across the Union, as follows:

“security of network and information systems” means the ability of network and information systems to resist, at a given level of confidence, any action that compromises the availability, authenticity, integrity or confidentiality of stored or transmitted or processed data or the related services offered by, or accessible via, those network and information systems;

[as defined in Article 4 of Directive 2016/1148]

Cybersecurity includes two types of threats resulting from unauthorised access to the systems/equipment/networks that collect, store, process, make available or transmit data:

1) physical security threats

It is necessary to secure systems/equipment/networks against direct access which could enable causing (intentionally or unintentionally) threats to functional safety.

2) IT security threats

It is necessary to secure systems/equipment/networks against logical access via IT systems/equipment/networks, which could enable causing (intentionally or unintentionally) threats to functional safety.

Cybersecurity defined this way applies both to information systems used for rail transport purposes and to operational systems used for rail transport purposes, but the STH railway standards do not include requirements for information systems, e.g. timetabling systems.

Physical security threats and IT security threats for operational systems for which requirements are defined in the STH railway standards should be addressed by railway operators as part of the risk assessment and by design engineers/manufacturers/contractors as part of threat control. Additionally, it is required for the applied protections to be documented and verified in accordance with the requirements included in Volume XVIII of the STH railway standards.

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Cybersecurity within the scope of this volume of the STH railway standards

Currently, in the area covered by this volume of standards, there are no networks and information systems whose security could be endangered. However, it is possible that such networks and information systems or technical solutions that collect, store, process, make available or transmit data may arise. For example, a system of sensors may be used that, through wired or wireless networks, public or non-public networks or directly, will connect to, for instance, an infrastructure manager's system. Then, they should be protected against physical security and IT security threats in a manner compliant with the requirements of the Information Safety Management System (ISMS) implemented by the STH company.

At the same time, it should be kept in mind that the ISMS will be subject to changes because maintaining the required level of cybersecurity is not possible by meeting requirements of the standards once since cybersecurity is a process rather than a state. In order to minimise the number and size of cyber threats, the requirements (obligations) included in the Act of 5 July 2018 on the national cybersecurity system in Chapter 3 for operators of key services, in Chapter 5 for public entities should be continuously observed in operational processes and only digital service providers fulfilling the obligations described in Chapter 4 of that Act should be used.

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3 Detailed technical conditions for rolling stock authorised to use the STH railway infrastructure

3.1 Formal arrangements

Each railway vehicle authorised to run on the STH railways shall be provided with an appropriate type certificate issued by the Office of Rail Transport.

3.2 Categories of railway lines and train traffic

3.2.1 STH railway line categories

- 1) Requirements for rolling stock shall be defined for categories of railway lines.
- 2) **Unless otherwise specified in the text, the requirements indicated for the individual subsystems apply to all categories of railway lines.**
- 3) STH railway line categories are defined in Volume I.1 “Railway – Layout geometry”, Chapter 3. The most important parameters of the railway line categories (speed, axial load) are presented in the table below.

Table 3 STH railway line categories

| Parameter | Railway line category | | | | | |
|---|--|-----------------------|---------------------|---------------------|---------------------|---------------------|
| | Passenger traffic | | | Mixed traffic | | |
| | CPK-P1 | CPK-P2 | CPK-P3 | CPK-M1 | CPK-M2 | CPK-M3 |
| Reference TSI INF codes | P1 | P2 | P3/P4 | P1, F1 | P2, F1 | P3/P4, F1 |
| Maximum speed of passenger trains ($v_{max,p}$) | 250 km/h ÷ 350 km/h | 200 km/h ÷ 250 km/h | 120 km/h ÷ 200 km/h | 250 km/h ÷ 350 km/h | 200 km/h ÷ 250 km/h | 120 km/h ÷ 200 km/h |
| Maximum speed of freight trains ($v_{max,t}$) | – | – | – | 100 km/h ÷ 160 km/h | 100 km/h ÷ 160 km/h | 100 km/h ÷ 160 km/h |
| Minimum speed* (v_{min}) | $\min \begin{cases} 0.5 \cdot v_{max,p} \\ 160 \text{ km/h} \end{cases}$ | $0.5 \cdot v_{max,p}$ | 100 km/h | 100 km/h | 80 km/h | 80 km/h |
| Axle loads | 21.5 t | 22.5 t | 22.5 t | 22.5 t ¹ | 22.5 t ¹ | 22.5 t ¹ |

- 4) The minimum speed V_{min} is a requirement for rolling stock. In calculations of layout geometries, V_{min} should be assumed in accordance with Chapter 4.7, point 3). Volume I.1 of the “Layout geometry” standards.

¹ The Investor may demand that track superstructure and substructure be adjusted to axle loads of **25.0 t** when the designed railway line will interface with another railway line on which axle loads of 25.0 t are allowed or its adaptation to axle loads of 25.0 t is planned as part of an investment project being implemented or in effective strategic documents of international or national significance.

3.2.2 Transport needs and reference characteristics of rolling stock for categories of railway lines

- 1) Functionally, passenger rail traffic varies due to maximum train speeds and stopping point density. Passenger transport may be functionally divided based on the following characteristics:
 - a. travel distance,
 - b. travel frequency,
 - c. expectations regarding comfort and transport offer.
- 2) Passenger transport services are divided into 4 main categories:
 - a. Inter-agglomeration transport
 - b. Inter-voivodeship transport
 - c. Voivodeship (regional) transport
 - d. Agglomeration transport (being a specific form of voivodeship transport services).

The characteristics of these four transport groups are set out in the table below.

Table4 Characteristics of railway traffic categories in terms of speed and stops

| Traffic category | Maximum speed of traffic | Density of commercial stops | STH line category |
|----------------------|---|---|--|
| eligible | 160 km/h or more | Large urban centres | CPK-P1, CPK-P2, CPK-P3, CPK-M1 CPK-M2, CPK-M3 |
| Interregional | 120–160 km/h, lower at some sections if the infrastructure does not allow to reach 120 km/h | Large and medium-sized urban centres, resorts | CPK-P1, CPK-P2, CPK-P3, CPK-M1 CPK-M2, CPK-M3 |
| Regional | 100–130 km/h; 160 km/h if the infrastructure and inter-stop distances allow it | A majority of stations and passenger stops, possible skipping of stops at sections with agglomeration traffic services available. | CPK-P2, CPK-P3, CPK-M2, CPK-M3 |
| Agglomeration | 100 km/h | All stations and passenger stops | CPK-P3, CPK-M3 |

- 3) The recommended functional requirements for reference characteristics of the rolling stock are presented in the table below.

Table 5 Reference characteristics of the rolling stock against traffic categories

| Traffic category / Functional requirement | Inter-agglomeration | Inter-voivodeship | Regional | Agglomeration |
|---|---------------------|-------------------|---|--|
| Maximum speed | At least 160 km/h | 160 km/h | At least 120 km/h; for rolling stock at main lines – 160 km/h | 120 – 130 km/h |
| Power output | Above 5 MW | 2 – 4 MW | Adequate to the required traction parameters | Adequate to the required traction parameters |
| Starting acceleration | Not specified | Not specified | Min 1.0 m/s ² in initial start-up phase | Min 1.0 m/s ² in initial start-up phase Up to 1.3 m/s ² |

| Traffic category / Functional requirement | Inter-agglomeration | Inter-voivodeship | Regional | Agglomeration |
|--|---|-------------------------------------|--------------------------------|--------------------------------|
| Number of train sections or cars | 6-10 | 4-8 | 2-4 | 6-10 (less in justified cases) |
| Possibility of reconfiguration of the train set in service and in holding stations | No, articulated train sets; Possible use of assisted operation | Yes, with accuracy to one train car | Yes, with accuracy to one unit | Yes, with accuracy to one unit |
| Possibility of reconfiguration of the train set in operation at junction stations | No, articulated train sets; Possible use of assisted operation | Yes, with accuracy to one train car | Yes, with accuracy to one unit | Yes, with accuracy to one unit |

Source: *InnoRail. Analysis of technical and functional requirements for railway vehicles; Functional requirements, including adaptation to railway infrastructure and special transport and traffic requirements*

3.3 Essential requirements for rolling stock

The design of the rolling stock shall comply with the requirements of the relevant Technical Specifications for Interoperability, the national technical specifications and the applicable standardisation documents, namely:

- a) directives: Directive (EU) 2016/797 of the European Parliament and of the Council of May 11, 2016 on the interoperability of the rail system in the European Union and Directive (EU) 2016/798 of the European Parliament and of the Council of May 11, 2016 on safety, established by the European Parliament and the Council.
- b) regulations and Technical Specifications for Interoperability (TSI) issued on their basis, as well as CSMs established by the European Commission together with the European Railway Agency (ERA)
- c) part of European standards and European specifications, e.g. ERTMS/ETCS and ERTMS/GSM-R specifications established by the European Standardisation Bodies, and referred to in the TSIs and the CSMs,
- d) other European standards and European specifications not referred to in mandatory requirements, established by the European Standardisation Bodies
- e) Other:
 - industrial standards of the UNIFE, UIC, etc. established by individual entities.
 - instructions and other internal regulations of infrastructure managers, railway undertakings, etc., established by individual entities.

The mandatory European requirements in the context of optional requirements are shown in Figure 1.

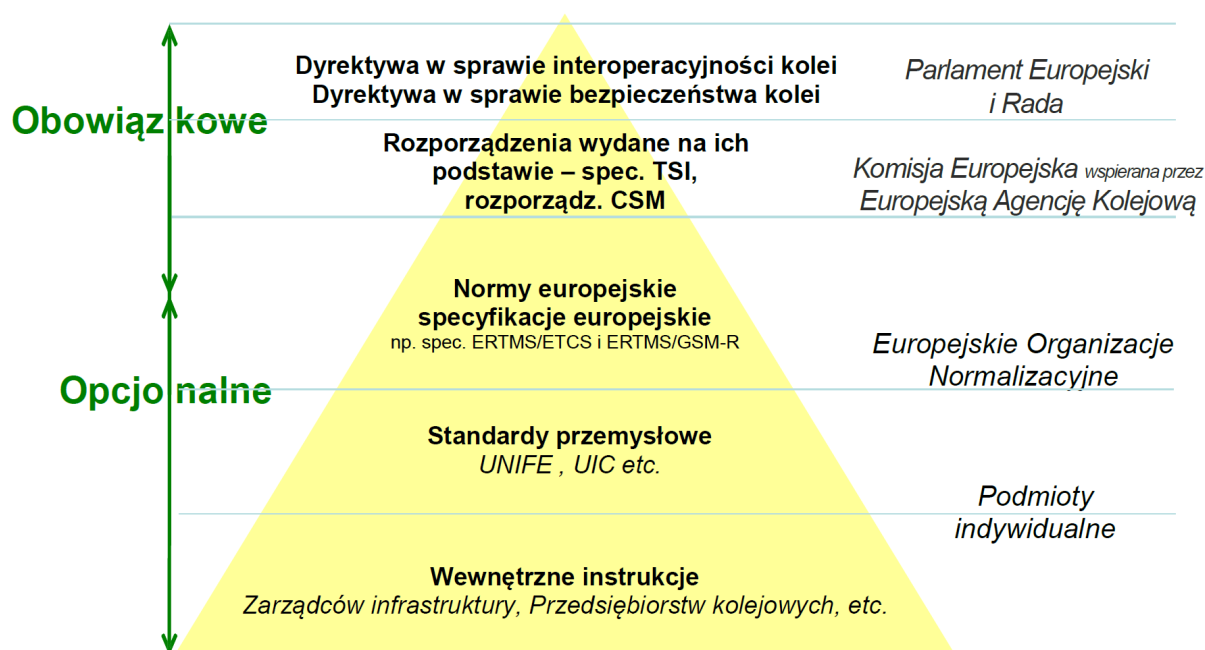


Figure 1. Relationship between mandatory and optional requirements

| PL | EN |
|--|--|
| Obowiązkowe | Mandatory |
| Opcjonalne | Optional |
| Dyrektywa w sprawie interoperacyjności kolei | Railway Interoperability Directive |
| Dyrektywa w sprawie bezpieczeństwa kolei | Railway Safety Directive |
| Rozporządzenia wydane na ich podstawie – spec. TSI, rozporząd. CSM | Regulations issued on their basis – TSIs, CSMs |
| Normy europejskie | European standards |
| Specyfikacje europejskie np. spec. ERTMS/ETCS i ERTMS/GSM-R | European specifications, e.g. ERTMS/ETCS and ERTMS/GSM-R specifications |
| Standardy przemysłowe UNIFE, UIC etc. | Industrial standards of the UNIFE, UIC, etc. |
| Wewnętrzne instrukcje Zarządców infrastruktury, Przedsiębiorstw kolejowych, etc. | Internal instructions of infrastructure managers, railway undertakings, etc. |
| Parlament Europejski i Rada | The European Parliament and the Council |
| Komisja Europejska wspierana przez Europejską Agencję Kolejową | European Commission supported by the European Railway Agency |
| Europejskie Organizacje Normalizacyjne | European Standardisation Bodies |
| Podmioty indywidualne | Individual entities |

Technical specifications for Interoperability (TSIs) define mandatory requirements for interoperable rail subsystems, and thus specify the mandatory requirements for rolling stock. The TSIs shall be established by the European Commission together with the European Railway Agency (ERA).

- TSI LOC&PAS Commission Regulation No 1302/2014 on the technical specification for interoperability relating to the subsystem “Rolling Stock — Locomotives and Passenger Rolling Stock” of the rail system in the European Union,
- TSI NOI Commission Regulation No 1304/2014 on the technical specifications for interoperability of the subsystem, amending “Rolling Stock – Noise”, amending Decision 2008/232/EC and repealing Decision 2011/229/EU,
- TSI SRT Commission Regulation No 1303/2014 on the technical specification for interoperability with regard to the aspect “Safety in Railway Tunnels” of the rail system in the European Union,
- TSI PRM Commission Regulation (EU) No 1300/2014 on the technical specifications for interoperability relating to accessibility of the Union's rail system for persons with disabilities and persons with reduced mobility,

- e) TSI CCS Commission Regulation No 919/2016 on the technical specification for interoperability with regard to the subsystem “Trackside Control-Command” of the rail system in the European Union
- f) Commission Implementing Regulation (EU) 2019/772 of 16 May 2019 amending Regulation (EU) No 1300/2014 as regards inventory of assets with a view to identifying barriers to accessibility, providing information to users and monitoring and evaluating progress on accessibility,
- g) Commission Implementing Regulation (EU) 2020/387 of 9 March 2020 amending Regulations (EU) No 321/2013, (EU) No 1302/2014 and (EU) 2016/919 as regards the extension of the area of use and transition phases,
- h) Commission Implementing Regulation (EU) 2019/776 of 16 May 2019 amending Commission Regulations (EU) No 321/2013, (EU) No 1299/2014, (EU) No 1301/2014, (EU) No 1302/2014 and (EU) No 1303/2014, Commission Regulation (EU) 2016/919 and Commission Implementing Decision 2011/665/EU as regards the alignment with Directive (EU) 2016/797 of the European Parliament and of the Council and the implementation of specific objectives set out in Commission Delegated Decision (EU) 2017/1474.
- i) Commission Implementing Regulation (EU) 2020/387 of 9 March 2020 amending Regulations (EU) No 321/2013, (EU) No 1302/2014 and (EU) 2016/919 as regards the extension of the area of use and transition phases.

These Technical Standards contain references to EN standards as per the wording and edition indicated in the valid Technical Specification for Interoperability appropriate for the scope.

UIC leaflets referred to in the standards **are optional** and, therefore, non-mandatory **documents**, and have been indicated to the extent to which there are no other (superior) normative documents covering a given issue.

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3.4 Technical and functional parameters of rolling stock

- 1) TSI LOC&PAS groups the technical and functional specifications for the “Rolling Stock” subsystem according to the following categories:
 - a. structures and mechanical parts,
 - b. track interaction and gauge,
 - c. braking,
 - d. passenger considerations,
 - e. environmental conditions,
 - f. external lights as well as audible and visual warning devices,
 - g. traction and electric equipment,
 - h. driver's cab and driver/vehicle interface,
 - i. fire safety and evacuation,
 - j. servicing,
 - k. documentation for operation and maintenance
- 2) Each newly manufactured railway vehicle shall meet the requirements of all TSIs – Technical Specifications for Interoperability in force at the time of its release for operation. All rolling stock manufactured in accordance with a design developed after the date of application of the TSI shall comply with this TSI. All Member States of the European Union are obligated to apply the TSI.
- 3) The detailed functional parameters of the individual subsystems are described in the relevant TSI provisions, the reference of which is indicated in the following sub-chapters.
- 4) The standards referred to in this volume of Standards are valid as per the wording and in edition indicated in the TSI appropriate for their subject matter.

3.4.1 Structure and mechanical parts

- 5) Requirements for structures and mechanical parts of rolling stock are in accordance with TSI LOC&PAS 1302/2014, point 4.2.2 “Structure and mechanical parts”
- 6) The mechanical interface of the coupler is defined according to the TSI points as follows:
 - a. 4.2.2.2.2 Internal coupler – specified in EN 12663-1:2010 + A1:2014
 - b. 4.2.2.2.3 End coupler according to EN 15551:2017, EN 15566:2016, EN 16019:2014, EN 16839:2017, EN 15807:2011, EN 14601:2005 + A1:2010 and UIC leaflet 648-09:2001
 - c. 4.2.2.2.4 Emergency coupler according to EN 15020:2006 + A1:2010 and UIC leaflet 648-09:2001
 - d. Safety during coupling and decoupling of rolling stock – only applicable to rolling stock with speed below 250 km/h
 - TSI LOC&PAS 1302/2014 as amended, point 4.2.2.2.5 “Access for coupling/decoupling personnel”
 - EN 16839:2017
 - For rolling stock suitable for speeds of 250 km/h and higher, it is mandatory to use an automatic coupler instead of a screw coupler and buffers; in this case, the requirements of point 4.2.2.2.3 of TSI LOC&PAS are not applicable, and the “berne space” is not required.
- 7) Gangways between cars are defined in
 - a. TSI LOC&PAS 1302/2014 point 4.2.2.3 “Gangways”
 - b. EN 16286-1:2013
 - c. Additional requirements for gangways between cars are specified in TSI PRM

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- 8) Strength of the vehicle structure according to EN 12663-1:2010 + A1:2014, and strength-related components are included in EN 15227:2017 (e.g. equipment fastening strength, and scrapper and wheel protector strength)
 - 9) Passive safety is defined in
 - a. TSI LOC&PAS 1302/2014, point 4.2.2.5 “Passive safety”
 - b. EN 15227:2020
 - 10) Lifting using ropes and lifting by means of a lift according to
 - a. TSI LOC&BELT point 4.2.2.6
 - b. EN 16404:2016
 - c. EN 15877-2:2013
 - d. EN 12663-1:2010+A1:2014
 - 11) Fixing devices to the body structure
 - a. TSI LOC&BELT point 4.2.2.7
 - b. EN 12663-1:2010+A1:2014
 - 12) Service and cargo entrance doors as required in point 4.2.2.8 of TSI LOC&PAS
 - 13) Mechanical characteristics of glass (other than windscreen) as required in point 4.2.2.9 of TSI LOC&PAS
 - 14) Load conditions and mass distribution according to
 - a. TSI LOC&BELT point 4.2.2.10
 - b. EN 15663:2009/AC:2010
 - 15) The normative requirements for flammability of components used in the vehicle structure are specified in point 4.2.10.2.1 of TSI LOC&PAS. See also Chapter 3.4.9 of this Volume of Technical Standards.

3.4.2 Track interaction and gauge

- 1) The definition of the category of railway lines and the geometry parameters corresponding to these categories are defined in Volume I.2 of the Standards; structural parameters are defined in Volume I.2 “Railway track – construction of civil structures”.
- 2) The reference to the structure gauge is presented in Volume I.4 “Railway track – gauge”
- 3) The gauge of railway vehicles is defined in
 - a) TSI LOC&PAS 1302/2014 as amended, point 4.2.3.1 “Gauge”
 - b) TSI ENE 1301/2014 as amended
 - c) EN 15273-2:2013 + A1:2016
 - d) UIC leaflets 505-1, 505-6, 506Ordinance of the Minister of Infrastructure of 12 October 2005 (Journal of Laws of 2016, item 226)
- 4) Recommended kinematic parameters of rolling stock for all categories of lines according to the GC profile. For rolling stock also using the PKP PLK infrastructure on contact lines, the G1 gauge shall apply. See Volume I.4 Gauge.
- 5) Axle load and wheel load are defined in
 - a) TSI LOC&PAS 1302/2014 as amended, points 4.2.3.2.1 “Axle load” and 4.2.3.2.2 “Wheel load”
 - b) PN-EN 14363+A1:2019-02

6) For high-speed trains, the axle load values shown in the table below are required.

Table 6 Axle loads for high-speed rolling stock

| Speed category | STH line category | Axle load [t] |
|-----------------|-------------------|---------------|
| $v \geq 250$ | CPK-P1, CPK-M1 | 17.0 |
| $200 < v < 250$ | CPK-P2, CPK-M2 | 17.0 |
| $v \leq 200$ | CPK-P3, CPK-M3 | 22.5 |

- 7) Trains suitable for higher line speed category meet the requirements for lower categories
- 8) The rolling stock characteristics regarding compatibility with train detection systems are specified in points 4.2.3.3.1.1, 4.2.3.3.1.2 and 4.2.3.3.1.3 of TSI LOC&PAS and in PN-EN 50238:2003.
- 9) Axle bearing condition monitoring according to point 4.2.3.3.2 of TSI LOC&PAS
- For vehicles with a design speed of 250 km/h or higher, the use of on-board detection equipment is mandatory.
 - Requirements for on-board detection equipment according to point 4.2.3.3.2.1
 - Requirements for rolling stock regarding conformity with signalling equipment in accordance with point 4.2.3.3.2.2 of the TSI and PN-EN 15437-1:2009
- 10) Dynamic behaviour of rolling stock is specified in point 4.2.3.4 of the TSI.
- Safety against derailment when driving on a twisted track in accordance with EN 14363:2016
 - Requirements for dynamic driving behaviour: point 4.2.3.4 of TSI and EN 14363:2016
- 11) The requirements for the running gear are described in TSI LOC&PAS, point 4.2.3.5 Running gear
- 12) The structural design of the bogie frame (point 4.2.3.5.1 of the TSI) is subject to standards
- PN-EN 13749:2011
 - PN-EN 12663-1+A1:2015-01
- 13) The mechanical and geometric characteristics of wheelsets (point 4.2.3.5.2.1 of the TSI) are defined in the following standards:
- PN-EN 13260:2009+A1:2010+A2:2012
 - PN-EN 13103:2009+A1:2010+A2:2012
 - PN-EN 13104:2009+A1:2010
 - PN-EN 12082:2007+A1:2010
 - PN-EN 13260+A1:2011
 - PN-EN 13103-1:2018-05
 - PN-EN 12082:2017-10
- 14) The mechanical and geometric characteristics of wheels (point 4.2.3.5.2.2 of the TSI) are specified in the following standard:
- EN 13979-1:2003+A2:2011
- 15) The requirements for variable gauge axles systems (point 4.2.3.5.3 of the TSI) are defined in Commission Implementing Regulation (EU) No 402/2013 of 30 April 2013 (as amended).
- 16) The minimum horizontal curve radius to be passed through shall be 150 m for all railway vehicles, in accordance with point 4.2.3.6.
- 17) Requirements for scrapers (wheel protectors) for use in railway vehicles equipped with a driver's cabin are specified in point 4.2.3.7 of the TSI.

3.4.3 Braking system

- 1) Requirements for the braking system are described in TSI LOC&PAS 1302/2014, point 4.2.4 Braking
- 2) The safety requirements for braking (point 4.2.4.2.2 of the TSI) are defined in Commission Implementing Regulation (EU) No 402/2013 of 30 April 2013.
- 3) Type of the braking system (point 4.2.4.3 of the TSI)
 - a. For locomotives and passenger cars (vehicles for so-called “general operation”), in accordance with PN-EN 14198:2017-01
 - b. for vehicles operated in fixed or pre-defined sets (including articulated trains, trainsets): no TSI requirements.
- 4) Braking control in accordance with point 4.2.4.4 of the TSI LOC&PAS “Braking control”.
- 5) Braking performance (point 4.2.4.5 of the TSI) is defined in
 - a. General requirements: PN-EN 14531-1:2005, EN 14531-6:2009.
 - b. Sudden braking: PN-EN 14531-1:2005, EN 14531-6:2009
 - c. Service braking: PN-EN 14531-1:2005, EN 14531-6:2009
 - d. For parking brake: PN-EN 14531-1:2005, EN 14531-6:2009
 - e. At high speeds (above 200 km/h), the brake test shall assess the delay (instead of the braking performance), but the brake shall be assessed based on the same set of rules as for the conventional rolling stock
- 6) Braking systems independent of gripping conditions are defined in point 4.2.4.8 of TSI LOC&PAS, and their requirements are specified in:
 - a. Magnetic track brake: EN 16207:2014, ERA/ERTMS/033281 version 4; 20.09.2018
 - b. Eddy-current track brake: ERA/ERTMS/033281 version 4; 20.09.2018, PN-EN 15273-2 + A1:2017-03
 - c. Requirements for emergency brakes according to UIC leaflet 648-09:2001
- 7) Indication of braking and failure conditions according to point 4.2.4.9 of TSI LOC&PAS

3.4.4 Passenger considerations

- 1) The space requirements for passengers are described in TSI LOC&PAS 1302/2014, point 4.2.5 “Passenger considerations”, and contain references to TSI PRM, point 4.2.2
- 2) Sanitary systems (TSI 4.2.5.1) according to:
 - a) Council Directive 98/83/EC of 3 November 1998
 - b) Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006
 - c) Directive 2006/11/EC of the European Parliament and of the Council of 15 February 2006
 - d) Requirements for toilets are specified in TSI PRM, point 4.2.2.5 “Toilets” PN-EN 16585-1:2017-04
 - e) 5.3.2.2 “Standard and universal toilets: Common parameters (interoperability constituent)”
 - PN-EN 16584-1:2017-04
 - PN-EN 16584-2:2017-05
 - PN-EN 16585-1:2017-04
- 3) Audible communication system (point 4.2.5.2 of the TSI)
 - a. Passenger alarm (point 4.2.5.3 of the TSI):
 - Commission Regulation (EU) 2016/919 of 27 May 2016
 - Commission Implementing Regulation 2019/776 of 16 May 2019
 - b. Passenger communication equipment (point 4.2.5.4 of the TSI):
 - Commission Regulation (EU) 1300/2014 of 18 November 2014

- Commission Implementing Regulation 2019/772 of 16 May 2019

- 4) External doors: embarkation and disembarkation as required in:
 - a. 4.2.2.5 TSI LOC&PAS
 - b. EN 14752:2015
 - c. Commission Implementing Regulation (EU) 402/2013 of 30 April 2013
- 5) Requirements for the adaptation of the passenger space to the needs of persons with reduced mobility are set out in TSI PRM, point 4.2.2
- 6) Gangways between cars in accordance as required in:
 - a. TSI LOC&PAS 1302/2014 point 4.2.2.3 “Gangways”
 - b. TSI PRM (1300/2014 as amended)
 - c. EN 16286-1:2013
- 7) The equipment of the passenger space with regard to the arrangement of seats and their profile is defined in the UIC leaflet 567.
- 8) Standing rooms – TSI LOC&PAS does not exclude the admission of standing rooms in passenger vehicles. Possible reduction of the number of such rooms in the train set results from the requirements concerning the weight of a railway vehicle at the nominal operational load indicated in PN-EN 15663 + A1:2019-02 which in the case of high-speed and long-distance vehicles:
 - a. for normal vehicle load, assumes 0 kg/m² (without standing passengers), if no specific values are specified, while these values should be within the range of 0–160 kg/m² (0–2 passengers/m²)
 - b. for extraordinary vehicle load, assumes 320 kg/m², if no specific values are specified, while these values should be within the range of 160–320 kg/m² (2–4 passengers/m²).
- 9) Resistance of seat covering to deliberate destruction (vandalproofness) in accordance with “Appendix A (normative appendix) Standard vandalproofness test of seat covering” according to PN-EN 45545-2
- 10) Strength of components inside the car, including shelves and chairs according to UIC leaflet 566
- 11) The fastening strength of the passenger compartment equipment must be in accordance with the highest mean level of delay for an average of 120 ms in collision scenarios 1 and 2 analysed according to EN 15227:2020

3.4.5 Environmental conditions and effects of aerodynamic forces

- 1) The environmental conditions are specified in TSI LOC&PAS 1302/2014, point 4.2.6.
 - a. Temperature (point 4.2.6.1.1 of the TSI): EN 50125-1:2014
 - b. Snow, ice and hail (point 4.2.6.1.2 of the TSI): EN 50125-1:2014 and EN 15227:2008 + A1:2011
 - c. Impact of aerodynamic forces on passengers staying on platforms, and on railway workers (point 4.2.6.2.1 of the TSI): EN 14067-4:2013
 - d. Pressure impact on the train front (point 4.2.6.2.2 of the TSI): EN 14067-4:2013
 - e. Maximum pressure differences in tunnels (point 4.2.6.2.3 of the TSI) EN 14067-5:2006 + A1:2010. The effect of aerodynamic forces in tunnels is discussed in point 3.10 “Aerodynamic effect and comfort criterion in tunnels” of Volume III.2 “Tunnels” of these Technical Standards.
 - f. Crosswind (point 4.2.6.2.4 of the TSI): EN 14067-6:2010
 - g. Aerodynamic forces on the track on the crushed stone ballast – point 4.2.6.2.5 of the TSI (open point)

3.4.6 External lights as well as audible and visual warning devices

- 1) Point 4.2.7 of TSI LOC&PAS defines requirements for external lights as well as visual and audible warning devices
 - a. Front lights (point 4.2.7.1.1 of the TSI): EN 15153-1:2013+A1:2016
 - b. Signal lights (point 4.2.7.1.2 of the TSI): EN 15153-1:2013+A1:2016
 - c. End-of-line lights (point 4.2.7.1.3 of the TSI) EN 15153-1:2013 + A1:2016
 - d. Light control (point 4.2.7.1.4 of the TSI): Regulation of the Minister of Infrastructure of 18 July 2005 (Journal of Laws of 2015, item 360)
- 2) Audible signals (acoustic warning device) are specified in point 4.2.7.2 of TSI LOC&PAS
 - a. General – warning sound, point 4.2.7.2.1 of the TSI (including basic frequencies)
 - b. Sound levels of the warning device (point 4.2.7.2.2 of the TSI): EN 15153-2:2013
 - c. Protection acc. to point 4.2.7.2.3 of the TSI
 - d. Control (of the audible signal) acc. to point 4.2.7.2.4 of the TSI

3.4.7 Power supply and electrical systems

- 1) The requirements for electrical systems are described in TSI LOC&PAS 1302/2014, point 4.2.8 Traction and electric equipment
- 2) Traction performance is specified in point 4.2.8.1 of TSI LOC&PAS
- 3) Overhead catenary system power supply voltage and frequency levels (point 4.2.8.2.2 of the TSI) are defined in:
 - a) TSI ENE 1301/2014.
 - b) PN-EN 50163:2006/A1:2007
- 1) Regenerative brake discharging energy to the overhead catenary system (point 4.2.8.2.3 of the TSI):
 - a) EN 50388:2012 and EN 50388:2012/AC:2013.
 - b) PN-EN 50163:2006/A1:2007
- 2) Maximum power and maximum current from the overhead catenary system (point 4.2.8.2.4 of the TSI):
 - a. EN 50388:2012 i EN 50388:2012/AC:2013
- 3) Maximum current during a standstill for DC power supply systems (point 4.2.8.2.5 of the TSI)
 - a. TSI ENE “1301/2014 as amended”
- 4) Power factor (point 4.2.8.2.6 of the TSI)
 - a. EN 50388:2012 i EN 50388:2012/AC:2013
- 5) Disturbances in power systems (in case of AC power supply systems) (point 4.2.8.2.7 of the TSI)
 - a. EN 50388:2012 i EN 50388:2012/AC:2013
- 6) Electricity consumption measurement function (on-board energy measurement system) (point 4.2.8.2.7 of the TSI)
 - a. EN 50463-1:2017
 - b. EN 50463-2:2017
 - c. EN 50463-3:2017
 - d. EN 50463-4:2017
 - e. EN 50463-5:2017
- 7) Requirements for the pantograph (point 4.2.8.2.9 of the TSI)
 - a. PN-EN 50206-1:2010
 - b. PN-EN 50367:2012
- 8) Pantograph working height range (point 4.2.8.2.9.1 of the TSI)
 - a. EN 50206-1:2010

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- 9) Pantograph head geometry (interoperability constituent level) (point 4.2.8.2.9.2 of the TSI)
 - a. EN 50367:2012
 - b. EN 50367:2012/AC:2013
 - 10) Pantograph current carrying capacity (interoperability constituent level) (point 4.2.8.2.9.3a of the TSI)
 - a. EN 50206-1:2010
 - 11) Contact strip according to point 4.2.8.2.9.4 of TSI LOC&PAS
 - 12) Contact strip material
 - a. ENE TSI "1301/2014 as amended"
 - b. PN-EN 50405:2016-06
 - 13) Pantograph static contact force (point 4.2.8.2.9.5 of the TSI)
 - a. PN-EN 50206-1:2010
 - b. PN-EN 50317:2012
 - c. PN-EN 50367:2012
 - 14) Pantograph contact force and dynamic behaviour (point 4.2.8.2.9.6 of the TSI)
 - a. ENE TSI "1301/2014 as amended"
 - b. PN-EN 50206-1:2010
 - c. PN-EN 50317:2012
 - d. PN-EN 50367:2012
 - 15) Pantograph arrangement (point 4.2.8.2.9.7 of the TSI)
 - a. ENE TSI "1301/2014 as amended"
 - b. PN-EN 50367:2012
 - 16) Passage through phase or system separation sections (point 4.2.8.2.9.8 of the TSI)
 - a. ENE TSI "1301/2014 as amended"
 - 17) Isolation of the pantograph from the vehicle (point 4.2.8.2.9.9 of the TSI)
 - a. PN-EN 50124-1:2007
 - b. PN-EN 50124-1:2007/AC:2010
 - 18) Pantograph lowering (point 4.2.8.2.9.10 of the TSI)
 - a. EN 50119:2009
 - b. EN 50119:2009/A1:2013
 - c. EN 50206-1:2010
 - 19) Electrical protection of the train (point 4.2.8.2.10 of the TSI)
 - a. EN 50388:2012
 - b. EN 50388:2012/AC:2013
 - 20) Diesel drive and other drive systems with thermal motors (point 4.2.8.3 of the TSI)
 - a. Regulation (EU) 2016/1628 of the European Parliament and of the Council of 29.04.2021
 - 21) Electric shock protection (point 4.2.8.4 of the TSI)
 - a. EN 50153:2014
 - b. The UIC 533 leaflet provides earthing requirements for equipment components.
 - 22) Traction performance requirements are specified in TSI LOC&PAS 1302/2014 (point 4.2.8.1.2)

3.4.8 Driver's cab, control and driver/vehicle interface

- 1) The requirements for the driver's cab and driving subsystems are specified in TSI LOC&PAS 1302/2014, point 4.2.9 "Cab and driving (driver's cab and driver/vehicle interface)"
- 2) Requirements for the driver's cab
 - a. 4.2.9.1.1. General provisions

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- TSI NOI (1304/2014 as amended)
 - b. 4.2.9.1.2.1. Embarking and disembarking under operating conditions
 - PN-EN 16186-4:2019-08
 - c. 4.2.9.1.2.2. Safety exit from the driver's cab
 - PN-EN 16186-4:2019-08
 - d. 4.2.9.1.3.1. Forward visibility
 - UIC 651 Ed. 4 07.2002
 - EN 15663:2009/AC:2010
 - PN-EN 16186-1+A1:2019-01
 - e. 4.2.9.1.3.2. Rear and side visibility
 - f. 4.2.9.1.4. Interior arrangement
 - UIC 651 Ed. 4 07.2002
 - PN-EN 16186-4:2019-08
 - g. 4.2.9.1.5. Driver's seat (driver)
 - UIC 651 Ed. 4 07.2002
 - PN-EN 16186-4:2019-08
 - h. 4.2.9.1.6. Driver's console – ergonomics
 - UIC 651 Ed. 4 07.2002
 - UIC 612-0 specifies requirements for the driver's console interface
 - PN-EN 16186-2:2017-09
 - i. 4.2.9.1.7. Room climate control and air quality
 - j. 4.2.9.1.8. Internal lighting
 - PN-EN 16186-4:2019-08
 - k. 4.2.9.2.1. Windscreen – mechanical properties
 - EN 15152:2007
 - l. 4.2.9.2.2. Windscreen – optical properties
 - EN 15152:2007
 - m. 4.2.9.2.3. Windscreen – equipment
- 3) The driver/vehicle interface is defined in point 4.2.9.3 of TSI LOC&PAS
- a. 4.2.9.3.1. Driver vigilance check function
 - b. 4.2.9.3.2. Speed measurement
 - TSI CCO (2016/919 as amended)
 - c. 4.2.9.3.3. Display and monitors in the driver's cab
 - TSI CCO (2016/919 as amended)
 - TSI NOI (1304/2014 as amended)
 - UIC 300 092–01
 - d. 4.2.9.3.4. Manipulators and displays
 - TSI CCO (2016/919 as amended)
 - TSI NOI (1304/2014 as amended)
 - UIC 300 092–01
 - e. 4.2.9.3.5. Marking
 - f. 4.2.9.3.6. Remote control by personnel for shunting purposes
 - g. 4.2.9.4. On-board tools and portable equipment

- h. 4.2.9.5. Lockers for personnel use
 - i. 4.2.9.6. Recording equipment
 - TSI OPE (2015/995)
 - EN/IEC 62625-1:2013
- 4) The permissible noise values inside the driver's cab are defined in the following:
- a. Point 4.2.4 of TSI NOI
 - b. EN ISO 3095:2013,
 - c. EN 15892:2011

3.4.9 Fire safety and evacuation

- 1) Fire safety and evacuation are subject to the provisions of TSI LOC&PAS 1302/2014, as amended, point 4.2.10 "Fire safety and evacuation"
- 2) For rolling stock, the characteristics of the subsystems are defined in TSI LOC&PAS.
 - a. 4.2.3.1. Fire prevention measures
 - b. 4.2.3.1.1. Material requirements The requirements are specified in TSI LOC&PAS, point 4.2.10.2.1. These requirements are also applicable to on-board CCS controls.
 - c. 4.2.3.1.2. Special measures for flammable liquids The requirements are specified in TSI LOC&PAS, point 4.2.10.2.2.
 - d. 4.2.3.1.3. Detection of axial bearing overheat The requirements are specified in TSI LOC&PAS, point 4.2.10.2.3.
 - e. 4.2.3.2. Fire detection and extinguishing measures
 - f. 4.2.3.2.1. Portable fire extinguishers The requirements are specified in TSI LOC&PAS, point 4.2.10.3.1.
 - g. 4.2.3.2.2. Fire detection systems The requirements are specified in TSI LOC&PAS, point 4.2.10.3.2.
 - h. 4.2.3.2.3. Automatic fire extinguishing systems for Diesel engine cargo units The requirements are specified in TSI LOC&PAS, point 4.2.10.3.3.
 - i. 4.2.3.2.4. Fire fighting and control systems for passenger rolling stock The requirements are specified in TSI LOC&PAS, point 4.2.10.3.4.
 - j. 4.2.3.3. Emergency requirements
 - k. 4.2.3.3.1. Emergency lighting system in trains The requirements are specified in TSI LOC&PAS, point 4.2.10.4.1.
 - l. 4.2.3.3.2. Smoke control system The requirements are specified in TSI LOC&PAS, point 4.2.10.4.2.
 - m. 4.2.3.3.3. Alarm devices and means of communication for passengers The requirements are specified in TSI LOC&PAS, point 4.2.10.4.3.
 - n. 4.2.3.3.4. Railworthiness The requirements are specified in TSI LOC&PAS, point 4.2.10.4.4.
 - o. 4.2.3.4. Evacuation requirements
 - p. 4.2.3.4.1. Emergency exits for passengers The requirements are specified in TSI LOC&PAS, point 4.2.10.5.1.
 - q. 4.2.3.4.2. Emergency exits from the driver's cab The requirements are specified in TSI LOC&PAS, point 4.2.10.5.2.
- 3) Detailed fire safety requirements for rolling stock crossing tunnels are presented in Volume III.2 in chapter 7.2. "Fire prevention measures". See also chapter 3.5.5 of this Volume.

3.4.10 Maintenance

- 1) Maintenance requirements according to point 4.2.11 of TSI LOC&PAS
 - a. 4.2.11.2. External cleaning of trains
 - b. 4.2.11.2.1. Cleaning of the driver's cab windscreen
 - c. 4.2.11.2.2. External cleaning in a train wash
 - d. 4.2.11.3. Connection to the toilet emptying system
 - e. 4.2.11.4. Water make-up device
 - f. 4.2.11.5. Interface with water make-up device
 - EN 16362:2013
 - g. 4.2.11.6. Special requirements for the standstill of trains
 - CLC/TS 50534:2010
 - EN/IEC 60309-2:1999 as amended, EN 60309-2:1999/A11:2004, A1:2007 and A2 2012
 - h. 4.2.11.7. Fuelling equipment
 - i. 4.2.11.8. Cleaning of train interior – power supply

3.4.11 Documentation for operation and maintenance

- 1) The requirements for the documentation for operation and maintenance purposes are specified in:
 - a. point 4.2.12 of TSI LOC&PAS
 - b. Regulation of the Minister of Infrastructure of 12 October 2005 (Journal of Laws of 2016, item 226)
- 2) Point 4.2.12 specifies in particular
 - a. 4.2.12.1. General provisions
 - b. 4.2.12.2. General documentation
 - c. 4.2.12.3. Maintenance documentation
 - d. 4.2.12.3.1. Maintenance project rationale file
 - e. 4.2.12.3.2. Maintenance description
 - f. 4.2.12.4. Operation documentation
 - g. 4.2.12.5. Lifting diagram and instructions
 - h. 4.2.12.6. Descriptions of rescue operations

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3.5 Other systems and requirements for rolling stock

3.5.1 IT systems (SIP, CCTV, SER, etc.)

- 1) Technical requirements for on-board IT equipment in rolling stock in line with the general requirements for the railway environment according to Chapter 3.1.2 of Volume VII.1 Fixed and wireless communication systems and data transmission.
- 2) Functional requirements for the passenger information system equipment within the scope covered by the TSI are subject to
 - a. TSI LOC&PAS, point 4.2.5 “Passenger considerations”
 - b. TSI PRM, point 4.2.2.7 “Passenger information”
 - c. In the scope of external information, the provisions of the UIC 580 leaflet shall apply
- 3) In the case of rolling stock operated without any train crew, it is recommended to equip the passenger space with internal CCTV monitoring.

3.5.2 HVAC systems

- 1) TSI LOC&PAS 1302/2014 do not indicate specific requirements for the design of air conditioning and active ventilation in railway vehicles.
- 2) The internal air quality of railway vehicles is defined in point 4.2.5.8 of TSI LOC&PAS
- 3) The airflow in the driver's cab is specified in point 4.2.9.1.7 of the TSI.
- 4) Climate comfort – HVAC system is specified in the following standards:
 - a. PN-EN 13129:2016-10
 - b. PN-EN 14750-1:2006
 - c. PN-EN 14750-2:2006

3.5.3 Traction power supply using the 2 × 25 kV 50 Hz AC system

- 1) Requirements for AC traction power supply are included in Volume II.1 “Overhead catenary system and the 2 × 25 kV 50 Hz AC traction power supply”.
- 2) Maximum current consumed by a train for the 25 kV AC power supply is determined in accordance with PN-EN 50388:
 - a. on CPK-P1 and CPK-M1 lines – the value of 1500 A should be assumed,
 - b. on CPK-P2 and CPK-M2 lines – the value of 600 A should be assumed,
 - c. on CPK-P3 and CPK-M3 lines – the value of 500 A should be assumed.
- 3) The static pressure of the pantograph is specified in point 3.4.1.5 of Volume II.1 of the Standards.
- 4) Pantograph spacing – point 3.4.7 of Volume II.1
- 5) Co-operation of the contact line with the pantograph – point 3.4.9 of Volume II.1

3.5.4 Traction power supply using the 3 kV DC system

- 1) Requirements for DC traction power supply are included in Volume II.2
- 2) The maximum current consumed by a traction vehicle for the 3 kV DC power supply is set at
 - a. 2500 A for $v < 200$ km/h on CPK-P3 and CPK-M3 category lines;
 - b. 3200 A – $v > 200$ km/h on a line upgraded to CPK-P2 and CPK-M2 categories,
 - c. 4000 A – $v > 200$ km/h on a new CPK-P2 and CPK-M2 category line
- 3) The static pressure of the pantograph is specified in point 3.4.1.5 of Volume II.2 of the Standards.
- 4) Pantograph spacing – point 3.4.6.2 of Volume II.2
- 5) Co-operation of the contact line with the pantograph – point 3.4.6 of Volume II.2

3.5.5 Requirements for rolling stock operated in tunnels

- 1) Safety requirements for railway rolling stock travelling in operated in tunnels are specified in TSI SRT – Commission Regulation (EU) No 1303/2014 of 18 November 2014 concerning the technical specification for interoperability relating to ‘safety in railway tunnels’ of the rail system of the European Union (as amended): 2016/912 dated 6 June 2016 and 2019/776 of 29.04.2021
- 2) For the rolling stock subsystem – see section 3.4.9 of this Volume.

3.5.6 Control command and signalling – European Train Control System (ETCS)

- 1) Requirements covering the “control” subsystem are specified in TSI CCS – Commission Regulation (EU) 2016/919 of 27 May 2016 on the technical specification for interoperability relating to the ‘control-command and signalling’ subsystems of the rail system in the European Union (as amended): 2019/776 dated 29.04.2021
- 2) Issues related to the on-board control command and signalling subsystem are described in Volume VI.2 “Control-Command and Signalling – ETCS” and constitute an integral part of this Volume XVI.
- 3) Basic interoperability constituents of the on-board control command and signalling subsystem – see point 7.1 of Volume VI.2
- 4) On-board signalling subsystem enabling rolling stock traffic on lines of other managers (class B systems) – see point 7.3 of Volume VI.2
- 5) Vehicle compatibility as part of the ERTMS – see point 7.4 of Volume VI.2

3.5.7 Measures to minimise environmental impact

- 1) The requirements for the reduction of noise emitted by railway vehicles shall include TSI NOI — Commission Regulation (EU) No 1304/2014 of 26 November 2014 on the technical specification for interoperability relating to the subsystem ‘rolling stock — noise’ amending Decision 2008/232/EC and repealing Decision 2011/229/EU (as amended): 2019/774 dated 29.04.2021
- 2) Permissible values of stationary noise:
 - a. Point 4.2.1 of TSI NOI,
 - b. EN ISO 3095:2013
- 3) Permissible values of starting noise:
 - a. point 4.2.2 of TSI NOI,
 - b. EN ISO 3095:2013
- 4) Permissible values of travel noise:
 - a. Point 4.2.3 of TSI NOI
 - b. EN ISO 3095:2013
- 5) Other environmental requirements at the interface of rolling stock with railway infrastructure are discussed in Volume IX of these Standards:
 - a. Noise from the railway line in chapter 3.5.1
 - b. Vibrations from the railway line in chapter 3.5.2

3.5.8 Structures – railway platforms

- 1) The nominal height of platforms to which the rolling stock should be adjusted is subject to the provisions of point 3.3 of Volume VIII.3 “Structures”
- 2) The nominal platform height is 760 mm, measured as the distance from the rail head surface to the edge of the platform.

3.5.9 Electromagnetic compatibility (EMC)

- 1) The requirements concerning electromagnetic compatibility are collected in Volume XI of the Standards “Electromagnetic compatibility (EMC)”, point 3.5.4 “Rolling stock and complete vehicle”

3.5.10 Technical support facilities and service rolling stock

- 1) Requirements for the technical support facilities are included in Volume XIII of the Standards “Technical support facilities”
 - a. Structures and equipment for the storage and maintenance of railway vehicles are described in chapter 5.4
- 2) Service and special rolling stock consists of the following:
 - a) normal rolling stock:
 - locomotives,
 - freight train cars,
 - social train cars;
 - b) special rolling stock:
 - diagnostic and inspection vehicles,
 - machines for railway construction works, including, but not limited to, tamping tools, ballast regulators, cleaning machines,
 - vehicles for maintenance of railway infrastructure in winter season,
 - vehicles for maintenance and repair of the overhead catenary system,
 - vehicles for maintenance and repair of engineering structures,
 - vehicles for maintenance and repair of railway tunnels,
 - rail cranes,
 - motor trolleys,
 - railway and road vehicles (PSD), including, but not limited to, diggers, loaders, two-way digger-loaders,
 - railway rescue vehicles.
- 3) Service and special rolling stock intended for construction and maintenance of railway infrastructure, such as track machinery, is covered by TSI LOC&PAS only if:
 - a. it moves on its own wheels,
 - b. it is designed and intended for detection by a track-mounted train detection system for traffic management,
 - c. in the case of track machinery, it is in a transport (travelling) configuration, by using its own drive or being pulled.
- 4) Exclusion from the scope of application of TSI LOC&PAS: “In the case of track machinery, the operating configuration is not covered by this TSI.”;

3.5.11 Automatic baggage check-in systems

- 1) The automatic baggage check-in systems are discussed in Volume XVII of the Standards “Automatic baggage check-in systems”.
 - a. Requirements for railway rolling stock can be found in chapter 3.2.3 “Requirements for rolling stock”
- 2) Requirements for the automatic baggage check-in subsystem are not a subject of the TSI specifications

- 3) The adaptation of railway rolling stock for the carriage of baggage under the automatic check-in mode should include:
- a) Baggage compartment adapted to the automatic loading of air containers
 - b) It should also be possible for the rail personnel to manually load individual pieces of baggage.
 - c) The baggage compartment should be isolated from the passenger space in a manner preventing passengers from accessing the baggage
 - d) Where the baggage compartment is located in the vicinity of the driver's cab, a passage must be maintained between the driver's cab and the baggage compartment in order to allow the driver to escape through the back in the event of a risk of collision.
 - e) Loading and unloading of the baggage compartment should be enabled by doors located on two sides of the vehicle.

3.5.12 **Security, protection and cybersecurity integrity requirements**

- 1) Security, protection and cybersecurity integrity requirements are collected in Volume XVIII of the Standards.

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4 Reference documents

The following reference documents were used to prepare Volume XVI:

4.1 EU legal documents

– directives:

- [1] Dyrektywa Parlamentu Europejskiego i Rady (UE) 2016/797 z dnia 11 maja 2016 r. w sprawie interoperacyjności systemu kolei w Unii Europejskiej (Dz.U.UE L 138/44 z dnia 26.05.2016)
- [2] Dyrektywa Parlamentu Europejskiego i Rady (UE) 2016/798 z dnia 11 maja 2016 r. w sprawie bezpieczeństwa kolei (Dz.U.UE L 138/102 z dnia 26.5.2016)

– regulations:

- [3] Rozporządzenie Komisji nr 1302/2014 w sprawie technicznej specyfikacji interoperacyjności odnoszącej się do podsystemu „Tabor – Lokomotywy i tabor pasażerski” systemu kolei w Unii Europejskiej,
- [4] Rozporządzenie Komisji (UE) nr 1301/2014 z dnia 18 listopada 2014 r. w sprawie technicznych specyfikacji interoperacyjności podsystemu „Energia” systemu kolei w Unii Europejskiej
- [5] Rozporządzenie Komisji nr 1303/2014 w sprawie technicznej specyfikacji interoperacyjności w zakresie aspektu „Bezpieczeństwo w tunelach kolejowych” systemu kolei w Unii Europejskiej,
- [6] Rozporządzenie Komisji nr 1300/2014 w sprawie technicznych specyfikacji interoperacyjności odnoszących się do dostępności systemu kolei Unii dla osób niepełnosprawnych i osób o ograniczonej możliwości poruszania się,
- [7] Rozporządzenie Komisji (UE) 2016/919 z dnia 27 maja 2016 r. w sprawie technicznej specyfikacji interoperacyjności w zakresie podsystemów „Sterowanie” systemu kolei w Unii Europejskiej
- [8] Rozporządzenie Komisji nr 1304/2014 w sprawie technicznych specyfikacji interoperacyjności podsystemu „Tabor kolejowy – Hałas”, zmieniające decyzję 2008/232/WE i uchylające decyzję 2011/229/UE,
- [9] Rozporządzenie wykonawcze Komisji (UE) 2019/772 z dnia 16 maja 2019 r. zmieniające rozporządzenie (UE) nr 1300/2014 w odniesieniu do wykazu majątku w celu identyfikacji barier w zakresie dostępności, zapewnienia informacji dla użytkowników oraz monitorowania i oceny postępów w zakresie dostępności,
- [10] Rozporządzenie wykonawcze Komisji (UE) 2020/387 z dnia 9 marca 2020 r. zmieniające rozporządzenia (UE) nr 321/2013, (UE) nr 1302/2014 i (UE) 2016/919 w odniesieniu do rozszerzenia obszaru użytkowania i etapów przejściowych,
- [11] Rozporządzenie wykonawcze Komisji (UE) 2019/776 z dnia 16 maja 2019 r. zmieniające Rozporządzenia Komisji (UE) nr 321/2013, (UE) nr 1299/2014, (UE) nr 1301/2014, (UE) nr 1302/2014 i (UE) nr 1303/2014, Rozporządzenie Komisji (UE) 2016/919 oraz Decyzję wykonawczą Komisji 2011/665/UE w odniesieniu do dostosowania do Dyrektywy Parlamentu Europejskiego i Rady (UE) 2016/797 oraz realizacji celów szczegółowych określonych w decyzji delegowanej Komisji (UE) 2017/1474.)
- [12] Rozporządzenie wykonawcze Komisji (UE) nr 402/2013 z dnia 30 kwietnia 2013 r. w sprawie wspólnej metody oceny bezpieczeństwa w zakresie wyceny i oceny ryzyka i uchylające rozporządzenie (WE) nr 352/2009
- [13] Rozporządzenie wykonawcze Komisji (UE) 2019/776 z dnia 16 maja 2019 r. zmieniające rozporządzenia Komisji (UE) nr 321/2013, (UE) nr 1299/2014, (UE) nr 1301/2014, (UE) nr 1302/2014 i (UE) nr 1303/2014, rozporządzenie Komisji (UE) 2016/919 oraz decyzję wykonawczą Komisji 2011/665/UE w odniesieniu do dostosowania do dyrektywy Parlamentu Europejskiego i Rady (UE) 2016/797 oraz realizacji celów szczegółowych określonych w decyzji delegowanej Komisji (UE) 2017/1474

- [14] Rozporządzenie Parlamentu Europejskiego i Rady (UE) 2016/1628 z dnia 14 września 2016 r. w sprawie wymogów dotyczących wartości granicznych emisji zanieczyszczeń gazowych i pyłowych oraz homologacji typu w odniesieniu do silników spalinowych wewnętrznego spalania przeznaczonych do maszyn mobilnych nieporuszających się po drogach, zmieniające rozporządzenia (UE) nr 1024/2012 i (UE) nr 167/2013 oraz zmieniające i uchylające dyrektywę 97/68/WE

4.2 Legal documents of the Republic of Poland

- [15] Ustawa z dnia 28 marca 2003 r. o transporcie kolejowym. Dz.U.2020.1043. z późn. zm.
- [16] Rozporządzenie Ministra Infrastruktury i Budownictwa z dnia 21 kwietnia 2017 r. w sprawie interoperacyjności systemu kolei (Dz. U. 2017 poz. 934),
- [17] Rozporządzenie Ministra Transportu, Budownictwa i Gospodarki Morskiej z dnia 27 grudnia 2012 r. w sprawie wykazu właściwych krajowych specyfikacji technicznych i dokumentów normalizacyjnych, których zastosowanie umożliwia spełnienie zasadniczych wymagań dotyczących interoperacyjności systemu kolei (Dz. U. 2013 poz. 43),
- [18] Obwieszczenie Ministra Infrastruktury i Rozwoju z dnia 23 stycznia 2015 r. w sprawie ogłoszenia jednolitego tekstu rozporządzenia Ministra Infrastruktury w sprawie ogólnych warunków prowadzenia ruchu kolejowego i sygnalizacji
- [19] Obwieszczenie Ministra Infrastruktury i Budownictwa z dnia 27 stycznia 2016 r. w sprawie ogłoszenia jednolitego tekstu rozporządzenia Ministra Infrastruktury w sprawie ogólnych warunków technicznych eksploatacji pojazdów kolejowych
- [20] Lista Prezesa Urzędu Transportu Kolejowego w sprawie właściwych krajowych specyfikacji technicznych i dokumentów normalizacyjnych, których zastosowanie umożliwia spełnienie zasadniczych wymagań dotyczących interoperacyjności systemu kolei z dnia 19 stycznia 2017 r.,
- [21] Rozporządzenie Ministra Infrastruktury z dnia 12 października 2005 r. w sprawie ogólnych warunków technicznych eksploatacji pojazdów kolejowych (Dz. U. 2005 nr 212 poz. 1771 z późn. zm.),

4.3 Normative documents

- [22] Decyzja Komisji 733/2002/WE z dnia 30 maja 2002 r. dotycząca technicznej specyfikacji dla interoperacyjności podsystemu energia transeuropejskiego systemu kolei dużych prędkości określonego w art. 6 ust. 1 dyrektywy 96/48/WE. Dz. Urz. WE L 245, s. 280 – 369.

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